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Monitoring and Evaluation of ICT in Education Projects

A Handbook for Developing Countries

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Abbreviations

GNP	Gross national product
HDI	Human development index
ICT	Information and communication technologies
ICT4D	Information and communication technologies for development
ICT4E	Information and communication technologies for education
IFC	International Finance Corporation
*info*Dev	Information for Development Program
IT	Information technology
ITU	International Telecommunications Union
LDC	Less developed countries
MDGs	Millennium Development Goals
NGO	Non-government organization
OECD	Organization for Economic Cooperation and Development
UNDP	United Nations Development Program
UNESCO	United Nations Education Scientific and Cultural Organization
Unicef	United Nations Childrens Fund

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Preface

The increasing profile and importance of the use of information and communication technologies (ICTs) in the education sector are visible in many developing countries. With over twenty years of widespread use of computers in developed countries, and almost ten years after computers (and shortly thereafter, the Internet) were introduced in the developing world, the ICT for education and development communities are still hard-pressed to present good answers to the following basic questions:

- What is the impact?
- What are the good models and lessons that we can learn from, and are these models and lessons scaleable?
- What does all of this cost?

Indeed, relatively little is actually known about the effectiveness of investments in ICTs in education in promoting educational reform in general, and Education for All (EFA) goals in particular. Despite the billions of dollars of investments in ICTs in education in OECD countries, hundreds of ICT in education pilot projects in developing countries, and untold articles and presentations extolling the *potential* of ICTs, little hard evidence and consensus exist on the proper, *cost-effective* utilization of ICTs to meet a wide variety of some of the most pressing educational challenges facing the developing world. To be sure, some good work has been done in these areas. But even where valuable lessons have been learned – for and against the use of ICTs – these lessons do not seem to be informing policy related to education in a significant way.

Apple Computer founder Steve Jobs once famously remarked that "Computers can't solve what is wrong with education." Fair enough, but the power of ICTs as enablers of change (for good, as well as for bad) is undeniable. In most developing countries, however, the stakes are much higher than they are – and were – in the developed economies of Europe and North America. The challenges facing education systems in most of the developing world are formidable (in many cases, seemingly intractable). Given the potential grave risks that may be associated with ICT use in education in many developing countries, especially the 'poorest of the poor', why should we even be devoting energies and efforts to investigating such uses?

For better *and* for worse, ICTs *are* currently being used widely to aid education in many developing countries, and it appears that there is increasing demand for their use in education by policymakers and parents in developing countries. Teacher corps ravaged by AIDS, inadequate number of schools, lack of equal educational opportunities for girls, desperate poverty – ICTs can play a role in helping to combat all of these significant

challenges. If policy advice related to ICT use in education is to be credible, however, it needs to be backed up by a rich database of lessons learned, best practices, impact evaluations and cost data. Advice is judged by results, not by intentions.

This volume – *Monitoring and Evaluation of ICTs in Education: A Handbook for Developing Countries* – is intended as an introduction and guide for busy policymakers and practitioners grappling with how to understand and assess the ICT-related investments underway in the education sector. This short but comprehensive work is specifically designed to meet the needs of developing countries, and it is hoped that its publication will help to stimulate further efforts in this emerging and very important field.

Michael Trucano
*info*Dev
Washington, DC
November 2005

Chapter 1

Monitoring and Evaluation of ICT for Education
An Introduction

Daniel A. Wagner

EXECUTIVE SUMMARY

- There is clearly much promise and hope in the expanded use of ICTs for education, but there is also a well-known ignorance of the consequences or impact of ICTs on education goals and targets.
- A relevant and credible knowledge base is an essential part in helping policy makers make effective decisions in ICT4E.
- A conceptual framework is presented that takes into account not only a variety of broad development concerns, but also the many context-sensitive issues related to ICT use for educational development.
- A key step in the monitoring and evaluation process is to develop a plan to measure the *implementation fidelity* of the intervention – that is, did the intervention do what it said it would do.
- By helping to create a stronger knowledge base through improved M&E, increased support for ICT4E innovations and investments is more likely to be assured.

One of the Millennium Development Goals (MDGs) is achievement of universal primary education by 2015. We must ensure that information and communication technologies (ICT) are used to help unlock the door to education. Kofi Annan (2005).[i]

ICT … consists of hardware, software, networks, and media for collection, storage, processing, transmission, and presentation of information (voice, data, text, images). Defined in the Information & Communication Technology Sector Strategy Paper of the World Bank Group, April 2002.[ii]

Monitoring and evaluation (M&E) of development activities provides government officials, development managers, and civil society with better means for learning from past experience, improving service delivery, planning and allocating resources, and demonstrating results as part of accountability to key stakeholders. World Bank, 2004.[iii]

1.1. MDGs, ICTs, and Evaluation as Knowledge: Why this *Handbook*?

The Millennium Development Goals (MDGs) have been adopted by the United Nations as the key development targets for the first part of the 21st century. All nations are "on board." Among the most prominent of these goals are those that relate to achieving basic education, building on the Education For All (EFA) initiative begun in Jomtien (Thailand) in 1990, and reaffirmed at a second EFA meeting in Dakar in 2000.[iv] The MDGs have gone further (see Box 1.1) in proposing goals that integrate not only education, but also extreme poverty and hunger, as well as health, gender equity and many other worthy social and economic outcomes. Within the final goal, there is a final item (Target 18) as follows: "In cooperation with the private sector, make available the benefits of new technologies, especially information and communications." This item is a reference to a growing and increasingly important area that has seen huge growth over the past decade, namely Information and Communications Technologies (ICTs) for education.

Box 1.1. U.N. Millennium Development Goals

Goal 1 Eradicate extreme poverty and hunger

- *Target 1* Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day
- *Target 2* Halve, between 1990 and 2015, the proportion of people who suffer from hunger

Goal 2 Achieve universal primary education

- *Target 3* Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling

Goal 3 Promote gender equality and empower women

- *Target 4* Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015

Goal 4 Reduce child mortality

- *Target 5* Reduce by two thirds, between 1990 and 2015, the under-five mortality rate

Goal 5 Improve maternal health

- *Target 6* Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio

Goal 6 Combat HIV/AIDS, malaria and other diseases

- *Target 7* Have halted by 2015 and begun to reverse the spread of HIV/AIDS
- *Target 8* Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases

Goal 7 Ensure environmental sustainability

- *Target 9* Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources
- *Target 10* Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation
- *Target 11* By 2020, to have achieved a significant improvement in the lives of at least 100 million slum-dwellers

Goal 8 Develop a global partnership for development

- *Target 12* Develop further an open, rule-based, predictable, non-discriminatory trading and financial system (includes a commitment to good governance, development and poverty reduction — both nationally and internationally)
- *Target 13* Address the special needs of the least developed countries
- *Target 14* Address the special needs of landlocked countries and small island developing States

- *Target 15* Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term
- *Target 16* In cooperation with developing countries, develop and implement strategies for decent and productive work for youth
- *Target 17* In cooperation with pharmaceutical companies, provide access to affordable, essential drugs in developing countries
- ➢ *Target 18* In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

➢ NB: *Indicates that this target is especially important for the present Handbook.*

Adapted from: UN Millennium Development Goals, United Nations.[v]

The attraction of ICTs for development (ICT4D) in general, and ICTs for education (ICT4E) in particular, is clear from the growth of both public and private sector investments. And the growth of MDG-relevant ICT investments has been increasingly recognized as well.[vi] As noted by the UN Secretary-General Kofi Annan, there is little doubt that ICTs may "unlock" many doors in education, and do much more than that as well. The irony, however, is that ICTs may also lead, literally, to "locked" doors, as school directors try to ensure the security of equipment from one day to the next. While there is clearly much promise to the use of ICTs for education, and for the MDGs more generally, there is at the same time a well-known ignorance of the consequences or impact of ICTs on education goals and targets. The issue is not, usually, whether ICTs are "good" or "bad", or even whether doors are more "open" than "locked." The real world is rarely so clearly divided. We are, more often than not, in a situation where we think there may be an opportunity for development investment, but are unsure of which of the large menu of options will have the greatest payoff for the desired results when related to the investments made. This is, simply put, a cost-benefit analysis.

But what *are* the costs and what *are* the benefits? Creating a relevant and actionable knowledge base in the field of ICT4E is an essential first step in trying to help policy makers make effective decisions. Yet, in the area of ICTs for education – unlike, say, improved

literacy primers – there are high entry costs (as ICT use in education may require significant investments in new infrastructure), significant recurrent costs (maintenance and training), and opportunities for knowledge distortions due to the high profile (and political) aspects of large ICT interventions. What does it take to create such a knowledge base?

1.2. Building the ICT4E Knowledge Base: Role of Monitoring and Evaluation

It has been said: "If you think education is expensive, try ignorance" (attributed to Derek Bok[vii]). This same ignorance can be, and has been, very expensive in the domain of ICT4E. We know that introducing ICTs in the education sector can be quite costly, both in terms of up-front capital costs related to basic infrastructure (hardware, software, connectivity), as well as in terms of the recurrent costs of maintenance and human resources training and development. Simply put, to make mistakes in ICT4E is not a trivial matter, so anything that can be known to reduce the level of errors in planning is a potentially valuable knowledge commodity. In some countries, even those with a rather large amount of ICT4E investment, relatively little monitoring and evaluation has been done (see, for example, Box 1.2).

Box 1.2 Senegal: In need of monitoring and evaluation studies

Although there exists a multitude of projects on the introduction of ICTs on several levels of the educational sector in French-speaking Africa, there are very few substantial Monitoring and Evaluation studies. In spite of (or perhaps because of?) this lack of assessment, the general public perception of the impact of the various ICT initiatives remains rather positive. This sentiment is probably also related to the fact that ICT for Education national programs have had little in the way of clearly defined objectives, while the majority of initiatives by international partners have not been well connected with Senegalese national strategy.

Further, the majority of the governments of the Francophone West Africa now recognize ICTs as being a necessary instrument to achieve EFA goals. However, this remains rather vague in official speeches, without strategies and precise objectives being worked out. In this context, the evaluation of the impact of the use of ICTs in the sector of education still remains very subjective and is often based on common sense as well as testimonies of key actors (learners, professors and administration). In Senegal, for example, one of the more economically advanced Francophone countries in this field, there is a recognition among specialists that ICTs

for education in-depth research on impact in primary and secondary schools has yet to be done. Nonetheless, it seems that parents of pupils do not hesitate to pay invoices related to costs of connection of schools and to accept increased tuition costs to allow their children to access computer rooms; moreover, even school teachers often oppose going to work in schools where ICT support may be lacking. In sum, there is a belief – even without scientific data – that ICT is good for a school's overall 'health.'

Even so, it is clear that more needs to be known from monitoring and evaluation on impact, especially for secondary schools (where most investments have been made to date). In such secondary schools, ICTs already serve as complements to the traditional curriculum, with some having integrated ICTs into their curriculum (primarily in private schools). Thus, it seems important to analyze the performance of these schools and to compare them with those that are not equipped with computers (the majority). Also, there appears to be some evidence that many teachers, at present, explicitly reject the use of ICTs as a tool for improving their own teaching, or at least are not sure of the relevance of ICTs. Interest in such work could include all of Francophone Africa, since there is a common educational system across the region.

Adapted from Boubakar Barry, personal communication.[viii]

Numerous international and national agencies, along with professionals, specialists and program developers in the field, have promoted ICT use in education, believing that ICTs will lead to a breakthrough in learning, and allow one to "leapfrog" in terms of social change and economic development.[ix] Yet, the empirical support for a wide variety of claims concerning development (at individual, institutional, and national levels) is without concrete and credible data to support them, and many key development questions remain largely unanswered (see box 1.3).

Box 1.3 Examples of key development questions related to ICT4E

- What is the impact of ICTs on secondary school achievement in developing countries?
- What are the factors that lead to 'success' in an ICT4E intervention program?
- How do ICT interventions compare to other types of interventions?
- How are different populations (e.g., such as boys vs. girls or first vs. second language speakers of a national language) affected differentially by ICT4E interventions?

- How should this impact be measured, and what are the related issues, especially as they relate to Education For All and other Millennium Development Goals?
- How should monitoring and evaluation studies of the impact of ICTs in education be conducted?
- What would a "cost-effective" ICT4E program look like? And could it be "transferred" from country X to country Y?

These and other key development questions have to be answered within a broad development context in each country, and sometimes regionally within and across countries. From a policy maker's perspective, these results can be thought of as an *impact evaluation* (see Box 1.4), which is part of the broader *monitoring and evaluation process*.

Box 1.4 Impact Evaluation: What is it?

Impact evaluation is the systematic identification of the effects – positive or negative, intended or not – on individual households, institutions, and the environment caused by a given development activity such as a program or project. Impact evaluation helps us better understand the extent to which activities reach the poor and the magnitude of their effects on people's welfare. Impact evaluations can range from large scale sample surveys in which project populations and control groups are compared before and after, and possibly at several points during program intervention; to small-scale rapid assessment and participatory appraisals where estimates of impact are obtained from combining group interviews, key informants, case studies and available secondary data.

Adapted from World Bank (2004).[x]

1.3. A Conceptual Framework for Monitoring and Evaluation

In this *Handbook*, we have tried to adhere to a conceptual framework that takes into account not only a variety of broad development concerns, but also the many context-sensitive issues related to ICT use for educational development**.** Current development thinking posits that to foster sustainable development, policies must go beyond simple market growth, and provide the human and social infrastructure for economic growth and development in the long

term. From this perspective, the goal of development should not only be a rise in the per capita GDP but also an increase in a nation's *Human Development Index* (HDI), as evidenced by longer life expectancy, a higher literacy rate, lower poverty, a smaller gender gap, and a cleaner environment – goals consonant with and central to the MDGs and EFA. Thus, government development policies should not only support economic growth, but also minimize distributional inequities, provide resources for the development of physical infrastructure and human capital, and develop the society's capacity to create, absorb, and adapt to new knowledge, including the reform of its education system and R&D capacity. Within education, reform is needed to revise the curriculum, improve pedagogy, reinforce assessment, develop teachers, and to bring the education system into alignment with economic and social development policy goals. The use of ICTs – and ICT impact – must be considered within this broad development context. Some countries have developed ICT master plans that specify the ways in which ICTs can support education reform and contribute to development, but many have not.

What follows is, we believe, a useful conceptual framework for any specific ICT intervention *context*, which takes into account the layers and interactions of a number of inputs into the development process. Once this context is established and the role of ICT is specified, then a plan for monitoring and evaluation can be designed. Such a plan would describe the components of the intervention, the role of ICT and how it is integrated into the curriculum, the pedagogy, and assessment. It must also describe the required infrastructure – the equipment, software, communications and networking – that would be required to implement the intervention. The evaluation design must also indicate human resources required (such as teacher training) that are needed, including training in equipment operation, software use, and instructional integration. It would not make sense to evaluate the outcomes of the intervention without first assessing the extent to which these intervention components were implemented.

Consequently, the first step of the monitoring and evaluation process would be to specify a plan to measure the *implementation fidelity* of the intervention. The monitoring and

evaluation (M&E) plan would then design measures of the *intended outcomes*, with a notion of how they might feed into the more "downstream," and less easily measurable, but desirable long-term development goals. Also, the study design would have to specify the analyses that would account for – either experimentally or statistically – the other *moderating factors* that would influence the success of the intervention, such as the level of community support, the availability of digital content in the appropriate language, and the extent to which ICTs are also available in the home or community. One way to conceive of these factors may be seen in Figure 1.1.

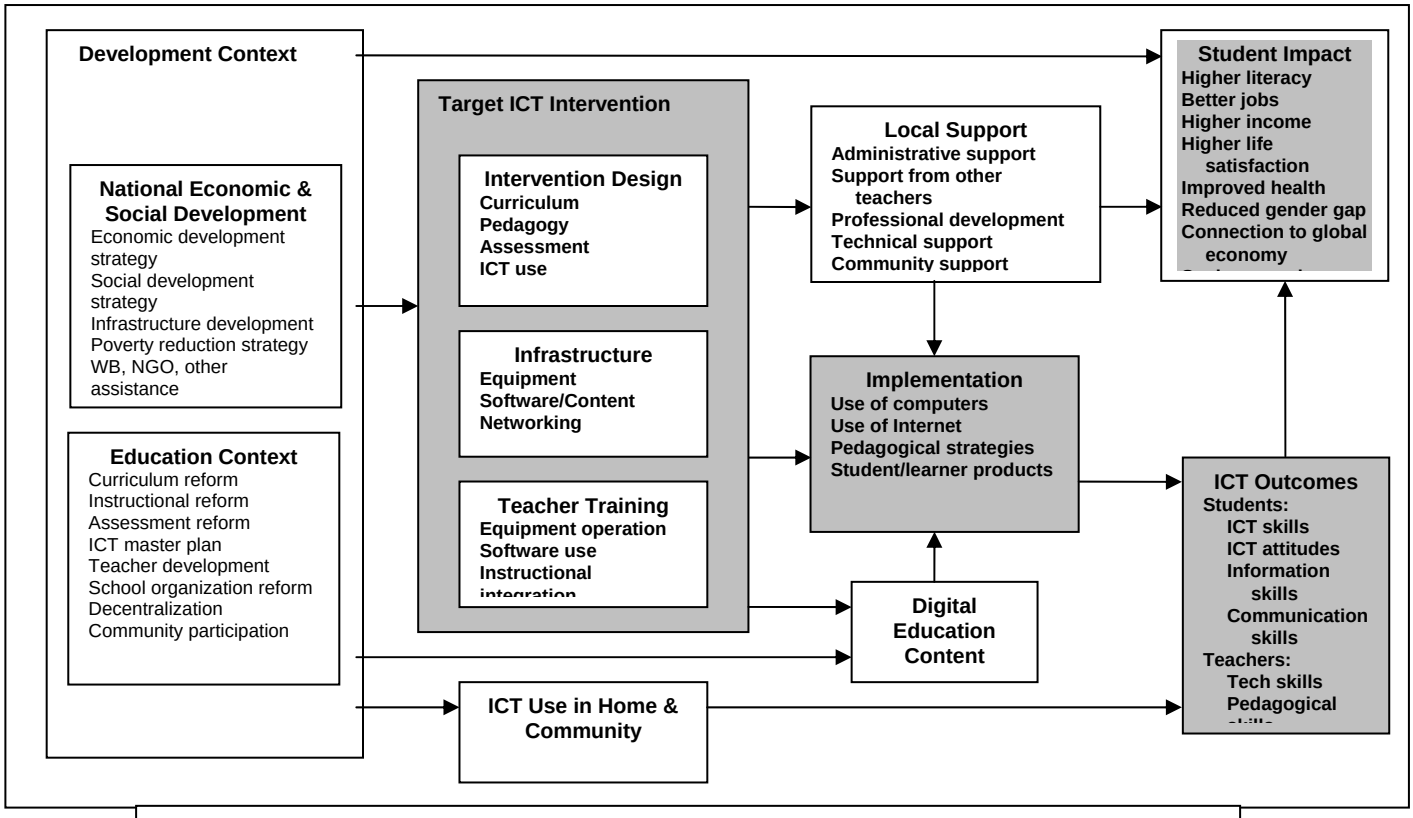

Figure 1.1 Conceptual Framework for ICT Monitoring and Evaluation

Based on this conceptual framework, operational definitions – both rigorous and measurable – are needed for desired learning outcomes (skills and attitudes), as well as acceptable methodologies and indicators that can be used (after likely adaptation) to consider

the impact of ICTs in education. There is also a need, we believe, to expand current definitions of basic skills to account for what we term the notion of a 'broader literacy'[xi], that would include, where appropriate, information literacy and numeracy skills (e.g., information analytical and search skills, statistical reasoning, and so forth), as well as desired social and economic outcomes. Finally, and perhaps most importantly, it needs to be understood that M&E is an imperfect science, but like any scientific endeavor, one builds on the accumulated knowledge (and yes, mistakes) of one's forebears. Thus, this *Handbook*, as detailed in the next section, will begin with an historical review of M&E impact studies – and then consider the key issues of M&E in ICT for education today and tomorrow.

1.4. Audience and Purpose

The primary audience for this *Handbook* is expected to include policy makers, program implementers and evaluation specialists. However, the exploration of issues herein is related to the effective use of ICTs in education more generally, and will hopefully be of interest to a broader audience including officials in a variety of ministries, agencies and higher education institutions around the world. Our goal – and principal priority – is to provide pathways (there is no singular in this business) toward contributing to a credible evidence-based future of ICT for education in the development process. And, while our focus is on less developed countries (LDCs) – and particularly among the most challenging and poor populations in the world – we hope that the concepts, methods and tools mentioned in the *Handbook* is will be of value in *any* country where ICT4E is a serious matter of consideration and policy planning.

It must also be said that this is a brief *Handbook*, not a fully comprehensive one. Our goal was to cover enough of the territory to get key people moving in the right directions. But we have not covered all directions. Indeed, in the fast changing domain of ICTs, providing an 'up-to-date' comprehensive volume would be nearly impossible – it would be out-of-date by the time it was published! Nonetheless, the interested reader should look at the Key References at the end of each chapter, as well as the Annex, as both contain useful website URLs that

connect to further information, some of which is likely to have very current information that was not available at the time we worked on the *Handbook*.

1.5. The Chapters

Following is a brief description of each of the remaining chapters.

Chapter 2. Monitoring and Evaluation of ICT for Education Impact: A Review (R. B. Kozma).

Research suggests that simply putting computers into schools is not enough to impact student learning. That said, specific applications of ICT *can* positively impact student knowledge, skills and attitudes. In this review, three main issues are considered in terms of the impact of ICTs in education: (a) student outcomes such as higher scores in school subjects or the learning of entirely new skills needed for a developing economy; (b) teacher and classroom outcomes such as development of teachers' technology skills and knowledge of new pedagogical approaches, as well as improved attitudes toward teaching; and (c) other outcomes such as increased innovativeness in schools and increased access of community members to adult education and literacy. A critical analysis is provided of leading comparative international studies as well as selected projects utilizing ICTs to benefit education in LDCs. The evidence to date suggests that ICTs can contribute significantly to changes in teaching practices, school innovation, and community services. Policymakers and project leaders should think in terms of *combinations* of input factors that can work together to influence impact. Coordinating the introduction of computers with national policies and programs related to changes in curriculum, pedagogy, assessment, and teacher training is more likely to result in greater learning and other outcomes.

Chapter 3. Core Indicators for Monitoring and Evaluation Studies for ICT in Education (R. B. Kozma and D. A. Wagner). Core indicators are the ways we come to understand the inputs and outcomes of a program or project that we may or may not be able to observe directly. The conceptual framework for the evaluation of ICT in education initiatives outlined above

identifies a variety of factors that can impact on ICT skills and student learning achievement. Some of these factors may appear relatively distant from direct ICT intervention, such as the national economy, social development context, or the education reform context. Other context factors are more immediate, such as those related to ICT use in the home, amount of local school support, and the availability of digital education content. However selected, *core indicators* need to relate to specific components of the ICT intervention and their implementation, and include both *input* variables (such as classroom ICT resources, teacher training, and classroom pedagogy), as well as *output* variables (such as student learning of school subject, learning of ICT skills, and "21st century" skills, affective outcomes, and so on). The use of direct and proxy (indirect) indicators that evaluators is reviewed, with a special focus on indicators that pertain to the ICT intervention, its implementation, and its immediate outcomes. Also considered are *cost-benefit* analyses – that is, how to determine the value of the costs and benefits of a particular project, both in fiscal and non-fiscal aspects. In sum, a framework is required in order to determine a core set of indicators of relevance for policy and practice, with a focus on what these indicators may or may not show concerning impact and effectiveness.

Chapter 4. Developing a Monitoring and Evaluation Plan for ICT in Education (T. James and J. Miller). Monitoring and evaluation provides ongoing learning and feedback throughout the design, planning and implementation stages of any ICT4E program. It includes an assessment of results at the end as related to the original objectives set for the project. Appropriate, realistic and measurable indicators should be selected to monitor outputs and outcomes. In developing an M&E plan, there are a variety of critical questions, and practical steps that must be accomplished, such as: Have major stakeholders been identified and involved in making M&E decisions. Are there enough resources (financial and human) to monitor all the indicators? If not, is there a prioritization process in place? What will be done with the data gathered on the selected indicators? How do the indicators support decision-making – in the project, the program, within various levels of government? Once the data is analyzed, is there a dissemination strategy in place? For example, how widely will the results be circulated and

to whom? Finally, have cost considerations of doing M&E been given adequate attention? How does one estimated the cost associated with arriving at an adequate M&E set of results? These and related questions are considered as pieces of the implementation plan that is required for each M&E effort.

Chapter 5. Capacity Building and Management in ICT for Education (T. Unwin). Capacity building is at the heart of the renewal of effective and high quality work in ICT and education. The committed involvement of professionals is required for any systemic change, large or small. One major limitation for change in ICT and education is that the large majority of the instructional staff in the education systems (formal and non-formal) in LDCs remains with little or no ICT literacy. Furthermore, there have been only limited resources and strategies for involving full-time ICT professionals in school-based settings. All too often, broad definitions of capacity building tend to get reduced in practice to mean enhancing the skills of a particular cadre of people, and in education systems this most usually means the teachers and administrators. If successful change management programs involving new technologies are to be introduced, it is of critical importance that all of the key participants are involved. In addition to service providers, there is also a need for the building of human capacity in the monitoring and evaluation sector. Teachers and administrators must also have more opportunities to understand and learn from local problems and to invent local solutions. Increasing the proportion of well-trained ICT-literacy teachers and/or full-time ICT instructors is an essential element of enhanced human capacity development. Capacity building and management go hand in hand; everyone needs to be trained appropriately, and the processes require careful management. In particular, it is important that those charged with undertaking formal monitoring and evaluation activities, such as proposed in this *Handbook,* are able to develop the appropriate skills to deliver these programs effectively.

Chapter 6. Pro-Equity Approaches to Monitoring and Evaluation: Gender, Marginalized Groups and Special Needs Populations (D. Wagner). It is widely understood that population characteristics and social-economic issues have a direct bearing on the effectiveness of any

educational intervention. Long before the term *digital divide* became a common way to describe gaps between the rich and the poor related to the access to and use of ICT, most policy makers, researchers and practitioners could at least agree on one thing: Reaching the poorest of the poor was going to be a very difficult challenge. Even reaching the so-called *ordinary* poor (often, men with some secondary schooling, living in predominantly urban areas) entails challenges of electrical power, telecommunications connectivity, human resources infrastructure, and the like. Reaching the *poorest of the poor* (for example, illiterate women with little or no schooling, living in predominantly rural areas, and possibly speaking minority languages) would be considerably more difficult. The goals of EFA and MDGs are very clear about the need to promote *pro-equity* approaches to gender (women and girls), among "marginalized" populations (such as illiterate persons, ethno-linguistic minorities, refugees, and so forth), and those with special educational need. Would the availability of equity-sensitive M&E indicators work towards promoting greater *inclusion* of populations within the MDGs? For example, what is the demographic breakdown of the intervention sample by gender, language, ethnicity, age, location, and income relative to the rest of the national population? Much can and needs to be done to support a pro-equity approach to ICT and development – one that will benefit and be inclusive to nations and *all* their citizens.

Chapter 7. Dos and Don'ts in Monitoring and Evaluation (T. Unwin & B. Day). There are many things one should *do* to enhance the impact and effectiveness of ICT4E programs. And, there are concomitant things that one should *not do*. Knowing which is which in this matrix is not as obvious as it seems. Generalities often are defeated in their truth value by specific contexts of application. This chapter draws together the key recommendations of the previous chapters to this *Handbook*. We try, wherever possible, to anchor these exhortations within a deeper discussion provided by the chapter from whence it derives. For the policy maker, the list provides a quick way into the prospects and opportunities that one or another program may encounter in an M&E effort; for the program director, there may be cautions concerning pitfalls that await. Overall, any list of do's and don'ts needs to be understood as a set of issues

to be confronted and dealt with – a summation of the experience gleaned from the record to date.

1.6. Final Comment

The present *Handbook* should be seen less in the classical academic sense of a document that comprehensively covers a domain of interest, both in depth and breadth. While beyond a manual in the sense of providing conceptual and empirical approaches that are derived from the research and evidence gathered to date, nonetheless the volume is supposed to be of practical value, to be a working document – one that moves the field of ICT4E ahead in practical ways. Our collective concern is that same as that of many donor organizations as well as NGOs. Development programs that have utilized ICTs are often left in very vulnerable political and fiscal conditions due to a lack of evidence about 'what works' in their program – both specifically and generally. By helping to create a stronger knowledge base through improved M&E, it is hoped that the support for ICT4E innovations and investments will be at least as great as the hopes that many have for its potential in promoting both equity and development around the world.

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[ii] http://info.worldbank.org/ict/ICT_ssp.html

[iii] http://www.worldbank.org/oed/ecd/

[iv] UNESCO (1990, 2000). In the Dakar meeting, item 69 explicitly states: "Information and communication technologies (ICT) must be harnessed to support EFA goals at an affordable cost. These technologies have great potential for knowledge dissemination, effective learning and the development of more efficient education services. This potential will not be realized unless the new technologies serve rather than drive the implementation of education strategies. To be effective, especially in developing countries, ICTs should be combined with more traditional technologies such as books and radios, and be more extensively applied to the training of teachers." http://www.unesco.org/education/efa/ed_for_all/dakfram_eng.shtml (accessed October 2005)

[v] http://www.un.org/mdg (accessed August 2005).

[vi] World Bank, 2003

[vii]http://en.thinkexist.com/quotes/derek_bok/

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[ix] Haddad & Draxler, 2002; Ranis, 2004; UNDP, 2001; Unwin, 2004; Wagner & Kozma, 2005; Wolfensohn, 1999.

[x] World Bank, 2004, page 22. (http://www.worldbank.org/oed/ecd/).

[xi] See Wagner & Kozma, 2005.

Chapter 2

Monitoring and Evaluation of ICT for Education Impact: A Review

Robert B. Kozma

EXECUTIVE SUMMARY

- Research evidence shows that simply putting computers into schools is not enough to impact student learning.
- That said, specific applications of ICT can positively impact student knowledge, skills and attitudes.
- ICT use can benefit both girls and boys, as well as students with special needs.
- ICT can contribute to changes in teaching practices, school innovation, and community services.
- Policymakers and project leaders should think in terms of *combinations* of input factors that can work together to influence impact. Coordinating the introduction of computers with national policies and programs related to changes in curriculum, pedagogy, assessment, and teacher training is likely to result in widespread use and learning.

In a world of constrained resources, it is no surprise that *impact* should be near the top of the development agenda. Without demonstrated impact, why would anyone invest in development work, with or without technology? How do we claim credible evidence of impact? And, in the ICT domain: Are there some special ways that impact must be both defined and measured?

Technology advocates describe a range of potential impacts that ICT can have when applied to education. These include:

- *Student outcomes* such as increased knowledge of school subjects, improved attitudes about learning, and the acquisition of new skills needed for a developing economy. Beyond learning outcomes, ICT may help close the gender gap, and help students with special needs.
- *Teacher and classroom outcomes* such as development of teachers' technology skills and knowledge of new pedagogical approaches, as well as improved mastery of content and attitudes toward teaching.
- *Other outcomes* such as increased innovativeness in schools and increased access of community members to adult education and literacy.

With the promise of these outcomes, government policymakers and NGOs in developing countries have put computers in schools and connected them to the Internet, provided students with multimedia tutorials and simulations, trained teachers and given them access to new resources, provided schools with management and productivity tools, and established community technology and multimedia centers in villages. These resources represent significant investments, particularly in light of limited resources and competing needs in developing countries. What have we learned from these experiences? To what extent has the potential of ICT been realized? And how do we use what we know to support the Millennium Development Goals?

In this chapter, we summarize the research results on the impact of ICT on students, teachers, schools, and communities. While the large majority of studies in these areas has been done to date in OECD countries, the results coming from developing countries lend support to similar conclusions. We will address some of the studies from developing region so as to provide a basis for understanding the benefits, and limitations, of the various study designs that were deployed. Finally, we draw some conclusions of immediate relevance to policymakers.

2.1 Student outcomes

2.1.1 Impact on learning of school subjects

The most pronounced finding of empirical studies on ICT impact is that there is *no* consistent relationship between the mere availability or use of ICT and student learning. Some studies show a positive relationship between computer availability or use and achievement; some show a negative relationship; and some show none. For example, two major studies in the U.S. found a *positive relationship* between availability of computers in schools and test scores.[i] A study in Australia[ii] found *no relationship* between computer availability in schools and test scores. And two large studies, one an international study[iii] involving 31 developed and emerging countries, and another U.S. sample of schools[iv], found a *negative relationship* between the availability of computers in the home and achievement scores. However, digging more deeply into these and other student outcome studies it becomes clear that the relationship between ICT and student learning is a more complicated one. When looking at *communication or educational uses* of home computers the researchers[v] found a positive relationship with achievement. Also in this study, students who *occasionally* used computers in schools scored higher than either those who never used them or those who used them regularly. But even these results are misleading. Students in this study were *tested* on mathematics and reading but the data collected on computer use was *general*; even the educational use was not specific to math or reading. Thus, in order to understand the connection between the input (computer use)

and the output (learning in school subjects), it is essential to have the learning measurement directly correspond to subject area in which the technology is used.

Some studies have looked at this direct relationship. For example, the Wenglinsky study cited above measured the amount computers were used in mathematics classes and scores on math tests. The study found a *positive* relationship between the use of computers and learning in both 4th and 8th grades. Similar positive relationships have been found in OECD countries between computer use school subjects and scores in those subjects for mathematics[vi], science[vii], and literacy[viii]. Still, some studies in mathematics have found negative relationships between computer use and scores[ix].

Conclusions from such studies are limited by the fact that they use correlation analysis. With this type of analysis, factors are simply *associated* with each other. It cannot be concluded with confidence that one *causes* the other, the question often asked by most policymakers. For example, it may be that the brightest students use computers most and it is student ability that accounts for higher scores rather than computer use. Causality can only be assured with controlled experiments, where one group uses computers or uses them in a certain way and an equivalent group does not. An example of this type of experimental study was conducted in Vadodara, India[x] in which students in primary schools used computer mathematics games two hours a week and students in equivalent schools did not (Box 2.1). The students who used computers scored significantly higher than the comparison students on a test of mathematics. The bottom group of the students benefited most and girls benefited as much as boys. One important limitation of this field-based experiment is the lack of a theory (and supporting analyses) of why some students gained more than others. Only by doing more in-depth data collection and analyses would usable policy outcomes become apparent.

Box 2.1 India: An experiment using ICTs in primary schools.

Pratham, a Bombay-based NGO, provided computers to 100 primary schools in Vadodara, India. In half the schools, teachers received five days of training in the use of computers and they were supplied with specially developed educational games in mathematics. The selection of the schools was randomized for the purpose of the evaluation and controlled for key input factors, such as student gender and previous math scores. The non-participating schools continued with the regular curriculum that concentrated on core competencies in numeracy and literacy. It was observed that computers were not used in these schools. But in the schools where teachers were trained, students played computer games for two hours a week. Students in the participating schools scored significantly higher on mathematics tests. Students scoring lower on the pretest benefited the most and girls and boys benefited equally. It is clear that in this study, the higher scores in the participating schools were due to the package of input factors that distinguished it from the other group: a combination of teacher training, the software, *and* the use of computers.

Adapted from: Linden et al., 2003

While the Vadodara study is quite useful, especially as it relates to the design of M&E projects, we can draw conclusions with the most confidence when they are consistent across a substantial number of experimental studies. This keeps us from being misled by one study that says one thing or a different study that might say something else. Kulik[xi] looked at a large number of studies in the U.S. that were carefully designed. His findings across 75 studies can be summarized as follows:

- Students who used computer tutorials in mathematics, natural science, and social science score significantly higher on tests in these subjects. Students who used simulation software in science also scored higher. However, the use of computer-based laboratories did not result in higher scores.
- Primary school students who used tutorial software in reading scored significantly higher on reading scores. Very young students who used computers to write their own stories scored significantly higher on measures of reading skill.
- Students who used word processors or otherwise used the computer for writing scored higher on measures of writing skill.

We can have a substantial confidence in such findings, at least as far as OECD countries are concerned, and as long as the demographics, technologies and school contexts do not change substantially over time. Yet, even though the U.S. findings tend to run parallel to the Vadodara example above, it is important to consider how context and developments over time may affect outcomes. For example, early educational applications of ICT in the 1970's and 1980's in the U.S. focused on tutorial, drill and practice, word processing, and programming. Later applications used networking and the increased power of computers for visualizations and multimedia, simulations, microcomputer-based science laboratories, Web searches. These different applications are likely to focus on different classroom practices and outcomes. Such changes will continue to occur as the technology develops in the future, and their varied and differential use by target populations may well affect the outcomes produced. Naturally, the cultural and socio-economic context will also have a major role in the impact of any ICT intervention.

2.1.2 Impacts beyond the curriculum: Student motivation, new skills

ICT can also have an impact on students beyond their knowledge of traditional school subjects. A number of studies have established that computers can have a positive effect on student motivations, such as their attitudes toward technology, instruction, or the subject matter. For example, the Kulik[xii] analysis found that students using computer tutorials also had significantly more positive attitudes toward instruction and the subject matter than did students receiving instruction without computers. This finding corresponds to that in a comparative study conducted in physics classes in Kenya[xiii] where two randomly assigned classes used computer-based instruction while a third equivalent group did not. Students in the computer sections learned physics concepts better and expressed positive attitudes about their physics learning, as ascertained in interviews at the end of the lessons.

Students also learn new skills that go beyond traditional school knowledge. Many technology advocates argue for the inclusion of a more sophisticated set of "21st Century skills" in the curriculum in order to promote economic development[xiv]. They claim that the use of ICT can support the learning of such skills as technology literacy, information management, communication, working in teams, entrepreneurialism, global awareness, civic engagement, and problem solving. One example that promotes these skills is the World Links program, in which African and Latin American secondary teachers and students use networked computers to support in student-centred pedagogy (see Box 2.2). In the evaluation of this program[xv], both students and teachers more often reported that World Links students learned communication skills, knowledge of other cultures, collaboration skills, and Internet skills. In addition to these self-reported data, a connected study in Uganda used a specially-designed performance assessment to directly measure student learning of these skills[xvi]. The study found that World Links schools out-performed the non-World Links schools on measures of communication and reasoning with information.

Box 2.2 World Links Program in Less Developed Counties

The World Links project is a program, originally managed by the World Bank and subsequently by a spin-off NGO, to place Internet-connected computers in secondary schools and train teachers in developing countries in Africa, Latin America, the Middle East, and South and Southeast Asia. The goal of the program is to improve educational outcomes, economic opportunities, and global understanding for youth through the use of information technology and new approaches to learning. Services provided by the program include:

* Feasibility studies and consultation on connectivity solutions and telecenter management.
* Teacher professional development on uses of technology in the context of innovative pedagogy.
* Workshops for policymakers on coordination of policies and implementation strategies.

As of 2005, the program has involved over 200,000 students in over 20 developing countries. The three-year evaluation of the program used a combination of approaches that included surveys of teachers, headmasters, and students, as well as direct assessment of student learning. Teachers and students in participating schools were compared with computer-using classes in equivalent non-participating schools.

Adapted from Kozma, et al. (2004).

2.1.3 Impact on diverse students

An important Millennium Development Goal is to achieve gender equity. If girls are to leave school ready to participate equally in the economy, they too will need the benefits of ICT: increased knowledge of school subjects and new skills, including ICT skills. However, much of the research in OECD countries shows a gap such that boys have more experience with technology than girls and that girls are more anxious about technology than boys[xvii]. Fortunately, studies also show that greater experience with computers results in improved attitudes among girls. Many technology-supported programs in developing countries focus on including girls' use of computers and data on impact often shows no gender gap. For example, girls and boys learned equally from the use of computers in the Vadodara study cited earlier[xviii]. In the World Links evaluation, teachers reported no difference between girls and boys in a wide range of learning outcomes related to computer use[xix]. In Andhra Pradesh (India), Wagner and Daswani[xx] have reported that poor girls learn more than boys in a non-formal ICT-based literacy program, when controlled for schooling (see Box 6.1 in Chapter 6).

ICT can benefit very diverse types of students. There is also quite consistent evidence, at least in the Western research literature, that students with disabilities, indigenous (minority language speaking) students, and students from low income homes all experience growth in their sense of self esteem and autonomy in their learning when given access to computers in the context of student-centered pedagogy[xxi]. Further discussion of this area, with examples from developing countries, is provided in Chapter 6.

2.2 Teacher and classroom outcomes

2.2.1 Impact on teacher skills and motivation

Many governments are using the introduction of ICT as a way of providing teachers with new skills and introducing new pedagogy into the classroom. For example, teachers

participating in the *Enlaces* program in Chile receive two years of face-to-face training consisting of at least 100 hours[xxii]. As a result, teachers acquire familiarity with computers and use them regularly for professional (e.g. engaging in professional circles, e-learning), managerial (e.g. student marks, parental reports) and out-of-classroom tasks (e.g. searching for educational content on the web, lesson planning).

The World Links program provided 200 hours of teacher training which included an introduction to ICT, use of the Internet for teaching and learning, use of tele-collaborative learning projects, integration of ICT into the curriculum and teaching, and innovative pedagogical approaches. The evaluation of the World Links program[xxiii] found that a large majority of teachers and their administrators reported that teachers learned these new computer and teaching skills, and gained more positive attitudes about technology and about teaching.

2.2.2 Impact on classroom practice

The use of ICT has often been thought to bring significant changes into classroom practice. This was evident from school surveys conducted in 26 countries[xxiv] and a series of case studies conducted in 27 countries in Europe, Asia, North America, South America, and Africa[xxv]. These studies and others show that innovative classroom use of computers depends not just on the availability of computers in schools but also on other factors such as administrative support, teacher training, and supportive plans and policies.

The extensive teacher training provided by the World Links program not only resulted in teachers *learning* new skills but *changes in their classroom practices*. World Links teachers and students more often used computers to engage in a wide variety of new practices than did non-participating teachers who also had access to computers, practices such as conducting research projects, gathering and analyzing information, collaborating on projects with students in other countries, and communicating with parents and other community members[xxvi]. However, there are also significant barriers to widespread ICT-supported change in classrooms in developing countries, such as lack of time in the curriculum and school day, lack of skilled personnel, and lack of

infrastructure, including power, telecommunication access, and Internet service providers[xxvii].

National policies can address many of these barriers and make a difference in widespread use of ICT to change classrooms. When countries commit to coordinating the introduction of computers with changes in the curriculum, pedagogy, and teacher training, change in classroom practices are more likely to be widespread. For example, Costa Rica introduced computers in primary schools in rural and marginal urban areas along with the Logo programming language and other software tools to support constructivist pedagogy and collaborative classroom activities to develop students' cognitive skills and creativity[xxviii]. The *Enlaces* program in Chile is a nation-wide effort that introduced networked computers into secondary and primary schools in conjunction with a national reform effort that encouraged the use of project-based learning and small group collaboration[xxix]. As a result, computers are widely used in Chile along with new classroom practices.

2.3 Broader contextual outcomes

2.3.1 Impact on schools

It is sometimes claimed that the introduction of ICT into schools can significantly transform school organization and culture[xxx]. However, the causality in this relationship is likely bi-directional: the introduction of technology promotes organizational change in schools and transformed school organization can increase the use and impact of ICT. An OECD study of ICT-supported school change in 23 countries[xxxi] provides evidence that the introduction of computers can be used as a lever to launch the cycle of ICT-supported organizational change in schools. To date, there is a dearth of research in developing countries on the school-level impact of ICT and future research needs to address this deficiency. In one recent example (see Box 2.3) in Thailand, there was an effort to utilize low-cost handheld devises, and where the work is intriguing – but, as with many studies to date, the M&E aspect is too limited for firm conclusions to be drawn.

Box 2.3 Thailand: Use of Handheld Devices

In the *Thai Project on the Uses of Low-cost Technology in Science and Mathematics*, an evaluation study was undertaken to measure the effectiveness of using low-cost handheld devices (e.g., calculators, probes or sensors) to assess the design patterns of sticky rice baskets for maintaining appropriate temperature and humidity of steamed sticky rice. Teachers encouraged the students to identify local problems of their own interests, and advised students, coordinated with local people as well as science faculty staff of the university, to act as learning resources for the students' investigations. Learning with handheld devices not only engaged students to explore more with pleasure and curiosity, but also helped them gain a deeper understanding of Thai heritage and develop the higher order thinking skills.

This was one of the cases resulting from the effort of Thai Institute for the Promotion of Teaching Science and Technology (IPST) to explore the potential uses of handheld technology across science and mathematics enrichment program designed for upper secondary students at 7 schools participating since 2000. The major inputs included handheld tools supported by Texas Instruments (Thailand), a series of teacher professional development and curriculum materials incorporated the uses of handheld devices, and a supportive network between government schools, IPST, resource teachers, and universities. Monitoring and evaluation were undertaken through school visits, classroom observations, teachers and students' portfolios, and feedback from school principals. Judging also from a number of award-winning student science projects, it could be said that these achievements resulted from the effective uses of technologies, handhelds in particular.. More and more schools, particularly those having limited access to ICT infrastructure and connectivity, can now incorporate handhelds into their school curriculum in lower secondary science and mathematics classrooms. Provision of time, recognition of success from the principal in the pedagogical uses of technology, and a collaborative network among stakeholders sustained the uses of technology in schools.

Adapted from Waitayangkoon, 2004.

2.3.2 Impact on communities

The introduction of ICT via community technology centers or multimedia centers, in a wide variety of geographical locations, can also address MDGs related to education and economic development. There is a significant body of research in developing countries

that illustrate this potential[xxxii]. Typically, these programs utilize a mix of technologies, such a radio, video, computers, and Internet access, that are employed by established community-based service agencies to provide community members with information and services related to ICT skills, adult literacy, and education for out-of-school youth, especially girls. However, most of the literature in this area is descriptive and not focused on systematically assessing the impact of ICT on education and community development. Impact research is needed. At the same time, it is important to note that many of these efforts are still in the early phases and evaluations should be sensitive to fact that these services do not result in "quick fixes".

2.4 Summary and Implications

2.4.1 Impact of ICT on education

The research to date on ICT on education has provided us with important findings that are relevant to policymakers and to the Millennium Development Goals. The most important may be summarized as follows:

- The mere availability or use of computer does not have an impact on student learning. However, results are clear that *certain* uses of computers in specific school subjects have a positive impact on student learning in those subjects.
- Specifically, computers have a positive impact on student attitudes and the learning of new kinds of skills, when ICT is used in conjunction with student-centered pedagogy.
- Computers may benefit girls and boys equally and can be effectively used by students with special needs.
- Teacher training is important. Through it, teachers can learn ICT skills and new pedagogical skills and these often result in new classroom practices.
- ICT can also be used to launch innovation in schools and provide communities with new educational services.

2.4.2 Limitations of current research

There are important limitations to the research conducted on impact to date, and these have implications for future studies.

- Most studies have been conducted in OECD countries and these represent the particular circumstances and concerns of policymakers and researchers in these (largely) industrialized countries. While M&E studies are starting to emerge in developing countries, more are needed in order to support – or call into question – claims of success.
- Studies that rely on correlation analyses are open to multiple conclusions. Well-designed experimental studies would provide greater confidence, but at increased cost (see Chapter 4).
- Case studies provide the most detail about *how* ICT is use in classrooms and they can provide practitioners with information that they can use when implementing ICT. Priority should also be given to conducting case studies and structuring them to be most useful to practitioners can.
- Impact research results are not static, but rather – and especially in the fast-moving area of ICT – must be seen as subject to change over time. For example, the impact on grades of touch-typing skills or web access in the year 2000 is likely to be very different from that 5 or 10 years later when speech recognition is widely available, whether the person is living in Brazil or the United Kingdom.

2.4.3 Implications for policy

- Since computer availability alone will not have an impact, policymakers and project leaders should think in terms of *combinations* of input factors that can work together to influence learning. Coordinating the introduction of computers with national policies and programs related to changes in curriculum, pedagogy, assessment, and teacher training is more likely to result in widespread use and impact.

- Policymakers in developing countries also need to address the barriers to ICT use. These will vary from country to country, but they may include the need for skilled support staff and access to adequate infrastructure.
- Program monitoring and evaluation can provide policymakers and program directors with important information on the success and impact of their policies and programs related to ICT. These efforts should be adequately funded and they should be integrated into the initial planning process.

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Chapter 3

Core Indicators for Monitoring and Evaluation Studies in ICTs for Education

Robert B. Kozma and Daniel A. Wagner

EXECUTIVE SUMMARY

- The choice of core indicators in ICT4E is the key to determining the impact of technology on student and teacher knowledge, skills and attitudes.
- In order to understand the outputs of any program, inputs must also be measured, such as ICT resources, teacher training, pedagogical practices, and the educational, technological, and social context.
- Outputs should be measured against these same variables as well as costs.
- Data should be collected throughout the program's implementation, and in sufficient breadth and depth such that conclusions have credibility with the consumer of the study.

> *An indicator is a piece of information which communicates a certain state, trend, warning or progress to the audience*.[i]

Core indicators are, simply put, the ways we come to understand the inputs and outcomes of a program or project that we may or may not be able to observe directly. In Chapter 1, we identify a variety of factors that can impact on program outcomes. In this chapter, we concentrate on those indicators that are most relevant and immediate to ICT-supported educational programs and projects, what we term *core indicators*. In addition, we examine indictors of longer-term outcomes, the national context, and program costs. Specifically, we examine ways to measure or describe:

- *Input indicators* – including, for example, the type of ICT equipment and/or software and/or organizational design features deployed in a classroom or setting.
- *Outcome indicators* – including, for example, student and teacher impacts (cognitive, affective and attitudinal).
- *National educational and socio-economic indicators* – including, for example, educational enrolment rates, gross domestic product, human development indicators (such as gender equity, literacy, etc.) that characterize and distinguish a country and enable and/or constrain a project or program.
- *Cost indicators* – including, for example, fixed, variable and recurrent costs.

We begin the chapter with a discussion of general issues related to the monitoring and evaluation as well as the selection and use of indicators. We then review various indicators that have been used in a variety of settings in various countries.

3.1 Monitoring and Evaluation: Providing options for decision-makers

Monitoring and Evaluation (M&E) seems like (and often is) a technical exercise, designed by and used by technical experts and researchers. In fact, like all numerical data of this kind, the ultimate purpose of the M&E 'exercise' is to provide useful information

to decision makers. This is not always obvious or easy to do, largely because to engage in an adequate M&E process may require a team of specialists who work on technical aspects that have only minor connection to the broader policy questions that are targeted. This can be as true in judging a matter of environmental impact as it is on educational impact using ICTs.

Thus, the purpose of M&E is to provide credible options based on the best information that can be gathered to support one or another decision. One of the first choices that must be made concerns the breadth and depth of the M&E task. Naturally, this is as least partly determined by the resources that can be made available (see Chapter 4). Yet, there are also conceptual issues in breadth and depth. For example, is a broad national representative sample necessary in order to justify the impact of a major ICT4E implementation of, say, computer labs in secondary schools? If a large (and perhaps debatable) investment has been made, then only a broad large-scale study might convince policy makers that either more of the same is required, or that a change in policy is needed (say, if the PC's were poorly utilized and understaffed). Alternatively, if an NGO set up a small number of very innovative Internet-enabled kiosks which provide health education information, it might be most appropriate to undertake an in-depth ethnographic case study of how the health information was used in real time, and whether it had impact on healthy behaviors.

Thus, M&E can take many forms when put into practice in specific contexts. However, the universe of M&E studies, while varied, can be straightforward if one understands the available options. For a quick sampling of M&E approaches, as related to both indicators and instruments, see Table 3.1. In this table, we can see that case studies, ethnographies, sample surveys, and direct assessment all can play meaningful roles in M&E, but the choice of tools will depend on both the questions asked and the resources available to be deployed. A more detailed M&E planning methodology will be provided in Chapter 4.

Table 3.1 Examples of Implementations and M&E Approaches

Implementation Example	M&E Questions	Research Approach	Sample Selection	Indicators	Instruments	Analyses
ICT is has been installed in health information kiosks.	Were the kiosks installed and maintained properly, and did people use them?	Qualitative, ethnographic, small scale survey of implementers and community participants. The word 'use' can have many implications, and more in-depth work would be needed to understand where health behaviors were affected.	All implementations sites since this is small scale. If larger scale, then a small random sample of sites would be appropriate.	Input indicators	Reports from site managers, surveys of teachers, administrators, students; direct observation.	Compare accomplishments with general goals. Compare expenses with budget.
Large ICT for education implementation; PC labs in 1000 secondary schools across the country.	Were the PCs installed and maintained? Were teachers effectively trained to enhance the program. Did students gain effective access?	Quantitative: Survey of sample of sites, directors and teachers to determine effective implementation	A modest sample (10% perhaps) would likely be sufficient, assuring that most broad categories (by age, gender, geographical location, ethnicity) are sampled as needed.	Outcome indicators	Surveys of teachers, administrators, students; direct observation, focus groups.	Compare accomplishments with schedule of expected intermediate outcomes.
Innovative mid-sized program to utilize new multimedia and online resources for distance education of teachers.	What did teachers learn, and did they change teacher practices? Further, were their students affected by teachers who participated in this intervention.	Quantitative: Survey and/or direct assessment of teachers and learners, before and after the intervention, and compared to teachers/learners who did not have the intervention. Qualitative: Close observation of the teaching-learning process.	An implemention and control (no intervention) sample (dependent on how the depth of the study and resources) would be required assuring that most broad categories (by age, gender, geographical location, ethnicity) are sampled as needed.	Input and outcome indicators.	Direct observation, interviews	Compare pre- and post-intervention samples of teachers and learners, using direct assessment instruments.

3.2 Indicator selection: Problems and possibilities

While easy to define, it is not always easy to select the right indicators. For example, one can indicate the literacy level in a household by asking the head of household whether there are family members who are literate – this is termed an "indirect" measure of literacy because it does not directly assess the skill of the individual. And, as it happens, this is precisely how most literacy census data are still collected in developing countries. One might find it more relevant in some cases to ask for the mother's literacy level, as that is an excellent "proxy" indicator of literacy skill of children in developing countries, and more directly predictive of positive social and economic outcomes[ii]. Of course, one could also measure literacy skills via a test for reading or writing skills on a variety of items – a "direct" measure of skill. Each of these indicators, and others, has been widely used to measure literacy in global education reports. Direct measurement tends to be more reliable, but also more expensive to implement. Indirect and proxy measures are less reliable but may also be less expensive.

Further, the designation of a particular factor as an "input" or an "outcome" is somewhat arbitrary, since each of these are often the intended impacts of ICT-supported educational programs or projects. For example, increases in the number of computers in schools or changes in pedagogical practices can be considered intended "outcomes" of some ICT-supported programs and they are treated this way in Chapter 2, but they may also be considered as "inputs" in order to achieve a particular set of learned skills.

How do we pick the right indicators for a particular evaluation? Fortunately, there are some guidelines, and previous experiences in the ICT impact domain, that can guide our choices. Nearly a decade ago, the International Development Research Center published a planning document that has been used by a number of ICT in education groups, particularly with field-based programs in mind (see Box 3.1).

Box 3.1. Conceptualizing effective ICT evaluation instruments

- Indicators need to be context-specific;
- Ideally indicators assess the direct issue. Most of the time, however, an indirect indicator is more feasible and therefore more reliably monitored;
- Indicators are expressions of the values of those who chose the indicator. Both the selection and acceptance of an indicator depends on values;
- Indicators often work best and sometimes only in combination - a single indicator does not necessarily tell you enough, and;
- Indicators are transitory or sometimes seasonal – they need to be reviewed and adjusted;
- Over the course of the program, conditions change, objectives are altered or better indicators [may be] discovered. In these instances, it may be appropriate to change the indicators you are monitoring.

Adapted from Wieman[iii]; Sander[iv].

Another issue in selecting indicators is the tension between context sensitivity and change over time. There is a longstanding debate in the evaluation field, between context specificity and universality[v], and between adaptation to changing circumstance and the stability of measurement over time. We shall see in this chapter, as in the *Handbook* as a whole, that the dual dilemmas above are features that must co-exist with effective M&E.

The conceptual framework introduced in Chapter 1 identifies a variety of factors that can impact on ICT skills and student learning achievement. Some of these factors may appear somewhat removed from direct ICT intervention, such as the national economy, social development context, or the education reform context. Other context factors are more immediate, such as those related to ICT use in the home, amount of local school support, and the availability of digital education materials. However selected, *core indicators* need to relate to specific components of the ICT intervention and their implementation.

3.3 Input indicators

3.3.1 Classroom ICT resources

It is important to specify the ICT input—amount, type, and location of ICT resources— when determining the role that ICT played in student knowledge, skills and attitudes. These need to be identified and described whether or not an increase in the number of these resources is an explicit part of the ICT-supported program. If increasing the amount, of and access to, ICT is an overt goal, then ICT resources should be measured both as a baseline variable and later as an outcome. Of course, there are many ways to measure ICT resources or infrastructure, some of which are illustrated in Box 3.2.

Box 3.2. Some indicators of ICT based access resources

- Availability of electricity
- Number of devices (computers, printers, projectors, etc.) per school (sorted by their technical characteristics)
- Number of students or teachers per device.
- Number of computers connected to the Internet and type of bandwidth
- Number of students/teachers using the Internet per school
- Number of pieces of educational software available for key subjects (mathematics, language and science) per school
- Investment in hardware and in software per school

Adapted from Hepp et al[vi] and UNESCO[vii].

3.3.2 Teacher training

Teacher quality is also a very important input (and potential outcome) of ICT for education programs and projects. Indeed, as shown in the review of Chapter 2, the level of qualifications and training of teachers has been shown to be one of the key factors in the success of ICT for education programs. UNESCO[viii] has identified a number of

training indicators that include percentage of teachers who received training, type of ICT training (basic or advanced), length of training, and percentage of teachers who use computers for teaching. The International Society for Technology in Education[ix] has also developed a set of standards for teacher and these can be used as indicators for teacher training (shown in Box 3.3).

Box 3.3. Teacher training standards

- Teachers understand technology operations and concepts.
- Teachers plan and design effective learning environments supported by technology.
- Teachers can implement plan that include methods for applying technology to maximize student learning.
- Teachers can apply technology to facilitate assessment.
- Teachers can use technology to enhance their own productivity.
- Teachers understand the social, ethical, legal, and human issues related to the use of technology.

Adapted from ISTE[x].

3.3.3 Classroom pedagogy

As we saw in Chapter 2, the way ICT is used in the classroom can make a big difference in the impact of an ICT-supported program or project. ICT use includes the extent to which ICT is integrated into the curriculum and the kinds of pedagogical strategies that are used in association with ICT use. In one international survey conducted primarily in OECD countries, principals identified a number of what were termed positive "emerging pedagogical practices" that were often supported by ICT use (see Box 3.4).

Box 3.4. Pedagogical practices of teachers

- Students developing abilities to undertake independent learning
- Providing weaker students with additional instruction

- Organizing teaching and learning so that differences in entrance level, learning pace, and learning route are taken into account
- Students learning to search for information, process data, and present information
- Students being largely responsible for controlling their own learning progress
- Students learning and/or working during lessons at their own pace
- Students involved in cooperative and/or project-based learning
- Combining parts of school subjects with one another (multidisciplinary approach)

Adapted from Pelgrum and Anderson[xi]

In the World Links evaluation in several developing countries, Kozma and his colleagues surveyed students and teachers on the extent to which students engaged in various classroom practices using ICT (see Box 3.5). The data were not based on observations (i.e., direct measures) by others, but rather on individual's self-report. However, the reliability of these reports was increased by collecting data from both teachers and administers. Often they agreed that teachers were engaged in these ICT-supported classroom practices.

Box 3.5. Indicators of student practices in the ICT supported classrooms

- Collaborate on a project with other students in the same class
- Collaborate on a project with students from another school in your own country
- Collaborate on a project with students from another country
- Exchange information with another students from another country
- Gather and analyze resource materials on a problem or topic
- Gather evidence to argue a position about an issue
- Use graphics in a report
- Collect information about another country or culture
- Draw conclusions or make predictions using data you gathered or obtained from resource materials
- Communicate with your parents or other members of the community about what you do in school

Adapted from Kozma et al.[xii]

3.4 Outcome Indicators

3.4.1 Student knowledge of school subjects

Often the most important outcome targeted by ICT efforts is an increase in student knowledge. Some studies of ICT-supported programs have used self-report indicators, such as asking students, teachers, or administrators if students increased their knowledge of mathematics, science, language or school knowledge generally[xiii]. These are *indirect* and typically unreliable measures of school learning; direct assessment of student learning is preferred where possible.

Generally, there are two broad types of *direct* measures of school learning that have been used in conjunction with ICT-based education projects: (1) national and international assessments, and (2) *customized* program- or project- specific assessments. In Chapter 2, we reviewed studies that used national and international assessments to measure the impact of ICT on student learning. Typically, these latter indicators do not effectively target the particular sample of students, grades, content subjects or specific uses of ICT being implemented. In this chapter, we focus therefore on the second category, customized designs. Of the various types of measures, customized assessments are the most likely to capture the learning that takes place in ICT-supported programs and projects. On the other hand, critics may claim that customized assessments are too narrowly focused on learning goals that are specific to a program and thus may be biased in favor of the ICT when comparing outcomes with more traditional instructional approaches. If this is an issue for a particular evaluation, it can be addressed by combining program-specific assessment items with items that are drawn from or similar to those on the more standard assessments, such as the national exam. The analysis can then compare performance of ICT-using and non-using students on both sets of items. Box 3.6 presents some guidelines to follow when designing customized assessments.

Box 3.6. Some guidelines for customized assessments

- Test complex knowledge, not just the memorization of factual knowledge. Items should be designed to measure students' understanding of important concepts, principles, and problem solving skills.
- At least some tasks should be similar to situations in which students might apply their knowledge in the real world outside the classroom. These tasks should be structured so that students exhibit their thought processes and problem solving solutions. They are sometimes call *performance assessments.*
- It is appropriate to use ICT as part of the assessment. Tasks should have students used ICT tools to solve the problems and should provide information on the ICT knowledge and skills, as well as their knowledge of school subjects.
- Information that comes from the assessment should not only describe what students know but should provide program directors, teachers, and even students with information that they can use to improve the program and student learning. This would include the types of errors or misconceptions that students typically exhibited.
- Regular testing throughout the duration of the program, rather than just at the end, will allow evaluators to monitor the progress of the program, allow program staff and teachers to improve the program, and allow students to improve their learning.

Adapted from Bransford et al.[xiv]; Pellegrino et al.[xv])

3.4.2 Student attitudes

In addition to the *cognitive* measures of learning, ICT is known to have *affective* consequences as well. These can include student motivation and attitudes about a particular school subject, about school or learning in general, or about other matters. Such indicators may be assessed through surveys, often self-report. Reliability of these measures can be increased by using multiple information sources, such as by surveying students, their teachers, and school administrators. If all of these sources agree on an indirect measure, this increases the confidence that the outcome did indeed occur.

3.4.3 Student skills

3.4.3.1 Learning of ICT skills

There are other potential student outcomes beyond attitudes and the knowledge of school subjects. Perhaps the most immediate expected outcome of ICT use is an increase in technological skill and confidence. ICT skills may not be part of the formal school curriculum and may not be assessed by national examinations. However, there are several commonly used indicators of technology skills. UNESCO[xvi] lists indicators that include: number of learners that demonstrate only basic ICT skills, number that demonstrate advanced skills, and the purposes for which they use ICT. The *International Computer Driver's License* (ICDL[xvii]), and variations of it, identifies and measures skills related to basic computer concepts, using the computer and managing files, and the use of word-processing, spreadsheets, database, presentation, and communication software. The advantage of the ICDL is that it is a standard curriculum and assessment of ICT skills that leads to an internationally recognized certificate. This assessment is useful to evaluators as an indication of program success related ICT learning and it provides the participants with a credential that is recognized by employers. However, the assessment is expensive, and is limited in its scope to skills in using ICT tools.

ISTE[xviii] has also developed a set of indicators for students' ICT skills that include the application of both basic and more advanced ICT tools, such as research tools, decision tools, and problem-solving tools. Unlike the ICDL, ISTE has not developed an assessment. Rather, they have developed a set of standards that describes the kinds of tasks that students should be able to accomplish with computers and software tools. For example, the NETS standards state that students will be able to "use technology to process data and report results"; or "employ technology in the development of strategies for solving problems in the real world". These statements are specific enough to develop indicators that can examine the extent that students have accomplished these standards.

3.4.3.2 Learning of "21st century" skills

With the continuing increase in average schooling attainment across the globe, and the ever-growing interconnectedness of national economies, it is no surprise that skill requirements are also rising. Indeed, several initiatives have focused on the engagement of students in the use of ICT to measure the advanced, "21st Century" skills that are needed to participate in globally-integrated economic development. These skills include technology literacy, information management, communication, working in teams, entrepreneurialism, global awareness, civic engagement, and problem solving[xix]. In one such effort[xx] an assessment system was developed, termed the *Integrated Performance Assessments in Technology* (IPAT), which is designed to generate "authentic", real world-like problems (with sets of tasks and questions) requiring students to engage in ICT strategies such as planning, analyzing, and communicating. This system was used to evaluate student learning in the World Links program, an ICT-supported program in a number of developing countries, specifically Ghana, Paraguay, and Uganda. The IPAT system allows modules to be customized to particular types of technology tools and specific goals, grade-level, and content of a particular ICT-supported program. For example, the World Links assessment tasks asked students to use the Internet to search for information on a specific topic. Students were asked to use productivity tools, such as digital image-clipping software and tables were used to gather and organize information about the topic, and word processing and graphics tools to communicate findings in a newsletter. Rubrics specified the criteria of adequacy for the quality of technology use (productivity and Internet tools), problem-solving strategies (analysis, comparison, prediction), and communication (thesis, supporting evidence and reasons, organization).

3.4.4 Systemic outcomes

Policy makers are naturally concerned with the impact that ICT programs might have on *systemic* education indicators such as enrollment rates, pass rates and dropout rates – each of which is rather easily measured directly. These have been used widely in all types

of M&E efforts. Fortunately, most ministries of education already have on hand the relevant data on the above systemic indicators.

3.4.5 Teacher outcomes

Teacher learning can also be an important outcome of an ICT-supported educational program or project. Many programs have teacher training components, and the goal of this training is to increase teachers' knowledge of ICT or the pedagogical knowledge related to the integration of ICT into the curriculum and their classroom practice. These learning outcomes can be assessed directly, but more often they are measured indirectly through self-report surveys. In the World Links evaluation[xxi], for example, a number of self-reported questions were provided to teachers, such as their knowledge of computer hardware; software applications; the Internet; Web page development; student groups in teaching; collaborative student projects; and design and use student assessment materials; and how to integrate computers into the curriculum. Another approach is to consider teacher attitudes, as was done in a study in Costa Rica (see Box 3.7). In any case, the reliability of such indicators can be increased by collecting information from more than one source, such as from both teachers and administrators.

Box 3.7. Costa Rica: Teachers´ attitudes towards technology in education

The attitudes of teachers towards the work they do with the support of digital technologies continues to be an important indicator of educational value. In 2003, a monitoring scale was developed to assess the attitudes of Costa Rican teachers towards ICT in education, within the National Program of Educational Informatics of the Ministry of Public Education and the Omar Dengo Foundation. The scale evaluates 11 attitudinal dimensions, including: the value that teachers place on technology, their motivation to work as educators, their satisfaction with the Program, their self-perception on their capacity to teach, their vision of future, their sense of control over the technology, and their disposition to learn abilities related to technology. The scale was applied to a total of 319 teachers of educational informatics during 2003, as well as to a small group of teachers in a study that compared 2 schools that do not belong to the program with two similar schools that belong to the Program. Among the important findings were the following:

- the geographic zone in which the teachers work is not associated with differences in their attitudes towards technology in the teaching-learning process, which are generally positive.
- the number of years of experience in their teaching position is a variable that is positively correlated with their vision of future, the positive perception on their own performance and the feeling of control over technology.
- Teachers in multi-grade schools (one-room schools serving populations of K-6 students), where a single teacher works, are the ones that show greater satisfaction with the Program.
- Teachers working in the Program tend to value the role of technology; they are more satisfied with their capacities to teach, and they feel that they can achieve better results with students.
- The Program seems, overall, to be able to create conditions and opportunities for the development of capacities in teachers, which supports the achievement of equity.

These results suggest that teachers who work with digital technologies have positive self-perceptions that enhance their capabilities in the classroom.

Adapted from: Fundación Omar Dengo[xxii]. For more information: http://www.fod.ac.cr/

Building ICT skills is often a goal of teacher training programs and such skills are a necessary prerequisite for the implementation of ICT in the classroom.

3.4.6 Long-term outcomes

Often the investment in ICT-supported education programs is justified by their impact on longer-term social and economic impact, such as higher life satisfaction, higher income, improved health, and increase economic competitiveness and access to the global economy. Many of these anticipated outcomes are related to the 'Millennium Development Goals' (MDGs, see Chapter 1), such as level of poverty, gender equity, literacy and health. More often these factors are considered the *context* for ICT programs; usually, the indicators that are used to measure such factors are provided in a general section on economic and social context. While it is fairly easy (although often expensive) to measure some of these indicators, it is much more difficult to attribute any changes in them to the specific introduction of ICT-supported education programs or projects because of the complex mix of educational, social, and economic variables that influence

these indicators and the length of time needed to affect change. However, one way to approach this is through the use of *tracer studies*. In these studies, a number of students in the target program and perhaps some that did not participate in the program are followed for several years afterwards. Measures of graduation rates, final average grade, tertiary matriculation, type of initial employment, and so on, can be used to estimate what the longer term impacts will be.

3.5 National educational and socio-economic indicators

3.5.1 National educational context

There are significant economic, technological, and educational contextual factors that enable or – more often in developing countries – constrain the potential impact of ICT-supported education programs. Identifying and describing these factors in an evaluation will provide a greater understanding of the national context for program development.

There are two types of educational indicators that need to be considered: those which pertain to the general educational system; and those which are particular to ICT for education (see Box 3.8). Base on such indicators, as reported by agencies such as World Bank, UNESCO, and UNDP, policy makers have an opportunity to relate both inputs and outcomes of ICT-based projects to independently developed indicators.

Box 3.8. Examples of national education indicators

General indicators

- Total public expenditure on education
- Educational expenditures per student
- Relative proportion of public and private investment in educational institutions
- School enrollment rates at various levels
- Instructional time
- Class size and ratio of students to teaching staff

Specific to ICT for education

- Presence of a national educational ICT policy
- Presence of a master plan with a timeline
- National expenditure on ICT in education
- Ratio of students to computers
- Availability of computer networks in schools
- ICT as a separate subject in the curriculum
- Integration of ICT into the curriculum
- Number of schools incorporating ICT

Adapted from UNDP[xxiii], and UNESCO[xxiv].

3.5.2 National infrastructure context

The use of ICT in schools is very much dependent on the national ICT infrastructure. The extent to which power, telecommunications, Internet service are generally available, even in remote and rural areas, will influence the extent to which an ICT-supported program can be successful. The "digital access index" used by the International Telecommunications Union[xxv] is a compilation of indicators that describes a country's information infrastructure (see Box 3.9).

Box 3.9. National ICT indicators

- Percentage of households with: electricity, radio, television, computer, Internet access
- Percentage of population that: are covered by mobile access, use a computer, have Internet access
- Percentage of businesses with: computers, Internet access, a website
- Ratio of students per computer in schools
- Percentage of schools and government offices with access to the Internet

Adapted from ITU[xxvi]

Often, there is a significant "digital divide" between developing countries and developed countries in these measures. Also, there are often digital divides within

countries, such as between urban centers and rural areas, or gender or ethnic or minority groups. These should be acknowledged and addressed by program evaluators.

3.5.3 National economic and social context

The economic and social context indicators that are most relevant to developing countries are those related to the UN Millennium Development Goals. Indicators are listed for each of the MDGs (see Box 1.1, Chapter 1). Other basic economic and social indicators and data are reported in the World Bank Development and the UNDP Human Development reports.

3.6 Costs and Outcomes

The kinds of programs and projects described in this handbook may be expensive in upfront and ongoing costs and could well be competing for funding with many other projects — including educational ones that seek similar outcomes without using ICTs. Policymakers should thus compare the outcomes of a program with its costs so that they can make the best choices for public investments. There are two ways to do this: cost-benefit analysis and cost-effectiveness analysis[xxvii].

For a *cost-benefit analysis*, a common metric or indicator — money — is used to value the most significant costs and benefits for a particular project. This indicator allows for an analysis of a program or a comparison of several proposals, taking into account the time-value of money to determine the best return on the investment. The intent is to compute the monetary value of benefits and compare them to the monetary values of program costs or expenses. If no program achieves a minimum acceptable return of benefits to costs, then no funds should be invested. On the other hand, a *cost-effectiveness analysis* identifies and compares the costs of a project with some measurable outcome, without having to convert this outcome to a monetary value.

For either the cost-benefit or cost-effectiveness analysis, it is relatively easy to tackle the cost side of the equation: *Fixed costs* will be incurred irrespective of the size of a program: central buildings, facilities and equipment such as servers and radio/TV transmitters, central training and technical support, and infrastructure costs such as LANs, WANs, satellite connections and Internet Service Provision. *Variable costs* are per-user costs and depend on the number of users or participants in the program. These might include initial and recurring local facilities costs like computer labs, hardware costs, teaching materials, local connectivity and Internet usage, and local technical support. It is important to carry out a comprehensive analysis of all potential fixed and variable costs for a program, since often there will be not-so-obvious costs that might have serious cash flow implications as a program unfolds.

On the other side of the equation, it is often difficult to assign a monetary value to the outcomes of a project in the public sector because outcomes (such as improved test scores, increased school attendance, more competent teachers, and higher graduation rates) do not have a direct market value, as outcomes do in the private sector. Consequently, *cost-benefit* analysis may not be possible or appropriate. When it is used, alternative programs may be selected based on their highest net benefit, rather than the highest return on investment, since a very small project may have small benefits but even smaller costs, relative to a larger, more beneficial project.

Nonetheless, it is sometimes preferable in the public sector to use *cost-effectiveness* analysis, rather than cost-benefit analysis. The many measures and indicators of success described in this chapter show clearly that in the complex world of ICT for education, the "intangible" benefits (that is, in non-monetary terms) may be the most crucial ones. Thus, cost-effectiveness must take into account the many non-fiscal dimensions of a project that cannot always be put in strictly program monetary terms. As with a cost-benefit analysis, planners figure the program cost elements in monetary terms; but effectiveness (of

outcomes) may be measured in other ways, such as improved test scores or number of student graduated or reduced downstream costs due to increased school retention.

3.7 Conclusions and Implications

Policymakers and evaluators can draw on a wide variety of indicators of inputs, outcomes context, and costs. Based on this review, we draw the following set of conclusions:

- Program evaluations should concentrate on measures of student and teacher learning. The learning measures that are likely to be most sensitive to ICT-supported programs are those that are custom-designed for the program. These customized assessments should include measures of learning that are likely to result from the systematic use of ICT.
- Evaluators need to document and measure baseline inputs to the program, such as the amount and kind of ICT used, teacher training levels, and pedagogical practices that are associated with the program.
- Evaluators need to acknowledge and describe the national educational, technological, social, and economic factors that enable and constrain what can be done with the program.
- Evaluators may also need to calculate the fixed, recurrent and variable costs of the program and compare these to the program's benefits (monetary and non-monetary), as well and the costs and benefits of alternative educational approaches.
- Direct measures of M&E indicators are the most reliable sources of information. They also tend to be the most costly. Indirect measures, such self-report surveys, can be less expensive, but also less reliable. The reliability of these measures can be increased by obtaining information from multiple sources.

- Finally, the program can benefit from obtaining and distributing information on these measures throughout the program's implementation, rather than just at the end. This information can be used to spot problems in the early stages and make adjustments that will increase the likelihood of success.

In this chapter, we have tried to describe the different types of indicators that may be used in M&E studies of ICT for education projects. It should be evident that there is no single recipe, but there are nonetheless quite a few guideposts. Based on these elements, the next step in the M&E process is to focus on how to implement an evaluation study, which is laid out in the following chapter.

Key references:

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Endnotes

[i] Sander, 1997

[ii] Wagner, 2000

[iii] Wieman, et al., 2001.

[iv] Sander, 1997.

[v] Wagner, 1991.

[vi] Hepp, et al, 2004

[vii] UNESCO, 2003

[viii] UNESCO, 2003

[ix] ISTE, 2000

[x] ISTE, 2003

[xi] Plegrum & Anderson, 1999

[xii] Kozma, et al, 2004

[xiii] Kozma et al., 2004

[xiv] Bransford et al., 2000

[xv] Pellegrino et al., 2001

[xvi] UNESCO 2003

[xvii] see http://www.ecdl.com/main/index.php

[xviii] ISTE, 1998

[xix] ETS, 2002; National Research Council, 2003; Quellmalz & Kozma, 2002, 2003; Partnership for the 21st Century, 2005

[xx] Quellmalz & Zalles, 2002

[xxi] Kozma et al., 2004

[xxii] Fundación Omar Dengo (2003

[xxiii] UNDP, 2004

[xxiv] UNESCO, 2003

[xxv] International Telecommunications Union, 2003

[xxvi] International Telecommunications Union, 2003

[xxvii] Stiglitz, 2000

Chapter 4

Developing a Monitoring and Evaluation Plan for ICT in Education

Tina James and Jonathan Miller

EXECUTIVE SUMMARY

- This chapter provides an overview of the processes, tasks and outcomes that are needed to implement a successful M&E plan.
- The M&E process should be an integral component of any planned ICT in Education program and should be factored into planning before a project starts.
- Appropriate, realistic and measurable indicators should be selected (and not too many!) to monitor outputs and outcomes.
- All major stakeholders should be identified and involved in making M&E decisions. This will avoid possible problems with buy-in and commitment later in the process.
- M&E implementation costs should not be underestimated. We suggest that approximately 5 to 10 percent of total project costs be set aside as a reasonable target for M&E programming.

4.1 Introduction

Monitoring and evaluation (M&E) allows ongoing learning and feedback throughout the design, planning and implementation stages of a program. It includes an assessment of results at the end as related to the original objectives set for the project – but only if you plan for it in advance. Program implementers sometimes regard M&E as an externally driven and imposed 'policing' action with little perceived value, while policy makers try to understand 'what happened' after project completion. Both of these are common occurrences in M&E for ICTs in education.

Fortunately, recent trends have been moving more towards a participative, learning approach with improved local ownership for M&E efforts, and greater collaboration between policy makers, implementers and learners. This requires that sound M&E frameworks and practices be put in place at the inception stage of an implementation program or research exercise, rather than as an afterthought once implementation is well underway. The M&E framework should be fully aligned with the program design or research methodology, drawing on both quantitative and qualitative data. Ongoing M&E then becomes a project output in its own right, with the added benefits of learning from past experience. The outputs from a well-designed M&E plan can in turn influence the future directions that an ICT in education program may take and allow levels of flexibility and adaptability to changing circumstances.

This chapter describes a number of steps that are common to virtually every M&E plan for ICT in education projects. They include how to get started with the M&E plan, how to translate the overall vision for M&E into implementation, and how to disseminate the results. The important aspect of determining the costs and benefits of M&E is covered, and the chapter concludes with some key recommendations.

4.2 What is Monitoring and Evaluation?

There are important similarities and differences between these two distinct components of the M&E process.

The monitoring process looks at what is being done and how it is being done. It could involve continuous tracking of activities, review of the flow of services and activities provided by the program, compliance with laws, regulations, guidelines, etc. Much of the information desirable to monitor a program is also valuable for the evaluation component.

Evaluation looks at performance against goals. This can and should take place while the program or research project is underway and is concerned with evaluating how the intervention is meeting its performance goals. The early aspect is called *formative evaluation*; it overlaps with monitoring to the extent that it uses the data gathered during monitoring that is specifically performance related. Near the end of the project there should be an evaluation of how effective the program has been or whether the research project has met its original objectives. This is called *summative evaluation*.

4.3 Getting Started

a) Before you begin. There are a number of things to look at right up front – understanding where you are going is the *only* way to get there. Here we include defining the overall goals and objectives, understanding the context for the study, identifying the key players, and selecting among different approaches to carrying out M&E.

b) The overall goals and objectives. Goals are high-level statements that provide the overall (often longer term and less tangible) context for M&E, while *objectives* are concrete statements describing what the M&E project is trying to achieve (often shorter term and precise). For instance, the goals of M&E in an ICT in education program might include broad confirmation that a new ICT curriculum is workable and acceptable to the majority of teachers who will be affected. The

objectives of the M&E program might be to gather quantitative data from at least a hundred teachers at two different grade levels in twenty different schools over a period of three months.

c) The context. No project takes place in isolation – it is important to understand the influences of existing national and local policies and strategies, and the political and administrative structures that affect implementation. Any information that can be gathered prior to the start of M&E, such as baseline data, previous studies, reports, proposals and project plans, will provided a better basis for understanding what the project or program is setting out to achieve. It is important to give some thought to whether there are any risks associated with the successful implementation of the M&E. For example: Will key players (such as those described below) cooperate? Will there be difficulties in collecting data?

d) The key players

- **The stakeholders.** Those who wanted the project in the first place, such as policy makers, national/local authorities, community associations, etc. as well as others who were brought into the project along the way and who need to be kept informed or involved more actively. In each case it is necessary to understand their specific interests and concerns in an M&E activity.
- **The implementers.** These include the program or project manager and staff. The M&E personnel should ideally be brought on board from the early stages of the project. Also, it is essential that the implementers have the right skills to carry out M&E otherwise there will be concerns about credibility when the results are made available.
- **The beneficiaries.** Those who are supposed to benefit from the project (e.g., learners and teachers), and who might be longer-term beneficiaries (e.g., employers).

e) Approaches to carrying out M&E. One of the major challenges facing implementers is how to integrate M&E into the planning and implementation of ICT in education projects. There are several well-known methods that are commonly used, including Outcome Mapping (OM)[i] and Logical Framework Analysis (LFA)[ii]. There are a number of common elements that run through most methods—including the need for the identification and involvement of key

stakeholders; the need for well-defined outputs; and the need for ongoing monitoring and evaluation. See Box 4.1 for an example of the OM approach.

Box 4.. Namibia: Large-scale Implementation of Computers in Schools

Beginning in February 2000, SchoolNet Namibia set up computer laboratories in some 112 schools, launched an ISP and successfully connected the schools to it. It showed how this could be done in rural and disadvantaged areas where there were neither telephone lines nor connections to the power grid. Through mentoring and training, SchoolNet had become a test bed and demonstrator for technical solutions that challenged more widely used proprietary operating systems.

The formal SIDA evaluation report noted that, in terms of the original project objectives, the project had clearly succeeded in *"installing basic (Internet connected) LANs in secondary schools"* although it was far away from the original objective of connecting 500 schools or the revised figure of 350. There was evidence indicating that some schools connected by SchoolNet were *"reaching a high level of Internet usage by learners and teachers."* But there was only anecdotal evidence that SchoolNet efforts were *"enhancing basic computer skills of learners and teachers."* SchoolNet was helping to *"create a recruitment pool for IT technicians and professionals,"* though not in the way envisaged in the original log frame analysis. As for the development goal to "*improve the preconditions for education and for the gathering of knowledge and participation in a democracy for the country's youth through broadened horizons and a higher level of knowledge by using the possibilities of cheap and simple communication that ICT offers,"* the report noted the rather vague phrasing and the lack of clearly defined indicators, which made it difficult to draw concrete conclusions. It also criticized the lack of quantitative data to monitor project performance and enable objective evaluation. The formal assessment had to rely on subjective commentary from users. The database on the progress and results of the various activities was incomplete and, when available, it was not easy to access and query. The SIDA evaluation report is a rich source of information and perspectives on shaping, monitoring and evaluating ICT projects. It highlights that large-scale project objectives are on shifting sands. What makes sense early on may well change in positive or negative ways as schools, teachers and learners appropriate new technologies and attempt to extract real value.

See www.schoolnet.na and www.sida.se.

4.4 Designing the M&E Plan

Once there is a clear picture of the context and key players, the overall goals and objectives of the M&E plan are defined and the broad approach is selected (or dictated), it is time to get down to the detailed design of the implementation plan. For one recent national planning model for M&E, see Box 4.2.

In this section we focus on different methods of study, selecting indicators of performance and how to gather that information. Guidelines are provided to help ensure objective interpretation of the results and the drawing of credible conclusions.

a) Choosing the Method of Study. There remains a severe lack of good qualitative and quantitative data on the impacts of ICT on education. It has still not been possible, for instance, to prove the benefits of including ICT in formal primary and secondary education settings. There has been general agreement though that ICT has benefited aspects such as teacher education, access to content for both teachers and learners, and development of vocational skills and knowledge. One of the reasons for this lack of conclusive evidence is the difficulty of carrying out scientific studies in the messy world of schools, teachers, learners and subjects. The interplay between so many variables that have to be controlled or tested, the social and political realities of education systems, the limited availability of program and research funding, and the shortage of research capacity in developing countries makes the conduct of rigorous "*controlled experiments*" difficult if not impossible.

Box 4.2. Kenya: Integrating Monitoring and Evaluation into a National ICT in Education Plan

The Ministry of Education, Science and Technology of the Government of Kenya is putting plans in place to introduce ICTs into Education to improve the quality of formal and non-formal education. A draft Options Paper was produced in June 2005 which addresses the requirements as spelt out in the Kenya Education Sector support Programme for 2005 – 2010. Included in the Options Paper are a number of proposed interventions – interactive radio instruction, ICTs in schools and teacher training colleges, ICT infrastructure development, computer refurbishment, open and distance learning, community ICT learning centers, educational management information systems (EMIS) and e-content.

An integral part of the Options Paper is the inclusion of monitoring and evaluation as part of the overall plan. The paper specifically addresses the need to develop appropriate indicators for measuring progress and impacts during

implementation. Three key areas have been identified: 1) Infrastructure and Access; 2) Training and Usage and 3) Impacts. Data collection for 1) and 2) will be done nationally whereas impacts will most probably be carried out through the use of in-depth case studies. The paper also recommends that data collection be disaggregated by gender and communities.

The types of indicators that are being considered for Kenya are:

a. Infrastructure: number of types of hardware, software, connectivity, technical support, number of ICT projects, etc

b. Training & Usage: types of training – technical support, ICT literacy; usage by learner, institutions, student, teacher and officer, etc.

c. Impacts: e.g. skill and knowledge improvements – ICT literacy, technical expertise, subject- area expertise; attitude and value changes.

Adapted from AED[iii].

What planners and researchers can do is carry out "design experiments", where they craft and implement a new design for a particular learning environment. For instance, a teacher might work closely with a research team to incorporate computer simulations into the learning process, jointly design a series of exercises to introduce novel procedures and carefully monitor and assess the impact of the innovation on the learners, the teacher and the interaction between them.[iv]

In larger scale studies, *sample surveys* can provide descriptive information on the status of learning processes, perceptions, or attitudes. They may also directly measure skills levels (see Chapter 3). Sample surveys rely primarily on quantitative techniques and are designed using carefully constructed rules for sampling, data collection, and analysis.

At the other end of the scale lie *case studies*: intensive, qualitative studies of specific situations in a classroom, school, school district, or schools in a country or region. Researchers have used the case study method for many years to examine contemporary real-life situations issues, and problems.

b) Selecting M&E Indicators. Underpinning all M&E activities is the need to determine what it is that is being measured, and for what purpose. The identification, selection and prioritization (in some

cases) of both quantitative and qualitative indicators are therefore critical before M&E can be undertaken. The need for specific indicators may also evolve and change over time, as circumstances change. Chapter 3 of this volume has provided a broad overview of core indicators and suggested that their selection may be based on inputs, outcomes, national contexts and costs. On a practical planning level, the context and process in which indicators are selected need to be taken into consideration. A variety of questions therefore need to be asked at the start of any M&E intervention, as shown in Box 4.3.

Box 4.3. Key questions to ask about the selection of performance indicators[v]

- Have any indicators been defined in policy and strategy documents, and implementation plans – at various levels (national, district, school level).
- What are these indicators? Are there too many / too few? Should they be prioritized?
- How were they chosen?
- Who was involved in the final selection of indicators?
- What specific inputs / outcomes / impacts will they measure?
- Are the indicators realistic, measurable, and useful? Are they accepted by key decision makers and stakeholders who will use the results of the M&E?
- Are there enough resources (financial and human) to monitor all the indicators? If not, is there a prioritization process in place?
- What will be done with the data gathered on the selected indicators?
- How do the indicators support decision-making – in the project, the program, within various levels of government?

4.5 Implementing the M&E Plan

a) Collecting the data. There are numerous methods of collecting data. The choices that are made will largely depend on: (i) the availability of budget; (ii) the appropriateness for the objectives to be achieved through M&E; (iii) the availability of skills to carry out M&E; and (iv) the

geographic distribution of the places where data is to be collected. Some choices will be dictated by the contextual environment in which the study is taking place. Box 4.4 provides a summary of various data collection tools that could be used, along with comments about each.

b) Analyzing and interpreting the data and developing credible conclusions. Built into an M&E plan should be a method of gathering data that allows rigorous analysis leading to objective and unbiased conclusions. This is particularly important to ensure that the results of M&E will be accepted and regarded as credible by key players and decision makers. Typically this would involve selecting a *random sample* of units of interest, such as students, teachers, or schools, . This means that if, for instance, you are creating a random sample of learners, every learner should have an equal chance of being selected for evaluation. Pulling names from a hat would be an acceptable way of ensuring a random sample in this case. In other cases, computer-generated random numbers could be used. If comparison is across grades, then a so-called "stratified" random sample would be appropriate—making sure equal numbers are chosen from each grade level for instance.

If at all possible, comparisons of outcomes should be made with a control group matched in defined ways to the experimental group. For instance, in the Khanya evaluation (see Box 4.5), a random sample of experimental schools was selected and compared with a random sample of schools with similar demographic characteristics, but outside the Khanya program.

Box 4.4. Types of Data Collection and Their Appropriate Use

Data Collection Types	Description	Appropriate Use	Advantages	Disadvantages
Questionnaires	A pre-determined list of questions which can consist of structured and / or open-ended questions: Can be printed or electronic versions	Large sample size Geographically dispersed samples Useful if sample has e-mail access and is comfortable with online surveys	Can reach many in a short time Relatively cheap if Internet is available Can save time Allows analysis of large sets of results	Generally a low return rate Long delays in returns of questionnaires Unreliable mailing systems ICT access could be limited
Face-to-face interviews	Interview generally conducted generally one-on-one . Generally tends to be more open-ended to allow for flow of ideas from key stakeholders	Small sample size Where more in-depth information is required With key stakeholders unlikely to complete a questionnaire	Generally a wealth of additional information that can inform more structured approaches e.g. audits, checklists, questionnaires	Time-intensive Analysis of the responses may be more complex Needs experienced interviewers
Telephonic interviews	Interviews conducted over the telephone. May include conference calling with more than one person	Geographically dispersed samples ICTs readily available and affordable	Can save time where extensive travel may be involved Can work well with more experienced interviewers	Can be expensive / difficult where telecommunications costs are high and lines unreliable 'Cold-calling' is not always conducive to good interviews
Workshops / Focus groups	Generally a facilitated discussion with several stakeholders A separate record-keeper / observer is ideal Generally a small number of focused topics	Good facilitators are required, particularly if the group is diverse in back-ground, power positions, education levels, etc Requires good record-keeping	A well-facilitated group can provide rich inputs	Underlying differences, even hostilities and mistrust, need to be understood and could be disruptive without good facilitation
Content analysis of materials	Analysis of key program documentation - electronic and/or hardcopy	Typical content includes curriculum materials, policies, strategies, teaching resources, websites, lesson plans, project and program plans, progress reports	Can provide useful background for any M&E activities.	Could be unreliable due to subjective analysis Documentation may not always be available or accessible
Infrastructure audits	Assess the levels of ICT infrastructure, access and availability - hardware, software and telecommunications	Useful to determine the status of ICT availability	Useful to assess ICT infrastructural needs	M&E may be seen to include only infrastructure and other factors in the use of ICT in education may be ignored / not measured
Checklists	A pre-prepared list of items which can be used to assess numerous activities rapidly. Requires completion of 'boxes' – hardcopy / electronic	Can be used for self-assessment, audit purposes, classroom observations, online surveys	Useful when quick responses are required and/or when the evaluator is not able to spend time writing Can be analyzed quickly	Can be relatively superficial, and reflect the evaluators' biases.
Software	Analysis of the content and	To assess the appropriateness of	Could be a basic requirement for	Could be unreliable due to subjective

Box 4.4. Types of Data Collection and Their Appropriate Use

Data Collection Types	Description	Appropriate Use	Advantages	Disadvantages
analysis	functionality of education software	software for educational purposes e.g. teacher education, school administration, etc	M&E involving educational software.	analysis.
Self-assessment reports	Widely used as an assessment tool in M&E in education	Assess self-perceived levels of proficiency, attitudes and perceptions, etc	Can be applied to large numbers of learners and teachers	Can result in bias due to self-reporting Time intensive to analyze
Work sample analysis	Analysis of work produced by learners, teachers, administrators	Tests productivity and proficiency levels, e.g. ICT literacy skills, presentation skills, administrative skills	Can provide a quick snapshot of skills levels	Could be relatively superficial and more appropriate for testing low-level skills Time intensive
Activity Logs	Records are kept by learners / teachers/administrators of specific activities	Monitoring of computer access, levels of learning achieved (self-assessment)	A useful indicator of levels of activity and productivity	Self-reporting can be biased
Classroom observations	Assess teaching practices in a classroom situation	Assessment of classroom layouts, instructional practices, learner-teacher interactions, learner behavior, integration of ICTs etc	Allows a hands-on assessment of classroom practices	Time intensive Inherent bias in that learner-teacher behavior may be 'rehearsed' for the sake of a good result from the observation

Box 4.5. South Africa: The Khanya Project of Computer-supported Learning in Schools

In the Khanya project, the Provincial Education Department in the Western Cape Province of South Africa has been rolling out computers and connectivity to enhance the delivery of curriculum throughout the province. Since 2000, Khanya has deployed some 12,000 computers across nearly 600 schools out of the 1500 in the province. About 9,000 teachers and 300,000 learners are being touched by the project so far. While deployment of computers and software, creation of LANs and connections to the Internet are critical components, the core objective of Khanya is to use ICT in the delivery of curriculum—to teach mathematics, science and other learning areas in secondary schools, and literacy and numeracy in primary schools. The intention is to empower teachers and learners to develop their own material, gain planning and organizational skills through lesson planning, enhance the delivery of curricula and to put learners in township and rural schools in touch with the rest of the world through the Internet and email.

About 50 staff run the Khanya project and engage in continuous internal monitoring and evaluation. In addition, since 2002 there has been a regular process of external evaluation by a team from the University of Cape Town in South Africa. The evaluation addresses appropriate ICT provisioning, teacher effectiveness in the use of technology for curriculum delivery and learner performance. Regular assessment reports are issued.

Of special interest is the recent and careful statistical analysis of the relationship between use of the ICT-based *Master Maths* program and mathematics scores on standardized tests. Two kinds of *post facto* analyses were done by the evaluation team – comparisons between a random sample of "experimental" schools paired with "control" schools, and a longitudinal (over time) analysis of mathematics scores for the three successive graduating classes in a random sample of experimental schools. In both analyses, controlling for several other variables, there is evidence that the mathematics scores for learners on the ICT-based maths programs were significantly better. The evaluation offers a good example of a significant attempt to carry out an objective analysis of the impact of ICT on specific learning outcomes, and at the same time illustrates a multitude of possible confounding variables and practical matters that make large-scale ICT interventions difficult to design, implement and evaluate. Adapted from Khanya[vi]

To facilitate data analysis, the data should, as much as possible, be quantitative (or quantifiable from case or qualitative approaches), and allow the application of well-accepted statistical techniques. The selection of indicators and sample sizes in the design of the M&E plan must take into account whether the data will be normally distributed (i.e. following the well-known *bell-shaped curve*), what kinds of statistical techniques will be applied, and the desired *effect size* (e.g. the percentage improvement in test scores). There are several techniques of data analysis that can be applied under these conditions, such as analysis of variance, covariance analysis, multifactorial statistical analysis, multiple regression techniques including multi-level regression, and structural equation modeling.[vii] Even if the nature of the data is not expected to lend itself to

such tests, there are other tests such as cluster analysis, analysis of ranks, etc., which can be applied. It is vital that the design of the intervention take into account *in advance* how the data will be collected and analyzed. Researchers sometimes end up with large quantities of data that they are not able to analyze in an effective way.[viii]

4.6 Disseminating the Results of M&E

When an M&E plan is formulated, it is important to consider how to manage interactions with the people who will be involved in the process. These people could be decision makers, teachers, government officials or learners, and each will require some form of interaction with the M&E team. In particular, there may be formal steering committees, user groups and program committees to consider. A number of factors will need consideration:

a) The *identification of the key stakeholders and stakeholder committees* who need to be involved, either directly or indirectly;

b) The *levels of participation* that will be required from different players. For example, how often will key stakeholders meet? And will this be through group meetings, personal discussions, through information sharing in presentations or through the circulation of the final reports?

c) The *formality of participation.* Are formal meetings with a minute-taker required and, if so, how often? Should such meetings be at regular intervals or to mark milestone events in the project (or both)?

d) The *levels of transparency* about the results of the M&E, as well as during the M&E process. For example, if there are very negative criticisms that emerge during the M&E, with whom will the outcomes be discussed?

e) The *dissemination* of the M&E results. A dissemination strategy is required that spells out exactly how to deal with the outcomes of the M&E activity, how widely the results will be circulated and to whom. This is particularly important if M&E is to be regarded as a potential means of increasing knowledge and improving the outcomes of

existing and future projects. A matrix such as the one below (see Box 4.6), which spells out how to communicate with different stakeholders, may be helpful.

Box 4.6 Matrix outlining intended dissemination approaches to various stakeholders

	Personal meetings	Presenta-tions	Small Discussion Groups	Website	Summary Report	Full report	E-mail lists
All Stakeholders					√		
Teachers			√	Closed website	√		√
Minister of Education	√				√	√	
Parents		√		√	√		
Etc.							

4.7 Analyzing the Costs (and Benefits) of Implementing an M&E strategy

The fiscal dimension of ICTs in education development is often seen in terms of capital investments, ongoing maintenance costs, regular costs of connectivity, and training costs. Some of these costs may be difficult to estimate in advance, including the cost of doing M&E. The scarcity of funding for any type of development initiative means, however, that its potential cost-effectiveness will be considered as a critical factor. When ICTs are involved in any initiative, the perception that they are costly further amplifies the requirement for clear budgeting for M&E as a component of the costs of 'doing business' in ICT4E. In countries that are at risk of failing to reach Millennium Development Goal (MDG) targets, the issue of cost is especially acute. Considering costs in M&E is not simple, as there are many and varied direct and indirect costs depending on the level of data gathering and analysis required.[ix]

The Costs of an M&E strategy. Each of the elements of an M&E plan will add additional costs to the overall program or project, and these must be dealt with up front, including those shown in Box 4.7. Exactly what the costs will be depends on the nature of the intervention, whether local or international personnel are used, and so forth. For instance, small stand-alone projects such as technology implementations (e.g. single school computer labs) that focus on tangible outputs and outcomes, may require little data gathering other than data generated by the project itself. M&E of large-scale multinational multi-year programmes based on implementation of national policies may

call for substantial investments in time and effort on the part of many professional evaluators, and greater levels of inputs of other kinds.

In its survey of well-known methods of monitoring and evaluation, the World Bank offers rough cost data for each method in terms of low, medium, or high investment, and suggests that each calculation depends on a whole host of factors, but with a cost factor that matches the usually large size of Bank loans and grants.[x] We take the position that an M&E budget should not divert program resources to the extent that operational activities are impaired. At the same time, the M&E budget should not be so small as to compromise the reliability and credibility of the results. In the end, we suggest the rule of thumb frequently offered – that M&E should be in the range of 5 to 10 percent of total program costs. For example, a $1M project should allocate $50,000 to $100,000 for M&E costs so as to assure that the impact of investment is measured and evaluated.

Box 4.7 Some principal costs of M&E, in measurable fiscal terms

- Technical assistance to determine and advise on the most effective M&E activities for the particular intervention
- Technical assistance to carry out the recommended ongoing monitoring and formative evaluations, and the concluding summative evaluation. This may involve continuing M&E of longer term outcomes and impacts.
- Defining performance goals related to activities, outputs, outcomes and impacts: for formative and summative evaluation
- Designing proper experimental or survey procedures, sample sizing and selection schemes, control groups, etc.
- Where needed, implementing increased sample sizes, numbers of enumerators, additional levels of treatment etc., to ensure a given level of accuracy in statistical analysis and providing conclusive results for a chosen effect size etc.
- Proper monitoring of the tasks being carried out to implement the project and deliver the identified outputs (observation, data gathering, analysis and reporting)
- Formative and summative evaluation of quantity and quality of outputs and the timing of their delivery
- Undertaking statistical analysis and interpretation of the data emerging from monitoring and evaluation

- Implementing management information systems (MIS) and procedures where recommended for more effective M&E

The Benefits of M&E. Complex as it is to estimate the costs of engaging in M&E, the benefits are even more difficult to state in financial terms. Some benefits do not lend themselves to easy quantification. For example, how can one measure the fiscal benefit of knowing that one type of implementation is better than another**?** We might know which implementation strategy to pick the next time, but we might not easily know whether the level of investment in M&E was too much or too little or just right. As with many "returns on investment" (ROI), only certain kinds of benefit lend themselves to measurement of this sort. The non-tangible benefits, such as the policy maker's satisfaction, or ICT interventions *not* to make the next time around, are important – or even crucial! – but may be difficult to put in monetary terms**.**

In sum, the benefits of engaging in M&E may be seen in the increased confidence of donors or sponsors to invest in a particular ICT for education initiative. In the policy domain, M&E results can strengthen the case for a budgetary shift in a particular direction or not; and in the social arena, M&E results can persuade teachers and principals that it is safe and beneficial to adopt ICT-related methods.

4.7 Conclusions

"Not everything that can be counted counts, and not everything that counts can be counted"

Attributed to Albert Einstein

This chapter has tried to provide an overview of the processes, tasks and outcomes that are needed to implement a successful M&E plan. In conclusion, we provide a list of pointers specific to the M&E implementation plan that will assist in focusing attention on the key elements that should not be ignored.

- The M&E process should be an integral component of any planned ICT in Education program and should be factored into planning before a project starts. This means that local ownership and accountability are crucial if learning is to be gained and built on for future activities. Disseminating the insights gained from M&E should form part of the learning process.
- Appropriate, realistic and measurable indicators should be selected (and not too many) to monitor outputs and outcomes. The data collected should be really relevant and there should be a clear understanding of what will be done with it once it has been collected.
- Monitoring activities should be clearly distinguished from the formative and summative evaluations of performance criteria – they fulfil different functions.
- All major stakeholders should be identified and involved in making M&E decisions. This will avoid possible problems with buy-in and commitment later in the process.
- Adequate thought must be given to who the key target groups will be in implementation - and what expected outcomes are desired for each group.
- Finally, M&E costs should not be underestimated. If the outcomes of M&E are seen as useful and add to the future improvement of implementation, the allocated funds will be well-spent and are likely to provide major benefits in terms of better outcomes and impacts. We suggest that approximately 5 to 10 percent of total project costs be set aside as a reasonable target for M&E programming.

Key References

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Endnotes

[i] OM focuses on the desired changes that a project or program wishes to bring about with stakeholders (e.g., officials, teachers, or parents of school children), rather than assessing the products (e.g., curricula, teacher training programs, educational software). OM is based on the belief that the power for change comes from the stakeholders, and that embedding the power and responsibility for change in the people, groups and institutions directly working with a development project will result in a higher likelihood of success. It emphasizes a participatory approach coupled with ongoing data collection, assessment and learning. See Earl, Carden and Smutylo, 2001.

[ii] The LFA method comprises the common elements described in the main text and calls for the development of a 5x4 logframe matrix. The matrix distinguishes between: the Goal, or broader development impact to which the project contributes - at a national and sectoral level; the Purpose, or the development outcome expected at the end of the project; all project elements will contribute to this; the objectives, or the expected outcomes of producing each of the outputs; the outputs, or the direct measurable results (products and services) of the project which are largely under project management's control; and the activities, or the tasks carried out to implement the project and deliver the identified outputs. See Lewis Grant (n.d.)

[iii] http://ict.aed.org/kenya

[iv] Collins, 1999

[v] UNESCO, Bangkok's website is an excellent resource

[vi] See: http://www.khanya.co.za

[vii] Kremer, 2003

[viii] In some cases scientific rigor may have to be compromised, and convenience samples may be chosen in light of local conditions (e.g., if the project budget allows only nearby schools to be part of an experiment). While such convenience samples may raise questions as to the scientific validity of the results, avoiding bias will always help to provide a more persuasive set of conclusions.

[ix] Perraton & Creed, 2000; Haertel and Means, 2003

[x] World Bank , 2004

Chapter 5
Capacity Building and Management in ICT for Education

Tim Unwin

EXECUTIVE SUMMARY

- Good management is essential for the successful implementation of monitoring and evaluation activities in the field of ICT4E.
- Monitoring and evaluation activities themselves also have a significant influence on educational management and enhanced capacity building in poor countries.
- These intertwined themes need to be carefully understood and negotiated if ICT4E programs are to be implemented successfully.
- Above all, it is essential for all those involved in teaching and learning to adopt appropriate monitoring and evaluation processes to ensure the successfully delivery of their aspirations.

The relationships between 'monitoring and evaluation' and 'capacity building and management' are crucial for the successful implementation of technology enhanced learning programs in three specific ways.

First, it is essential for monitoring and evaluation activities to be well-managed and led so that they can be used effectively for the improvement of technology enhanced educational programs. Those involved in monitoring and evaluation likewise need to be well trained so that they can deliver sensitive and appropriate recommendations.

Second, monitoring and evaluation have a direct impact on capacity building and management. Used effectively, monitoring and evaluation provide a key mechanism to enable those involved in both formal and informal educational systems to improve their practices.

Third, capacity building and management activities themselves need to be monitored, so that their role in delivering technology enhanced learning can be better understood and enhanced.

Despite this importance, policy makers and practitioners have rarely sufficiently considered the complexities associated with the interactions between these core elements of e-learning strategies. Academic studies have been little better. Cox *et al.* in their comprehensive review of the research literature on ICT and attainment thus only mention 'management' twice, and fail to mention capacity building at all![i] This chapter therefore provides a practical overview of the key aspects of capacity building and management that should be taken into consideration in the monitoring and evaluation aspects of any ICT for education activities. Above all, this chapter advocates a virtuous cycle of quality enhancement, through which all those involved in technology enhanced educational activities can work to improve their organisations and activities by being self-critical and engaging regularly in monitoring and evaluation.

5.1 Key issues

5.1.1 The central role of capacity building and management

The introduction of ICTs into learning environments, be they in schools, universities, adult learning centres or the workplace, requires inspirational leadership and skilful change management expertise. This is not just a matter of head teachers or Chief Executive Officers (CEOs) being committed to the process, but rather reflects a need for everyone involved to understand the implications of the changes being made, and to feel able to contribute to the processes. Capacity building and management go hand in hand; everyone needs to be trained appropriately, and the processes require careful management. In particular, it is important that those charged with undertaking formal monitoring and evaluation activities as proposed in this handbook are able to develop the appropriate skills to deliver these programs appropriately and effectively.

5.1.2 Understanding the role of ICT

Appropriate management skills are insufficient by themselves to deliver effective e-learning programs. It is essential for everyone involved to understand the true potential of ICT to transform learning experiences. Far too often computers have been put into schools with insufficient attention being paid to the ways in which teachers will use them.[ii] One of the fundamental lessons to be learnt from European, North American and Australian experiences over the last 20 years has been that those responsible for helping people learn must be confident in the appropriate use of new technologies if the process is to be successful.[iii] Introducing new technologies into places of learning should involve a fundamental shift whereby the role of teachers becomes less didactic and more that of facilitating individual learning processes .[iv]

5.1.3 The involvement of all

For monitoring and evaluation to be effective, all participants in the learning process need to be involved. Measuring the impact of change can be seen by *teachers* as being very threatening, and it often alters the relationships between them and *learners*. It is therefore critically important that monitoring and evaluation are seen as a shared activity in which everyone learns how they can achieve better and more through the introduction of new

technologies. It is often, for example, the case that pupils adapt to the use of new technologies more swiftly than teachers, and teachers need to be open to the possibility of learning new skills from their pupils.

5.1.4 Measuring the impact on what?

The use of new technologies in learning has far more fundamental influences on people's lives than can be measured simply in terms of traditionally defined educational attainment targets.[v] It is therefore difficult to design comprehensive 'measurement' procedures to evaluate the 'effectiveness' of such initiatives. This is a point that has been stressed throughout this handbook, and it is therefore very important that managers involved in such programs think carefully about the most appropriate and cost-effective procedures that should be adopted in their specific contexts. Moreover, even on the educational front, changes in performance levels in schools resulting from the use of ICTs might simply reflect the fact that pupils and teachers feel valued from the emphasis being placed on education through such programs rather than any actual changes in the way that people learn. It is fundamentally important therefore both that managers identify exactly what it is that they want to measure in any such program, and also that they are open to considering a far wider diversity of influences that they might envisage simply from an 'educational' perspective.

5.2 The context and importance of capacity building and management

5.2.1 Defining capacity building

What do we mean by capacity building? Different organisations adopt varied interpretations of 'capacity building', but ever since the Agenda 21 plan of action following the United Nations Conference on Environment and Development in 1992[vi] the concept has gained increasing acceptance as being of fundamental importance to the delivery of 'development' objectives. Significantly, the Agenda 21 definition[vii] not only notes that 'capacity building encompasses the country's human, scientific, technological, organizational, institutional and resource capabilities', but also that one of its fundamental goals is 'to enhance the ability to evaluate and address the crucial questions related to policy choices and modes of implementation'.[viii] At the heart of discussions about capacity building

is therefore the notion of its role in measuring and evaluating. This theme has been central to the work of organisations such as the International Institute for Communication and Development[ix] in the Netherlands and the German Internationale Weiterbildung und Entwicklung GmbH,[x] both of which have developed particular expertise at the interface between capacity building, ICT and evaluation.

5.2.2 The key participants

All too often broad definitions of capacity building tend to get reduced in practice to mean enhancing the skills of a particular cadre of people, and in education systems this most usually means the teachers and administrators. However, if successful change management programs involving new technologies are to be introduced, it is of critical importance that all of the key participants are involved. While different cultures vary in their approach to education, this handbook therefore recommends that a variety of groups of 'stakeholders' should be involved in the design and implementation of monitoring and evaluation studies (see box 5.1):

Box 5.1. Stakeholders in monitoring and evaluation planning

- *learners* – most usually pupils in the school environment, but also adult learners and those in a diversity of workplaces; everyone is in reality a lifelong-learner
- *teachers and facilitators* – those on the front-lines, helping people to learn, including both trained and untrained teachers, classroom assistants, and workplace trainers
- *technicians* – most ICT enhanced learning experiences require expertise beyond that usually possessed by teachers; technical support staff are therefore often needed in such programs
- *parents* – parental involvement in education goes beyond concerns over what exactly is 'taught' in schools, and parents are themselves learners
- *curriculum developers* – the introduction of ICTs into the classroom requires fundamental changes in the curriculum; curriculum developers must therefore be involved in designing, implementing and monitoring change
- *teacher trainers* –teacher training is sometimes ignored in the early stages of ICT-enhanced learning programs which tend to focus excessively on delivering 'technology drops' rather than enhanced means of sharing information and communication
- *administrators* – educational administrators – be they office staff or managers in educational establishment – have a fundamental role in delivering programs of learning, and must be central to the monitoring and evaluation processes

- *education ministry officials* – with their responsibility for overall policy, target setting and budgets, it is important that ministry staff not only take an interest in measuring change, but are also actively involved in the learning processes resulting from such measurement
- *employers* – education in part serves interests beyond those of the individual learner, and it is important that educational systems therefore serve the wider needs of nations and peoples; such interests can incorporated by involving a diversity of employers in the evaluation of ICT enhanced educational change.

5.2.3 Sharing expertise and understanding: a dynamic of continued enhancement

One assumption behind the inclusion of such a wide range of stakeholders in the conceptualisation of monitoring and evaluation processes is that it takes the significance of education far beyond simply the school, college or university. It is about measuring the fundamental impacts of learning across many aspects of people's lives. For this to be effective, it is important that all those involved in monitoring and evaluation seek to adopt a collaborative attitude in developing shared expertise and understanding. The introduction of ICTs into education is not a one-off process, but is instead the setting in motion of an entirely different modality of learning; one in which those involved seek to put in place a continued dynamic of enhancement. Striving for excellence, pushing the barriers back beyond traditionally accepted norms lies at the heart of what monitoring and evaluation is about. If we were not interested in enhancing learning, making it more readily available to people from different backgrounds and with a range of abilities and disabilities, there would be little point in seeking to measure the effects of changes in educational methods, systems and content. All those involved in measuring these effects must therefore seek to work together supportively and creatively in designing systems that enable the lessons learnt to be introduced swiftly and efficiently back into the learning environment, so that good practices can be shared more widely and learners consequently benefit more effectively from the monitoring process. In effect, we need to create a virtuous cycle of learning enhancement, where everyone is able to benefit from being involved in the monitoring processes.

5.2.4 Practicalities of professional development and training

From the previous section, it should be evident that strong leadership and the committed involvement of professionals are required for any systemic change, large or small. One major

limitation for change in ICT and education is that many of those involved in helping people to learn in both formal and non-formal contexts have little or no skills in the appropriate use of new technologies. This is particularly so in poorer countries, and most notably in Africa. Furthermore, there have to date been rather few effective and sustainable schemes designed to enhance ICT4E literacy among teachers. To be sure, there are numerous projects that have sought to provide teachers with ICT skills, but many of these have been developed externally, often in the private sector, to develop skills that are relevant primarily in office environments. These are not necessarily those skills of most relevance in the classroom.

Knowing how a set of blended learning solutions, involving text, sound, imagery, touch and even taste and smell, can contribute to someone's learning is of much more value than simply giving teachers an ability to use word processing or database management skills (Unwin, 2005)! Tactile keyboards, for example, bring the Internet to life for blind people; audio cassettes transform learning for those who have difficulty seeing; the visual use of sign language opens up communication for the deaf and those with hearing disabilities.[xi] There is, therefore, a profound need to develop systems and capacities that enable policy makers, administrators, teachers, and tutors to engage in professional staff training and development as an ongoing process within programs and to link staff development more closely with service improvement and evaluation/monitoring. Teachers and administrators must also have more opportunities to understand and learn from local problems and to invent local solutions. Increasing the proportion of well-trained ICT-literacy teachers and/or full-time ICT instructors is an essential element of enhanced human capacity development.

In recent years China has initiated several major ICT-supported programs to enhance teacher training in its poorer Western provinces. These include the EU-China Gansu Basic Education Project,[xii] the UNDP and DFID supported program in Gansu, Sichuan and Yunnan,[xiii] and the Asian Development Bank's program in Hunan. Monitoring and evaluation are key components of these initiatives, as indicated in Box 5.2 below.

Box 5.2. China: *Chuan Xin Xie Zou Lao Lu* (Walking the old road but just wearing new shoes): A Focus on Teacher Capacity Building

Since 1990, the People's Republic of China has made impressive progress toward achieving universal compulsory education. In addition, China has attached considerable importance to improving education via the use of information and communication technologies (ICT). In one important recent project, with the assistance of the Asian Development Bank, the government has focused on the key area of teacher quality and teacher training using ICTs. The project is located in Fenghuang County in Hunan province, a high poverty area where the government has already opted for large-scale hardware procurement.

However, China determined that increased hardware infrastructure in schools will not be effective without appropriate professional development and sustained support for teaching practice. There was a worry that simple infrastructural improvements would amount to *Chuan Xin Xie Zou Lao Lu* "walking the old road but just wearing new shoes." That is, new multimedia classrooms would merely be used as another (and more expensive) blackboard for teacher lectures.

The China technical assistance project places particular emphasis on soft components — i.e., educational content and materials, training of teachers to use new ICT tools for innovative teaching, peer support networks, and monitoring and evaluation — to add value to existing ICT facilities and capacity. Professional development and capacity building has been built into the project design, including: (1) Equipping local teachers of English and Science in grades 7-8 with skills and tools to adopt new pedagogies of student-centered instruction (SCI)—particularly inquiry-based and collaborative learning—to nurture pupil creativity, flexible knowledge mastery, and problem-solving ability; and (2) Building effective networking mechanisms. This will include teacher peer networks (e.g., for sharing of lesson plans, and more broadly acting as "communities of practice" to spur grassroots-level innovation), support from head teachers and local educational officials, and an enhanced role of township-level host schools in supporting village-level primary schools.

Box prepared for the Asian Development Bank.[xiv]

5.2.5 Building the capacity of evaluators

In addition to service providers, there is also a need for the building of human capacity in the monitoring and evaluation sector. Many of those involved in monitoring and evaluation, particularly in poor countries, have little experience of such work, and it is crucial that simple but effective schemes are developed to enable them to contribute to, and benefit from, such

activities. Chapters 3, 4 and 7 of this handbook provide ready to use guidelines for such users, but the principles and examples of good practice outlined below should also help to build up familiarity with the concepts and approaches involved. This may initially require the involvement of external people, but it is essential that all those involved in formal monitoring and evaluation procedures should be trained effectively in their management and implementation. It would therefore be highly desirable for specialist centres of excellence in such processes to be developed at a national or regional level.

5.2.6 The funding of evaluation

This chapter emphasises the importance of a continual cycle of educational enhancement in which monitoring and evaluation play a dialectic role in capacity building and improved educational management. These should not be seen as separate entities, but rather as intimate partners in leading to improved systems of formal education and lifelong informal learning. However, the practical reality in most educational systems is that monitoring and evaluation, alongside measuring performance against targets, are frequently treated as separate and distinct activities, often undertaken by external reviewers or evaluators. In many African countries, where over 90% of Ministry of Education budgets are spent on teachers' salaries, governments and donors frequently see such external monitoring and evaluation as being less important than the actual delivery of education on the ground. This suggests that involving all participants in the education system in ongoing monitoring and evaluation as an integral part of their jobs would bring significant benefits. It will be particularly important to integrate detailed monitoring and evaluation processes in the strategies being developed in the countries participating in the Fast Track Initiative.[xv] Of these, several countries such as Ethiopia, Ghana, Mozambique and Vietnam, also have ambitious plans to use ICT in transforming their education sectors, and it is therefore all the more important that the additional funding available is used in part to develop and implement procedures as recommended in this handbook.

5.3 Good practices in capacity building and management

Much can be learnt from past experiences in incorporating effective monitoring and evaluation into ICT for education initiatives. Two case studies have been chosen, each from

different continents and each reflecting very different aims and objectives, to highlight some of the themes and principles addressed in this chapter. Although Singapore and Chile are far from poor, as many of the countries embarking on technology enhanced learning programs discussed elsewhere in this handbook, the lessons drawn from their experiences in the field of monitoring and evaluation provide invaluable insights for those seeking to develop their own programs in this area.

5.3.1 Singapore

Management priorities were central to Singapore's *Masterplan for IT in Education* (MPITE; Box 5.3), with the intention being to use IT to 'promote greater efficiency in administration and communication, thereby supporting more effective educational management'.[xvi] Moreover, one of the four key elements of the plan specifically addressed human resource development through training teachers in the purposeful use of IT in teaching, equipping them with core skills in teaching with IT, and involving partners from industry and institutions of higher learning in schools. Between 1997 and 2000, most teachers in primary and secondary schools completed 8 to 10 core modules over 30 to 50 training hours, covering topics such as involving IT in pupil project work, appropriate teaching and learning strategies, and how to evaluate IT resources for their teaching.[xvii] This program was implemented through face-to-face workshops for core subjects, shared sessions for non-core subjects and dialogue sessions for the exchange of ideas and experiences amongst heads of departments. As a result, the MPITE evaluation report in 2001, suggested that 78% of teachers surveyed felt that the use of IT as a teaching tool had helped them to implement more learner-centred activities.

Box 5.3. Singapore: Masterplan for IT in Education

In 1997, Singapore launched a Masterplan for IT in Education (MPITE) was initiated to:

- enhance linkages between schools and the surrounding world
- generate innovative processes in education
- enhance creative thinking, lifelong learning and social responsibility
- promote management excellence in the education system.

This has led to a highly successful and innovative ICT for Education program, based on four key dimensions:

1. Curriculum and Assessment

Focusing on achieving a better balance between skills and knowledge, encouraging pupils to engage in independent learning, and including assessment modes that include information, thinking and communication.

2. Learning Resources

Emphasizing the development of appropriate educational software, facilitating use of relevant Internet resources, and providing effective procurement systems.

3. Human Resource Development

Training every teacher and trainee teacher in the appropriate use of ICT, and involving partnerships with industry and institutions of higher learning.

4. Physical and technological infrastructure

Providing access to IT in all learning areas of schools, with school-wide networks, a pupil: computer ratio of 2:1 and a teacher:computer ratio of 2:1.

See http://www.moe.gov.sg/edumall/mpite/overview/index.html, accessed 6th May 2005.

5.3.2 Chile

Realising the potential that new technologies have to transform education in a relatively poor country, the Chilean government initiated the Enlaces program in 1990 (Box 5.4).[xviii] One of the key findings from this has been that 'well-trained and motivated teachers can improve the learning *conditions* with ICT, and can acquire ICT skills together with their students, thus preparing them more properly for the emerging knowledge society'.[xix] Fundamentally, Hepp *et al.* note in reviewing this program that 'introducing ICT into the schools, without a proper *staff development* plan and without a pedagogical perspective, is a low-return investment'.[xx] Where resources are limited, as across much of the African continent, this is a lesson that really must be learnt fast. Far too many programs are still beginning with the technology rather than the teachers. Another important feature noted from the Enlaces work has been the significance that motivated and competent management play in the delivery of such initiatives: 'In our experience, it is advisable to assemble a team with solid educational and technical background and also one with strong leadership and political backing so as to remain relatively unhindered in the face of continuous political change'.[xxi]

These observations stress the key significance of both capacity building and management, but they also emphasise the need for effective evaluation: 'if evaluation is not an integral part of each major decision, it will be difficult to reach sound and reliable conclusions about the effectiveness of the program and to decide whether or not there is need for adjustments and change'.[xxii]

Box 5.4. Chile: The *Enlaces* Evaluation System

Enlaces (links), the Chilean ICT in education initiative, started in 1992 with the aim of integrating ICT as learning and teaching resources for all students and teachers in the ten thousand Chilean public schools. By the year 2005, 88% of primary and 85% of secondary schools participated in *Enlaces*, covering 93% of the student population. During its implementation, Enlaces developed a variety of initiatives to evaluate and monitor the on going activities of the project as well as its products and (possible) impact.

Regarding monitoring, Enlaces developed web based systems that enabled schools and service providers to directly register the provision, reception, installation and configuration of the computer networks, annotate technical support visits and training activities developed in the schools. Using these systems, the national coordination of the program was able to follow up the status of the main activities of the project at any time and decide, for example, whether the services were accomplished and due to payment.

Concerning the evaluation of the quality of the services provided to the schools, Enlaces applied a periodic survey that was answered by the teachers and principals of the schools. This survey asked for teachers' and principals' perceptions about the quality of the technical support, training, and equipment provided to the schools. This information was then used to negotiate the contents and quality of the services to provide in the following period with the institutions working for the project.

In terms of its goals and aims, several surveys were used with principals, teachers, computer lab coordinators and students, concerning the ICT infrastructure present in schools, ICT related activities, time of use of ICT infrastructure, teacher professional development, ICT related policies at school level, self-perception of ICT skills and obstacles for ICT uptake. Aimed at comparing these results, surveys were designed and implemented following international guidelines (www.iea.org, www.unescobkk.org). Significant results included: the extensive time that computer labs were used for pedagogic and non-pedagogy related activities, and the enormous impact that the project has had in providing access to ICT to low income students. Additionally, several case studies were carried out concerning innovative pedagogical practices, which showed that there was no clear evidence of the impact of ICT on students' learning achievement as defined in the national curriculum and measured by the national students' assessment tests. However, the studies did show that teachers and

students using ICT gained competencies about students' conception of the world and social relations beyond the school.

Adapted from Hinostroza *et al*.[xxiii]

5.4 Conclusions: Five key principles

This chapter has outlined some of the interwoven complexity of the interactions between capacity building, management, and measuring the effects of the use of ICT in education. If there is one over-riding lesson to be learned, it is that these interactions are complex and as yet imperfectly understood. However, there are five key principles that underlie many of the chapter's arguments:

1. *The importance of including a diversity of participants in the monitoring and evaluation procedures at the earliest stages of the implementation of ICT4E programs.* The introduction of new technologies and methods into learning environments provides an opportunity to open up education to a range of other innovations. ICTs are technologies designed to enhance the flow of information and communication; they are not ends in themselves. This therefore opens up education more widely, and creates a valuable opportunity for all those involved in education to reconsider their practices, and in so doing to develop a more reflective approach to their activities. At the very least, learners, teachers, administrators, government officials and external agents such as employers need to be involved in designing and implementing effective monitoring and evaluating procedures.

2. *Evaluation as a non-threatening process*. All too often, systems of monitoring and evaluation are put in place that are punitive, and failure is seen as being something to be ashamed of. However, in many cultures, loss of face is something to be avoided at all cost. There are therefore tricky issues to be negotiated in measuring the effects of ICT initiatives in education. However much we might wish to think otherwise, there is unfortunately almost always likely to be an element of coercion and control in the use of monitoring and evaluation. Nevertheless, it is of fundamental importance that

all those involved should see such evaluations as part of a learning process, whereby people will not only become better educators and learners, but will also be more fulfilled in so doing. We often learn more from our mistakes than we do from our successes.

3. *Successful programs cannot be achieved overnight*. The experiences of Enlaces emphasise with great clarity that it can take at least a decade of dedicated hard work to implement effective nationwide programs that use ICT appropriately in education. Initiatives require careful planning, and considerable foresight if they are to be successful. Their management is of great importance, and central to this must be a program of appropriate monitoring and evaluation, through which lessons learnt in one phase can be implemented in the next.

4. *Charismatic leadership*. Successful monitoring and evaluation activities require a range of conditions to be in place, but paramount in the process is the quality of leadership and management. Some are cautious in drawing firm conclusions, and suggest that 'It may be, therefore, that quality of leadership can account for ICT-related performance'… 'School leadership influences the relationship between ICT learning opportunities and pupil attainment'.[xxiv] Using effective monitoring and evaluation procedures to learn what exactly it is about leadership that makes such a difference is therefore important. Equally, leaders and managers are essential to the successful implementation of the sorts of supportive evaluative mechanisms discussed in this chapter.

5. *Starting with the teachers*. There is a growing consensus that training teachers in the appropriate use of new technologies as part of a blended learning environment is one of the most important places to start in delivering effective ICT4E programs.[xxv] As a first step, teachers need to be enabled and empowered to evaluate the effects of using new technologies in the classroom, and then to begin to develop their own communities of practice to assist them more effectively in enabling people of all ages to enhance their learning opportunities.

Key references

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Endnotes

[i] Cox *et al.*, 2003

[ii] Farrell, 2004; Unwin, 2005.

[iii] Harrison *et al.*, 2002; Zemsky & Massy, 2004

[iv] Bruner, 1996; UNESCO, 2002.

[v] Watson, 1993; Cox *et al.*, 2003; Pittard *et al.*, 2003.

[vi] http://www.un.org/esa/sustdev/documents/agenda21/index.htm.

[vii] Chapter 37.1

[viii] http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter37.htm accessed 6th May 2005.

[ix] http://www.iicd.org, accessed 23rd May 2005.

[x] InWEnt, http://www.inwent.org, accessed 23rd May 2005.

[xi] Casely-Hayford & Lynch, 2004; see also Chapter 6.

[xii] http://www.eugs.net/en/index.asp.

[xiii] http://www.cicete.org/english/news/11.htm

[xiv] Prepared by Meng Hongwei for the Asian Development Bank. See URL:
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[xv] World Bank, 2005.

[xvi] http://www.moe.gov.sg/edumall/mpite/overview/index.html - accessed 6th May 2005.

[xvii] http://www.moe.gov.sg/edumall/mpite/professional/index.html - accessed 6th May 2005.

[xviii] http://www.enlaces.cl/ - accessed 6th May 2005.

[xix] Hepp *et al.*, 2004, p.iv.

[xx] Hepp *et al.*, 2004, p.iv.

[xxi] Hepp *et al.*, 2004, p.7.

[xxii] Hepp *et al.*, 2004, p.50.

[xxiii] Hinostroza *et al*. (2002; 2003). see also, www.enlaces.cl/libro/libro.pdf

[xxiv] See Pittard et al. (2003.

[xxv] (Commonwealth of Learning *et al*, 2004)

Chapter 6

Pro-Equity Approaches to Monitoring and Evaluation:
Gender, Marginalized Groups and Special Needs Populations

Daniel A. Wagner

EXECUTIVE SUMMARY

- M&E can play a significant role in supporting pro-equity approaches to ICT for education.
- A *pro-equity* approach to M&E should try to accomplish at least two goals:
- First, M&E specialists should engage in data collection with transparency as to who comprises the population target, and where this population fits into the national fabric and policy of poverty reduction. For example, what is the demographic breakdown of the intervention sample by gender, language, ethnicity, age, location, and income relative to the rest of the national population?
- Second, it is important to draw from M&E activities any conclusions about both policy formation and program implementation that can address pro-equity issues. For example, evaluation results should be prepared in a manner that allows expansion of the program to additional marginalized groups (by caste, location and other language groups).
- Much can be done to support pro-equity and pro-MDG approaches to ICT and development – efforts that will benefit and be inclusive to nations and *all* their citizens.

6.1. Pro-equity approaches

Long before the term *digital divide* became a common way to describe gaps between the rich and poor in access and use of ICT, most policy makers, researchers and practitioners could at least agree on one thing: Reaching the poorest of the poor was going to be very difficult challenge. Even reaching the so-called *ordinary* poor (that is, men with some secondary schooling, living in predominantly urban areas) would entail challenges of electrical power, telecommunications connectivity, human resources infrastructure, and the like. Reaching the *poorest of the poor* (that is, illiterate women with little or no schooling, living in predominantly rural areas, and possibly speaking minority languages) would be considerably more difficult. The goals of EFA and MDG are very clear about the need to promote *equity* by gender (women and girls), special educational needs (SEN), and among "marginalized" populations (such as illiterate persons, ethno-linguistic minorities, refugees, and so forth). This chapter attempts to describe where M&E might be able to play a role in supporting pro-equity approaches to ICT for education.

Who are the 'poor' in the world today? Clearly, poverty is a relative term – the poor in New York would have resources quite different from the poor in urban Johannesburg or rural Senegal. Yet, using UN data, there is general consensus, as stated in the 2004 World Bank Annual Report[i] that OECD countries have, on average about 10-20 percent poor, while this number climbs to a range of 40-60% in the bottom third of LDCs. In poor LDCs, the characteristics of poverty include an average GNP per capita of less than 1-2 U.S. dollars per day, high illiteracy levels (including either illiteracy or 'functional illiteracy' of 40-50% of the overall population), and relatively low social status (as related to gender, ethnicity, language, geographic location, and so on). It is variously estimated that only a tiny fraction (less than 5%) of ICT investments globally have been made that focus on the poor as defined above.[ii] Indeed, when considering the life opportunities of the poorest populations, direct investments of ICTs have clearly been more rhetorical than real. Yet such work is crucial if the MDGs of universal basic education and literacy are to be achieved.

What is the overall scale of the target population that is covered within the MDG-ICT framework above? Women and minority language status may be overlapping, but clearly contain a large majority of those on the *wrong side* of the digital divide. Further, there are over 100 million primary school-aged children out of school, and about one billion adult illiterates, the majority of whom reside in the poorest countries of South Asia and Africa.[iii] Even these large numbers are likely to be a serious *underestimation* of literacy needs in the digital age. Indeed, if a larger set of skill competencies (reading, writing, math, ICT literacy) were included, along with the limited efficiency of adult literacy and "second chance" education programs, and the very low quality of many poor rural schools in developing countries, it would probably be more accurate to say that those in need of improved basic skills (required in order to effectively use ICT) today represent between 2-3 billion individuals (Wagner & Kozma, 2005). Of these individuals, we might estimate that at least half are among the poorest of the poor, as they will undoubtedly be over-represented by ethno-linguistic groups for whom ICT access in the international languages of the world (i.e., English, French, Spanish) is quite limited.

This raises a key question: Are the methods and indicators most commonly used in the monitoring and evaluation of ICT in education initiatives *biased* in any key ways that will work against the narrowing of gaps and towards the growth of equity in ICT for education? Put another way: Would the availability of equity-sensitive M&E indicators work towards promoting greater *inclusion* of populations within the MDGs?

Consider, for example, the *Bridges to the Future Initiative* project undertaken in India. In this project, a specific focus was on how to reach the most challenging poor populations, but within fiscal constraints that meant that an ICT infrastructure had to pre-exist in order to reduce expenditures. Within this important constraint, the project had to determine the best way to achieve MDG education goals, and measure the impact of multimedia instructional material on youth and young adults (see Box 6.1).

Box 6.1. India: Focus on ICT and the poor in the Bridges to the Future Initiative

The Bridges to the Future Initiative (BFI) in India provides multimedia, local language resources on literacy and vocational training for out-of-school youth and adults – about 50% of the population in poor parts of India that never had access to and/or completion of quality primary or secondary schooling. A key aspect of the BFI is that it seeks to address directly the needs of the poorest sectors of the populations in developing countries with the best of user-friendly ICT-based instructional tools. According to UN statistics, there are more illiterates in India (270 million) than in any other country. With a 35% adult illiteracy rate, economic and social development *for all* is highly constrained. While great strides in Indian education have been made, it is now clear that many schools are able to offer only inadequate quality of instruction, leading to a primary school drop-out rate of between 35-50% across the poorest states of India, including in Andhra Pradesh state where the BFI has been operating since 2003. Thus, the main target are the tens of millions of disadvantaged youth (ages 9-20 years) who are at risk of never getting a good job, performing poorly in trades that are education-dependent (especially those that change with the knowledge economy), and suffering a variety of health consequences due to poor education and income. Many of these youth (especially girls and young women) have had some schooling, but often too poor in quality for these individuals to achieve a functional literacy ability.

The BFI model is designed to take advantage of already-existing ICT infrastructure, largely in secondary schools, and create content to which such out-of-school youth have access. The instructional model builds on the oral competence of the learners in their mother-tongue, *Telugu*, the majority language in the state. As part of the BFI, a major impact assessment – a longitudinal study – has been undertaken to follow BFI out-of-school youth, and other youth in control groups, to measure skills and knowledge acquisition. Up to the present (March 2005), over 200 youth (age 10-20 years: about 60% girls) have participated in the BFI program study. Results indicate that the participating youth are learning literacy skills at an accelerated pace and show greatly enhanced motivation and retention. Further, results suggest that those youth with least schooling – especially girls – show the most gain in performance, and many of these have left the BFI program to return to complete their primary schooling. The BFI in India (along with a companion project in South Africa) was designed to demonstrate that cost-effective solutions can and should be developed for the most challenging situations.

Adapted from: Wagner and colleagues[iv]

Many projects in the ICT sector claim to be 'bridging' the digital divide. But *what* divide are they bridging? Is it between the rural and urban? Between boys/men and girls/women? Between

the well-off and the less-well-off? In many leading studies, including most of those referenced in this document, we have relatively *little* idea of the demographics around equity issues. We may be helping the "poor," but are we doing so at the expense of other poor people? While investment in a given ICT in education initiative may be effective and desirable for its target groups, to what extent does it satisfy the priority in the MDGs to reach the most disadvantaged? If a student is in high school in the lowest third of GNP countries, he/she is likely to already be in the top 10-20 percent of the socio-economic structure. Will helping this individual (no doubt a useful goal in and of itself) help achieve greater equity in the country concerned? In the following sections, we describe a number of key MDG areas that will need to be the subject of considerably greater investment if the MDG targets are to be met.

6.2. Gender

Since the introduction of personal computers in developed countries in the early 1980's, the 'convention wisdom' has been that introducing ICTs in schools would favor males. Yet, as we have seen in numerous examples across the world, there are many cases where girl's and women's motivation and learning in ICT for education programs is equal to or greater than that of boys and men. The root causes of the initial 'digital gender divide' (conscious or unconscious) against females have been generally been perceived (by policy makers) to relate to issues such as lack of a safe place of access, limited literacy, and little in the way of useful outcomes. Another interpretation, of course, is that men's access to economic resources in the 'external' (outside of home) environment simply put them in greater proximity to technology access. We will unlikely know the definitive set of causes, but we do know the results. In most countries today, especially outside of the OECD, women's access to ICTs inside an educational system lags significantly behind that of men's (see Table 6.1).

Table 6.1. Women's Internet use in selected developing countries and the United States

Country	Women as % of Internet users, 2000	Total women Internet users in '000s	Total no. Internet users in '000s	Internet users as % of total population	Population in '000s	Female prof. & tech. workers % of total	Female literacy rate	Female GDP per capita (US$)	GDI Rank 1/174
U.S.A.[15]	51.1	83,479	170,280	60.0	283,800	53.1	99.0	23,540	3
Philippines	51.0	76.5	150	0.6	77,726	65.1	94.3	2510	65
South Africa	51.0	645.6	1,266	4.2	42,835	46.7	83.2	4637	84
Brazil	43.0	1,075	2,500	2.1	169,807	63.3	83.9	3813	67
Croatia	42.0	63	150	4.3	4,672	n/a	96.4	3557	50
Mexico	42.0	567	1,350	2.5	98,553	45.2	87.9	4594	48
Estonia	38.0	57	150	14.1	1,421	66.8	99	4236	49
Russian	38.0	4,560	12,000	1.8	146,861	n/a	98.8	3503	61
Zambia	37.5	1.13	3	0.2	9,461	31.9	67.5	753	125
Uganda	31.5	4.73	15	0.1	22,167	n/a	35	944	131
China	30.4	6,840	22,500	0.7	1,265,530	45.1	74.5	2485	79
India	23.0	115	500	0.2	983,377	20.5	39.4	902	112
Poland	18.7	295.6	1,581	5.4	38,607	61.2	99	5061	40
Belarus	17.5	14	80	0.1	6,667	38.4	98.5	3909	54
Ethiopia	13.9	0.83	6	0.1	58,390	n/a	29.2	349	172
Slovakia	12.0	60	500	13.0	5,393	59.7	99	6366	39
Czech Republic	12.0	48	400	6.8	10,286	54.1	99	7952	34
Senegal	12.0	.90	7.5	0.3	9,723	n/a	24.8	1253	127
Lithuania	10.0	7.0	70	2.9	3,600	67.5	99	3323	55
Jordan	6.0	3.7	60.8	1.8	4,435	n/a	81.8	1429	n/a
Colombia[16]	n/a	n/a	350	0.0	38,581	45.6	90.8	4725	51
Peru	n/a	n/a	200	1.5	26,111	39.4	83.7	2335	71
Turkey	n/a	n/a	450	2.3	64,567	33	73.9	4681	73
Thailand	n/a	n/a	200	1.3	60,037	54.5	92.8	5000	58
Indonesia	n/a	n/a	300	0.2	212,942	40.8	79.5	2359	88
Pakistan	n/a	n/a	61.9	0.1	135,135	21.0	25.4	701	116
Vietnam	n/a	n/a	10	0.1	76,236	27.6	89	1385	91

As with most areas in development, such gender biases are clearly counterproductive for all social indices. In the area of ICT4D, we now have many examples of women (and girls) being at the forefront of the social and economic uses of new ICTs. One of the best-known examples of the use of microcredit for women, Grameen Bank in Bangladesh made loans to women, even poor and illiterate women, for the creation of small mobile phone businesses. The results were dramatic – not only were the women more reliable then men in paying back the loans, but they also made use of their local social networks to run highly successful enterprises even in poor rural areas.[v] There are

many such examples today that show that women in developing countries recognize the empowering dimensions and economic returns of ICTs.[vi]

When considering gender within the M&E area, it is increasingly the case that gender is a variable of interest. Today, gender is increasingly taken note of by program implementers, and the importance of gender in development processes overall now assures more than ever before, that ICT programs will be 'engendered'.[vii] See Box 6.2 for some examples of who to improve a gender-sensitive approach to ICT4E.

Box 6.2. Several strategies have proven effective in encouraging the continued participation of girls and women in education in general.

- Provision of scholarships;
- Culturally appropriate facilities;
- Female teachers;
- Alternative schools with flexible schedules;
- Vocational training;
- Presentation of a gender-neutral, or gender-inclusive image of scientists and the practice of science;
- Emphasis on hands-on activities and applications to everyday life, society, and the environment;
- Introduction of female role models and mentors;
- Conscious effort by teachers to treat girls and boys as equals in the classroom.

Adapted from World Bank[viii]

6.3. Marginalized populations

As noted earlier, the most disadvantaged groups in all societies tend to be those "on the margin" – on the socio-economic and cultural-linguistic periphery of a national population. Marginalized populations may be considered to be those that are. Beyond issues of gender and age (which also can be marginalizing), such marginalized populations usually have one or more of the following kinds of characteristics:

- Belong to an indigenous people or special caste or race that has a pattern of historical social discrimination;
- Speak a language (or dialect) other than a major regional or national (or international) language;
- Have a history of little or no education, and likely to be illiterate or low-literate;
- Reside in, or migrate from, an historically deprived (usually rural) geographical region.

Being a member of a marginalized, usually an *ethno-linguistic* minority group, often has a broad set of deleterious social and economic consequences. In ICT for education projects, such factors must be taken into account directly, much as has the issue of gender discrimination. As yet, however, most technology projects have, for a number of (often political) reasons, chosen to focus on 'majority' digital divide issues, rather than 'minority' or marginalized group issues. As with gender, M&E can play an important role in focusing attention on the problem, as well as providing a better targeting of implementation processes.

Language is an exceptionally important marginalizing factor in the digital age**.** One reason for this is that the Internet itself is *not* language-neutral. Recent research shows that English is more present on the World Wide Web (approximately32% in October 2005) than any other language, and is about at parity with the next nine most prominent languages combined.[ix] Interestingly, the dominance of English has dropped somewhat from an even greater dominance only a couple of years earlier (65% in mid-2001). No other language seems to rival the English total. And, even though Chinese (at 13% of the world total) is rapidly growing, the role of English as a preferred global *second* language of communication will almost certainly guarantee its global dominance for years to come. Of course, there are major changes taking place on the Internet today, and there is serious disagreement as to the breadth and depth of availability and use of digital information. There are more languages in use every year, and languages after the top ten. Nonetheless, most research, as of 2005, shows that the top ten languages[x] dominate 80% of Internet use today, leaving

those who have not mastered one of these languages as a first or second language in the margins of global information.

While similar data are not available for language-based instructional software production, a substantial dominance is likely to be found for English today, at the expense of other international languages, and major regional languages (e.g., Hindi, Swahili). Further, local minority/indigenous languages (e.g., Telugu in India, with 50 million speakers; or Mayan in Mexico with several million speakers) receive relatively little digital attention at all. It should also be noted that most of the monolingual speakers of indigenous languages are female, which adds an additional burden on the obstacles that women face in ICT for education projects.

Illiteracy and low-literacy, when combined with ethno-linguistic status is a further marginalizing factor. UNESCO[xi] has estimated that there are nearly 862 million illiterates in the world aged 15 and above. One could estimate that at least 80-90% of this illiterate population is from the types of marginalized groups detailed above. Of this total populatiion, we know that nearly 60% is comprised of women, most of whom are from the poorest countries or regions in the world. Overall, developing countries have increased literacy rates by 6.6% between 1990 and 2000. However, such increases in official literacy rates often do not keep pace with population growth (especially in South Asia and Sub-Saharan Africa) with the actual number of illiterate citizens having increased during the same period of time. As a consequence, illiteracy and low-literacy are fairly direct indicators of those who are marginalized in each society; furthermore such skills are central to ICT4E success due to their role in serving as a base for technological skill proficiency.

6.4. Special Educational Needs

New technologies have long been seen in industrialized countries as an exceptional way to reach out to individuals who are especially challenged with physical and psychological handicaps. Indeed, when resources can be deployed, new ICTs can be seen in a host of efforts to aid those with sight, hearing, and other physiological handicaps. Thus,

"special educational needs" (SEN; a subset of the broader domain of special needs) usually refers to the subdomain of ICT for education where two inter-related issues may arise: (1) Does the SEN learner have particular problems (such as visual or hearing impairments, or learning disabilities, and so on) that make the *ordinary* person-technology device (PC, PDA, other) interaction difficult (e.g., difficulty in seeing print on a screen); or (2) are there particular technology devices (*assistive technologies*) that are or can be especially tailored for SEN learners such that they are responsive to the particular needs of the learner (e.g., voice recognition technologies for the blind). While there is a long history in the use of such assistive technologies for learning, mainly in industrialized countries (such as described in Box 6.3), due to resource constraints, this area has only begun to receive significant attention in developing countries.

Box 6.3. United Kingdom: Assistive technologies in education

Assistive Technology (AT) is the software and technology which helps people with disabilities and special needs to overcome the additional challenges they face in communication and learning. For example, switch-operated software, onscreen keyboards and mouse alternatives are all types of assistive technologies. A number of studies have shown that technology can enable students to overcome barriers to learning and develop positive relationships with peers and teachers. …[E]valuation into the use of assistive technology is limited and often lacks detailed and comprehensive criteria for assessing the effectiveness of the devices. … Research studies indicate fairly positive outcomes from people with profound multiple learning difficulties using micro-switches and speech output systems. However, more advice, support and training for teachers and carers is needed to help students make effective use of the technology...

Speech-recognition software is of most value to those students who cannot produce handwritten work of sufficient quality or quantity. These systems can have a positive effect on reading and spelling with students showing significant improvement in word recognition, reading comprehension and spelling. However, not all students have expressed positive feelings about using the systems and have often reported the task of correcting speech recognition errors to be tedious and frustrating. In particular, some primary-age students [in the U.K.] have been unable to use such systems because the software has failed to recognise their high-pitched voices or unclear speech... …Most of the research evaluating speech- recognition systems has concentrated on the reliability and robustness of the systems for general use. Much less evaluation has been undertaken on the ways

in which speech-recognition systems can be used and customized to meet the particular needs of individuals.

Adapted from Becta.[xii]

In recent years, AT has been used increasingly in developing countries as well. Popular tools such as *JAWS*, a screen-reader software for the blind or visually impaired offers access to a wide variety of information, education and job-related applications (see http://www.synapseadaptive.com/). Two case examples are provided below that provide a sense of the types of AT in use, and the type of M&E that has been employed. In the first example, in Morocco (Box 6.4), visually impaired university students were provided with AT software that supported web access. The case study evaluation provided evidence of impact on a small number of students, with the hope of convincing government authorities of the utility of ICT/AT for education on a larger scale.

Box 6.4. Morocco: ICTs for assisting blind students

"Having joined the center, I was newly born. I have acquired what I have been deprived of for years. I can now navigate the Net as freely as I like with almost no difficulty. It is a precious opportunity to prove my humanity. Instead of feeling embarrassed whenever I ask somebody to read or record for me, pressing CONTROL+ALT+J is enough to save me all that trouble by JAWS's presence following me all along the way carrying out any order I give it. I am free at last!" A fourth-year blind student at Cadi Ayyad University, Marrakech, Morocco

In Morocco, people with visual impairment, be it total or partial, are disadvantaged in two ways in terms of access to education. First, the usually humble social origins of these individuals (poverty and illiteracy of their parents) and the very limited availability of specialized institutions restrict their access to education. Second, even those having the opportunity to go to school are usually blocked by the lack of pedagogical materials adapted to their needs. Currently, specialized schools for the blind are very poorly equipped. The production of such materials is still far from responding to current needs. Blind students need help to compensate for the absence of adapted pedagogical material (manuals, reference books, etc.). This lack of adapted pedagogical material has slowed down the progress of blind students significantly and has increased the degree of their dependence on others (people assisting with their voices or offering writing services, etc.).

For its first year of operation, a group of 20 blind students at the Cadi Ayyad University Multimedia Center for the Blind (UMCB) were invited to benefit from a new training program. Results of the project to date,

based on a qualitative interview assessment, include: (1) The student beneficiaries declare having gained much autonomy and independence. Most have acquired the skills needed for the independent use of the computer. Having benefited from free access to the UMBC at any time and having been engaged in a process of self-learning with the assistance of some volunteering students, the students managed to digitize many pedagogical tools and to transform them into audio files. (2) Some of the most motivated students managed to use resources available through the Internet by browsing the web and exchanging information through e-mail. (3) Some of the most motivated students engaged in training of trainers. Having themselves benefited from the training, they started ensuring the supervision of sessions of free access and giving personalized lessons to other beneficiaries. The evaluation undertaken today is an important step in demonstrating to government authorities that ICTs are not only useful, but that universities with research and evaluation capacities can play an important role in justifying further implementation activities.

Adapted from Bougroum.[xiii]

In a second effort, SEN adult learners in four Central American countries were provided with both AT software and hardware that was designed to foster employment skills (see Box 6.5). As may be seen, a variety of tools were deployed, and a group of several hundred individuals were evaluated and trained.

Box 6.5. Central America: ICT-based Employment Training for People with Disabilities

[V]olunteer [staff] were sent to work directly with 10 organizations in Honduras, El Salvador, Guatemala, and Nicaragua. They trained more than 300 people who represented 44 organizations in the region. The principal skills taught by the volunteers included software training (Microsoft Office, Internet navigators, Microsoft Front Page, Netscape Composer, e-mail applications, database design) and adaptive technologies (among them, *Scan and Read* for the blind, and adaptive devices for people with impaired mobility). The project had a direct impact at three different levels: 1) introducing adaptive hardware and software, 2) training people with disabilities, and 3) training disability organizations as trainers. Unemployed people with disabilities were the target group. These people had been unable to find a job for a variety of reasons, including: (a) limited access to education, [since] special education services in the region are provided to [only] 3 percent of school-age children with a disability…; (b) inaccessible physical structures: many public buildings and roads are not modified for people in wheelchairs. Access to public transportation barely exists for the disabled, thereby limiting people's ability to get to work; (c) negative societal perceptions and discrimination: even when people endeavor to circumvent

architectural barriers and have the necessary job-related skills, societal attitudes often keep them from being hired.

During the project evaluation, many organizations confirmed that they had improved their ICT skills and the quality of their work as a consequence of the training. They also reported that their use of e-mail had increased.

Adapted from Batchelor.[xiv]

There is little doubt that the notion of inclusive education is taking hold across the world, both as national and international policy, and this is a priority central to the MDGs. OECD countries have moved strongly in this direction[xv], and more recently in-depth Africa-focused reports show new emphasis in the same direction.[xvi] While technological tools in LDCs are only beginning to be utilized, they nonetheless hold out hope for the millions in poor countries that are in need of additional ways to be included into the age of global education and information.

6.5. Conclusions: Towards a Pro-Equity Use of M&E

Many of the current ICT for education efforts, even if deemed to have been successful, have not included a sufficiently *pro-equity* perspective. This is obvious from a variety of perspectives. Earlier, we asked, rhetorically, "Whose divide is really being bridged?" But, we may also simply observe the following: The vast majority of software/web content (mainly in major languages such as English, Chinese, French, Spanish) is of little use to the many millions of marginalized people for reasons of literacy, language or culture. Of course, the private sector produces, in large part, for the largest potential and most lucrative market – with clear (and negative) consequences for the poor in most circumstances. It is increasingly clear that user-friendly multimedia tools can satisfy the needs of the poor to a much greater extent than heretofore produced.[xvii] Providing such tools and developing the human resources capacity to support the local development and distribution of relevant content is one important way to help initiate a positive spiral of sustainable development. Indeed, if the private sector can learn to market to the poor (much as soap manufacturers have

'discovered' that smaller soap bars can be sold to a much larger segment of the poor in India), then real markets need to be found that support pro-equity approaches of investment.

How can M&E help this situation? A pro-equity approach to M&E could accomplish two goals: *First*, M&E specialists should engage in data collection with transparency as to who comprises the population target, and where this population *fits* into the national fabric and policy of poverty reduction. For example, what is the demographic breakdown of the intervention sample by gender, language, ethnicity, age, location, and income *relative* to the rest of the national population? *Second*, it is important to draw from M&E activities any conclusions about both policy formation and program implementation that can address pro-equity issues. For example, in the BFI-India project (Box 6.1, above), evaluation results should be prepared in a manner that allows expansion of the program to additional marginalized groups (by caste, location and other language groups).

It is also important to keep in mind the fundamental reality that effective programs, even without rigorous and state-of-the-art M&E method, can be found and supported. That is, while we advocate strongly here for M&E in all interventions, there are some projects, nonetheless, with little empirical data that we believe (from anecdote and observation) are worth greater investments. One case in point is a women's ICT-based program in Colombia (Box 6.6). Here we see the power of individual women in describing their own situation. Household surveys and the like cannot provide much additional value to what a group of motivated and reflective participants contributed in a set of workshops. Of course, simply becoming aware of the key issues as described in the Columbia example is not the same as knowing whether these issues have been effectively addressed from an evidenced-based perspective.

Box 6.6. Columbia: Pro-Gender Approach to Monitoring and Evaluation.

Bosa [a locality in Colombia] has a telecenter located in a lower class neighbourhood where majority of the people are plain workers or unemployed. It is housed in *Kerigma*, a community cultural center, a community meeting space for different groups and organisations. Most of the women active in women's groups or organisations in the Bosa neighbourhood are housewives who have their children and housekeeping as their main interests and activities. Representatives of, *Virtuous Mothers*, *Eco-Mujer*, and *Women's Centre* took part in a [Gender and Evaluation Monitoring] project in 2003.

[A series of workshops were held, the results of which are provided in the comments below from participants]

- There are strong feelings involved in using a computer. Curiosity, fear of technology and the unknown, uneasiness, fear of breaking things, making mistakes, being mocked at are only a few of the difficulties faced by people who have not used a computer or do not know much about it. Women also think that computers are something fascinating, a new world where they do not belong.
- There is a need to learn and be taught in using computers in a sensitive manner.
- There is a lot of discrimination against women in this field. Society seems to give little importance to women's needs in the field of computer technology.
- Women feel they are looked down on by their own children because they don't know how to use a computer. They also feel bad because they can't help their children with their homework because they know nothing about computer studies. "We don't want to be called donkeys", one of them said.
- Women have to respect themselves and make others respect the role they play in society
- Women have to work towards equal opportunities. We don't want to copy men's ways, and instead show that there can be other ways that show respect for each other's rights.
- We don't have to discriminate against girls within the family. We should teach that girls and boys have equal opportunities in mind.
- We need to overcome fear of science and technology.
- Sometimes we feel that our only right is the right to be in the kitchen.

Adapted from APCWomen[xviii]

Much can and needs to be done to support pro-equity and pro-MDG approaches to ICT and development – efforts that will benefit and be inclusive to nations and *all* their citizens. The role of M&E in this domain should not be underestimated. As Margaret Mead famously said: "Never doubt that a small group of thoughtful, committed people can change the world. Indeed, it is the only thing that ever has." In a parallel fashion, it is only through a small set of credible studies aligned with policy prerogatives (such as the MDGs) that national policy change can take place in a guided fashion. This is the pro-equity challenge, a core component of what this M&E effort should be striving to achieve.

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Endnotes

[i] World Bank, 2004

[ii] Wagner & Kozma, 2005

[iii] Unicef, 2000

[iv] Wagner, 2001; Wagner & Daswani, 2005; Wagner & Day, 2004); for more information on the BFI, see www.literacy.org or www.bridgestothefuture.org.

[v] Richardson et al., 2000.

[vi] For reviews, see Batchelor, 2003; Hafkin & Taggart, 2001; and Huyer & Sikoska, 2003.

[vii] KM International, 2003; World Bank, 2003.

[viii] World Bank, 2003.

[ix] Langer, 2001; Internet World Stats, http://www.internetworldstats.com/stats7.htm

[x] The top ten languages of the WWW are, in order, English, Chinese, Japanese, Spanish, German, French, Korean, Italian, Portuguese, and Dutch. See http://www.internetworldstats.com/stats7.htm.

[xi] UNESCO, 2000.

[xii] Becta, 2003, page 3.

[xiii] From Mohammed Bougroum, Cadi Ayyad University, Marrakech, Morocco, personal communication (2005).

[xiv] Batchelor et al., 2003.

[xv] OECD, 2000.

[xvi] Brandjes, 2002; Casely-Hayford & Lynch, 2003a, b; see also web resources at http://www.gg.rhul.ac.uk/ict4d/Disability.html).

[xvii] Wagner & Kozma, 2005.

[xviii] Gender Evaluation Methodology (GEM) (accessed August 2005), at http://www.APCWomen.org.

Chapter 7

Dos and Don'ts in Monitoring and Evaluation

Tim Unwin and Bob Day

EXECUTIVE SUMMARY

- This concluding chapter provides a checklist of recommendations relating to the practical monitoring and evaluation of ICTE initiatives in the form of a series of 'Dos' and 'Don'ts'.

- It is intended explicitly for a range of practitioners, from government officials, policy makers and planners, to teachers and learners in a variety of types of educational establishment.

This chapter draws together the key recommendations of the previous chapters to this handbook. It is designed to be accessible to policy makers, program managers, implementers and evaluators, as well lay users, at the international and national levels. Not only does it reiterate some themes from the previous chapters (identified in parentheses after each sub-heading, where possible), but it also seeks to identify less evident issues, especially those that are of longer-term benefit and impact.

Of course, *dos* and *don'ts* are often merely different sides of the same coin. However, we are also conscious that there are things that we can practically *do* that can make a real difference to the success of technology enhanced learning programs, as well as traps that we all too often fall into if we do not consciously think about things we should *not do*! In selecting the sections into which particular issues for discussion are placed, we have therefore tried to bear this distinction in mind. Moreover, there are some issues that are of such importance that we have decided to discuss them from different angles in each of the two main sections.

7.1 Dos

In the foregoing chapters, a range of issues have been raised in a pragmatic fashion with the intention that not only should the readers understand and learn, but especially they should implement and benefit significantly from the contents. In this section, we summarize the most important issues that practitioners should actively *do* to appropriately introduce and use monitoring and evaluation techniques in implementing any initiative aimed at ICT enhanced learning.

Things *to* do…

1. ***Do include monitoring and evaluation at all stages in educational programs (****4.4).*
   This *Handbook* has emphasized throughout the importance of creating a virtuous cycle of improvement in education through the use of monitoring and evaluation techniques as integral components of all ICT for education activities from their inception. Thus, teachers and learners are encouraged both to monitor their progress and to think of ways in which they could enhance what they have been doing in a system of continual self-

evaluation and quality enhancement. There should then be opportunities for this to be fed back into systemic aspects of educational provision through regular evaluation. Monitoring and evaluation should not therefore be treated as one-off exercises, but should rather be embedded across all aspects of educational provision. Finally, practitioners should clearly distinguish monitoring activities from the formative and summative evaluation of performance criteria as well as from any subsequent research.

2. ***Do recognize that although monitoring and evaluation have significant cost, time and human resource implications, they are essential for successful programs*** *(3; 4.11).* The temptation to avoid these additional costs until the later stages of any ICT for education initiative should be resisted. Instead, appropriate monitoring and evaluation processes for a particular initiative should be identified (as described in chapters 3 and 4), and the associated overhead costs should be estimated up front. It is then essential to ensure that management personnel and donor agencies understand and are fully committed to these overheads, as well as being committed to take forward the recommendations resulting from monitoring and evaluation. We estimate that about 5-10% of any ICT4E project should be set aside for monitoring and evaluation, depending on the scope and scale of the project.

3. ***Do ensure that those involved in the monitoring and evaluation are appropriately trained and understand the importance of monitoring and evaluation*** *(3; 4.3).* It is essential that the implementers understand the monitoring and evaluation techniques that they are employing, and the reasons why. Depending on the initiative, different levels of implementer may be needed, with accordingly different types of monitoring and evaluation training. It is equally important that program implementers accept responsibility for the processes used, are fully committed to them, and feel empowered to convince all other stakeholders (including the inevitable sceptics) of their short and long-term benefits. Monitoring and evaluation is not an exercise that can be safely left to paid consultants from “head office”.

4. ***Do involve as many stakeholders as possible in monitoring and evaluation*** *(3; 4.10).*
   We are not dealing with an exact science. The best results are as dependent on involving a broad range of appropriate stakeholders as they are on identifying the most suitable and pragmatic monitoring and evaluation techniques. This requires significant effort at an initiative's inception in identifying who the key target groups will be in the implementation, as well as understanding what anticipated outcomes are wanted for each of these groups. In addition to improving quality and the likelihood of sustainability, this approach creates awareness and helps to build capacity.

5. ***Do involve the learners in any evaluation process*** *(3; 4.10).*
   It is remarkable how few studies actually take into consideration or report the attitudes and opinions of the end-beneficiaries of ICT-based educational initiatives. Our experience in Africa is that despite children being the beneficiaries of much well-intentioned support from civil society organisations, as well as having many foreigners visit them, they are seldom, if ever, asked for their opinions. Consequently, the educational initiatives that they were 'subjected to' did not necessarily deliver on what they saw as their main needs and priorities. Learners should therefore be involved from the earliest planning stages in the implementation of educational ICT programs. They should be included in the identification of targets, in the design of the monitoring and evaluation processes, and in the reporting and dissemination phases. Remember too, that everyone is a learner! Teachers are just as much learners as pupils, especially in the early stages of the implementation of technology-enhanced educational initiatives.

6. ***Do assess student learning*** *(3).*
   In many programs or projects, the most important outcome is an increase in student learning. It is important to measure this as directly as is possible and affordable. Learning achievement indicators should be linked to the goals of the project and the ways ICT are used. To the extent appropriate, the full range of student learning outcomes should be measured: school subject learning, ICT skills, and 21st century skills. Often this requires the design of learning measures that are customized to a particular program or project.

7. ***Do make sure that all monitoring, evaluation and assessment instruments are carefully pilot tested*** *(2; 4.6).*

   It is crucial to ensure that the chosen instruments do indeed measure what they are intended to measure in the circumstances within which the measurements are to be made. This includes the development of appropriate indicators to monitor outputs and outcomes, as well as ensuring that the data that you collect is really relevant and that you know what you will do with the data once you have collected it. When it is important to establish causality, use experimental and quasi-experimental evaluation designs. For example, to establish that an educational improvement *is due to* the use of ICT, it is necessary to have some schools or classrooms use ICT while other equivalent schools or classrooms do not use it. However, the introduction of ICT is often accompanied by such changes as teacher training, new curriculum, or new pedagogical approaches. Indeed, we recommend this. In these cases, all these interventions should be considered as a package, and only *combined impact* can be measured.

8. ***Do ensure that you promote the idea that monitoring and evaluation is about learning from the experiences of a program*** *(4.12; 5).*

   The establishment of a *culture* of monitoring and evaluation is important – where all stakeholders appreciate the short and long-term benefits, and accept the additional costs and effort involved. No matter how sceptical some may become when confronted with the near-term difficulties of M&E (costs, time, training, etc.), it is important to emphasize the cumulative impact of the learning and associated research that this effort will stimulate, and the improved probability of genuinely sustainable development that will result. The approach should be flexible and innovative, geared to the needs of the stakeholders rather than a recipe book (or this Handbook)! One must incorporate a range of different approaches to M&E, and be prepared to make adaptations as the project evolves.

9. ***Do disseminate your findings so that others can benefit from your experiences*** *(4.10-12, 5).*

   It is all too easy once an evaluation has been undertaken for it to be filed away and forgotten. Apart from minimising any practical impact on the learning environment, it

will also prevent others (e.g., direct stakeholders or those interested in undertaking a similar program in the future) from learning from the successes and mistakes recorded. Moreover, this dissemination needs to be in as diverse media as possible to provide access to many different groups of people. Publishing excellent reports in obscure academic journals is not good enough! Nor are simplistic press releases with senior officers pronouncing on the 'good works' accomplished! Monitoring and evaluation reports should be made accessible to all major stakeholders at built in checkpoints and milestones, and presented in formats appropriate for the key stakeholders, using computer-based tools and electronic reporting where appropriate.

10. ***Do remember to keep the MDGs in mind, and the need to prioritize the most excluded*** *(6).*

    A focus on the poor within MDG goals does not automatically happen when working on *digital divide* problems. *Not all gaps are created equal*, so to speak. Some have more valence than others. While there are many ways that can help varying groups of individuals, helping promote ICTs in peri-urban Indian high schools in English is not the same thing as helping girls who have dropped out of primary school get back into class.

11. ***Do try to create M&E tools that allow the possibility of supporting not only the MDG goals, but also effective strategies that work*** *(6).*

    Using internationally developed M&E tools can provide important ways to compare and contrast results of ICT for education worldwide; but they made also mask important ways in which locally developed tools can provide greater precision for project implementation.

7.2. Don'ts

In advocating the importance of disseminating good practice in monitoring and evaluation, the authors of this handbook have always tried to be positive in their suggestions. We have thus sought to *encourage* people to be innovative, to *build* on examples of successful initiatives elsewhere, and to *develop* monitoring and evaluation practices that are integral to the entire education process. This section of the *Handbook* is rather different in

approach. We have tried here to provide a summary of some of the things that tend to go wrong in the practical delivery of monitoring and evaluation activities. We raise them primarily to serve as a checklist – intended to limit the chance of someone accidentally slipping up despite having followed the good precepts (hopefully) identified previously! The material is presented in three distinct sections: first, the 'active don'ts', where we focus on the most important things that you should *not* do when initiating monitoring and evaluation activities associated with technology enhanced learning; second, we summarize things that it is all too easy to forget; and then there is a short final section – for those who make it that far.

Things *not* to do…

1. ***Don't simply monitor and evaluate for the sake of it; don't measure for the sake of measuring*** *(4.6).*

   It is easy to get into the habit of evaluating and monitoring for the sake of it, without there being any real purpose for so doing. Even worse can be the situation where an external donor or agency supporting an educational initiative insists that there should be a monitoring and evaluation process in place, without anyone involved really knowing why. Such initiatives, while satisfying the interests of the donors, may have little or no real benefit for the intended beneficiaries. For example, it is much more important to know whether the methods used have actually enhanced the experiences of learners than it is to know whether a school has acquired a targeted number of computers. This also highlights the need for such evaluations to focus primarily on outputs, rather than simply measuring the inputs into a program. For monitoring to be part of an ongoing process of educational enhancement it is crucial that all involved in the process know why they are engaged in it.

2. ***Don't impose a punitive management structure that seeks to use monitoring and evaluation as a way of negatively criticizing performance*** *(4.12).*

   Monitoring and evaluation procedures are sometimes imposed in a top-down manner on unwilling educators who fear that it is being used merely as a means to criticize their performance. The introduction of new technologies into learning contexts can be threatening, and in order to minimize such threats it is essential that teachers are closely involved in the design and implementation of the relevant procedures. The use of ICTs

may transform the role of a teacher into that of a facilitator, and can subtly shift the power relationships within a learning environment away from the teacher and towards the learner. This need not be seen as threat, because learners invariably retain their respect and admiration for teachers who actually help them to learn. Managers should nevertheless make it clear from the outset that they are not using monitoring and evaluation processes to criticize individual teacher performances, but rather as part of a package of activities designed to achieve an overall increase in educational attainment at several levels.

3. ***Don't embark on monitoring and evaluation unless sufficient funding is in place***. Successful monitoring and evaluation must build on appropriate and relevant baseline studies that provide the basis for comparative accounts of the impact that any initiative has had. This cannot be done after the event, and neither can it necessarily be done cheaply. It is therefore essential for sufficient funding to be in place at the start of any such initiative so that a comprehensive monitoring and evaluation program can be incorporated from the very beginning. The allocation of funding is also an indication that those supporting or proposing the initiative are also really committed to seeing it through effectively, and if necessary to change aspects of delivery on the way in response to the comments of teachers and learners. Given the difficulty and complexity of implementing technology enhanced learning activities, often with limited resources, it is also simply not feasible to expect those involved to spend their time chasing additional resources to undertake the monitoring activities that should have been in place at the start! Such effort is highly likely to detract from the actual implementation of the proposed activities themselves. Another aspect of this issue is that if funding gets tight towards the end of the program, don't simply save costs by cutting the monitoring and evaluation.

4. ***Don't try to rush the implementation of ICT for education initiatives*** *(3; 4.12; 5).* Successful and sustainable programs designed to enhance education through the use of new technologies cannot be implemented overnight (see Chile Box 5.4). There is a great deal of desire to implement rapid changes designed to transform educational systems in poor countries overnight, but this is usually unfeasible and unrealistic. We need to plan systemic changes over at least a decade, and not merely concentrate on things that can be

done in the short term. It also takes time for the results of regular monitoring to be clear, and for these then to be incorporated into changes in the educational system under consideration. Before a great deal is said about the influence of ICTs on learning, we need to have undertaken sufficient longitudinal studies to enable reliable conclusions to be drawn of their real costs and benefits.

5. ***Don't focus exclusively on the technology*** *(2).*
   It is tempting in monitoring and evaluating the role of new technologies in education programs to focus exclusively on the technology. However, it may be, for example, that the key success factor in a particular ICT-based program is the increased attention given to teachers and their training, rather than their actual use of the technology itself. We must be sure that we concentrate primarily on the educational objectives, and explore a sufficiently wide range of causal variables before firm conclusions are reached.

6. ***Don't allow self-reporting to be the only way to ascertain learning in a target population; and don't only use external people for monitoring and evaluation*** *(4.3).*
   It is not easy to get the balance right between self-monitoring and external evaluation. However, it is very important that all such processes include not only the relevant stakeholders, but also experienced people from 'outside' who can bring a different perspective, and ask the difficult questions that could so easily be ignored in a purely self-reporting environment. In so doing, though, it is important that people with real practical experience and cultural sensitivity are chosen actually to work with these communities to identify how best to enhance learning outcomes.

7. ***Don't forget that "culture is local"*** (6).
   Be aware of the anthropological dimension of all interventions, especially those in multicultural societies. No technology is culture-neutral, nor is any implementation that uses multimedia, linguistic and other educational content. When designing monitoring and evaluation tools, these must not be simply dropped in from other studies carried out elsewhere. They need to be refined to suit local needs and cultures.

Things not to forget…

8. ***Don't forget to consider the unintended results of programs*** *(chap 2; 4.4).*
   Programs have both intended and unintended results. Evaluations focus mainly on intended results, because that is what they are usually specifically set up to do. Post-project evaluation reviews, desired by many donors, wish to learn whether a project has delivered on its targets. Rarely do they seek to explore other impacts that they may have had along the way. It could be, for example, that the introduction of ICTs into a learning environment has little effect on the formal educational processes as measured by traditional examination systems, whereas learners may have gained a wealth of other skills and knowledge through using such facilities. This learning impact could be missed entirely by an evaluation that concentrated only on the effects of the changes on examination performance (See Namibia, Box 4.1).

9. ***Don't forget that ICTs cover a wide variety of technologies – don't just concentrate on computers*** *(2; 4.7).*
   With all of the emphasis on the use of computers and the Internet (see Khanya Project Box 4.3), it is very important that other technologies are not ignored. Basic technologies such as radio and television have many uses in the enhancement of education, as do recent technologies such as the use of mobile telephones and other hand-held devices. The ways in which all of these different technologies enhance both information transfer and communication need to be fully investigated before any convincing conclusions are drawn.

10. ***Don't forget to manage the buy-in process with key stakeholders*** *(4.10; 5).*
    The importance of learners in the processes of monitoring and evaluation has already been stressed. However, it is important that other groups are also not forgotten. Precisely who these stakeholders are will vary depending on the circumstances, but the list of stakeholders (see Box 5.1) provides a quick check on some of the most important people who should always be included. It is all too easy, for example, to forget to involve parents, employers and even government departments in undertaking monitoring and evaluation processes. Failure to include them will not only give rise to a partial set of

conclusions, but more importantly it will also mean that it will be much less easy to implement any consequent recommendations. If people feel that they have been involved in the process, they are much more likely to be positive about its proposed action plan.

11. ***Don't forget the importance of contextual and geographical variation*** *(2; 4.7; 6)*.
    The actual places where monitoring and evaluation are undertaken are crucial factors influencing the results obtained. Focusing on a group of urban schools with access to electricity and the internet may be important if one wants to show what is potentially feasible in poor countries. However, if one wants to obtain a wider picture of the role of technology in educational programs across Africa, for example, it is equally important to monitor their uses in some of the most marginalized and poorly served communities across the continent. It is therefore essential that one does not forget to incorporate appropriate sampling strategies in monitoring and evaluation activities (6).

And finally…

12. ***Don't worry if you don't get it right the first time*** *(ALL chapters)!*
    There is no definitively correct way to undertake monitoring and evaluation of technology enhanced learning programs. This *Handbook* has tried to provide users with a range of ideas and a set of possible tools that they might use in the particular circumstances in which they find themselves. There are no absolutely right or wrong answers in how to go about this. Taking risks and making mistakes is how progress is made.

13. ***Don't leave your ICT implementation strategy talks without having monitoring and evaluation as a funded component of the process***. Learning from our mistakes, and yes, successes, is the only way (a la Margaret Mead cited in Chapter 6) that we will be able to change how things are done.

7.4. Conclusion

We hope that readers are by now convinced that appropriate monitoring and evaluation is essential for the successful implementation of any kind of ICT for education initiative, and that they will also have an understanding of the type of process most relevant

to their needs. Cross-references have been provided, where appropriate, to evidence from case studies in the various chapters. There are also a variety of in-depth tools and case information provided in the Annexes. The present document is necessarily a 'work in progress', and we trust that others will be able to build on the present material so that some later compilation will be able to extend further our collective ability to be more certain of investments in ICT for education.

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Monitoring and Evaluation Handbook

Annex

Note: This is provided to supplement the text with tools, survey questionnaires, and other materials that support the implementation of M&E in ICT for education. These documents and associated URLs are related to specific chapters in the Handbook, *but are likely to be of broader and more up-to-date utility for the reader.*

Chapter 1. Monitoring and Evaluation of ICT for Education: An Introduction

1. United Nations Millennium Development Goals (United Nations).
   A complete description of the UN Millennium Development Goals, which form a blueprint agreed to by all the world's countries and all the world's leading development institutions to meet the needs of the world's poorest.
   http://www.un.org/millenniumgoals/goals.html accessed October 16, 2005.

2. ICT and MDGs: A World Bank Group Perspective (World Bank).
   This report illustrates the opportunities ICTs offer policy makers and practitioners in their efforts to achieve the MDGs and highlights selected World Bank Group funded projects using ICT to accelerate development.
   http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2004/09/15/000090341_20040915091312/Rendered/PDF/278770ICT010mdgs0Complete.pdf
   last accessed October 18, 2005.

Chapter 2. Monitoring and Evaluation of ICT for Education Impact: A Review

1. School Factors Related to Quality and Equity (OECD/PISA).
   A report on the effects of policies and the structure of education systems on educational outcomes, based on analyses of PISA 2000, the results of a multi-year, international study. The frameworks and assessment instruments from PISA 2000 were adopted by OECD member countries in December 1999, (see Annexes A & B).
   http://www.pisa.oecd.org/document/35/0,2340,en_32252351_32236159_34669667_1_1_1_1,00.html last accessed October 16, 2005.

2. Monitoring and Evaluation: Some Tools, Methods, and Approaches (World Bank).
   An overview of a sample of M&E tools, methods, and approaches, including purpose and use; advantages and disadvantages; costs, skills, and time required; and key references.
   http://www.worldbank.org/oed/ecd/ last accessed October 18, 2005.

Chapter 3. Core Indicators for Monitoring and Evaluation Studies for ICT in Education

1. Young Children's Computer Inventory Summary (Texas Center for Education Technology).
   A 52-item Likert instrument for measuring 1st through 3rd grade children's attitudes on seven major subscales. Also contains links to the survey instrument and scoring.
   http://www.tcet.unt.edu/research/survey/yccidesc.htm last accessed October 16, 2005.

2. Tips for Preparing a Performance Evaluation (USAID).
   This document outlines USAID's framework for performance monitoring plans (PMP) used to plan and manage the collection of performance data (and occasionally includes plans for data analysis, reporting, and use). It describes the following components as essential to PMPs: a detailed definition of each performance indicator; the source, method, frequency, and schedule of data collection; how the performance data will be analyzed; and how data will be reported, reviewed, and used to inform decisions.
   http://pdf.dec.org/pdf_docs/pnaby215.pdf (primary link) last accessed October 16, 2005.
   http://topics.developmentgateway.org/evaluation/rc/ItemDetail.do~287167 (overview link) last accessed October 16, 2005.

3. Development Research Impact: REACH (International Development Research Centre), Paper by C. Sander (1998).
   This report outlines issues in accountability and development research impact assessment; introduces "reach" as impact of development research; illustrates reach assessment with findings from impact studies; and concludes with suggestions for impact assessment as learning accountability and reach as a concept to facilitate assessing and designing for research impact.
   http://www.idrc.ca/uploads/user-S/10504282450reach_e.pdf last accessed October 16, 2005.

Chapter 4. Developing a Monitoring and Evaluation Plan for ICT in Education

1. ICT Survey Questionnaire Summary (UNESCO-Bangkok).
   This instrument was developed with the understanding that many countries are at different stages of ICT development and, hence, indicators may vary. Questionnaires are meant to serve as a basis, and evaluators may tailor them to their specific contexts. The overall framework includes four questionnaires to be completed: ministry of education, school heads/principals, teachers & teaching staff, and students.
   http://www.unescobkk.org/index.php?id=1006 last accessed October 16, 2005.

2. Open Source Monitoring & Evaluation Tool (International Institute for Communication and Development).
   IICD provides advice and support to local organizations in developing countries to benefit from the potential of ICTs. This tool supports the collection of data and the analyses of results and includes surveys for project users, training & seminar participants, project team members & managers, information network members, and global teenager.
   http://testsurvey.iicd.org/ last accessed October 16, 2005.

3. Evaluation Planning in Program Initiatives (International Development Research Centre).
   A series of guidelines to help IDRC managers, staff, and partners improve the quality and consistency of evaluations in IDRC and to enhance evaluation capacity, including guidelines for: searching for previous IDRC evaluation reports, program initiative evaluation plan tables, formatting evaluation reports, writing terms of references, identifying intended uses and users of evaluations, selecting and managing an evaluation consultant or team, and preparing program objectives.
   http://web.idrc.ca/en/ev-32492-201-1-DO_TOPIC.html last accessed October 16, 2005.

4. Resources for Technology Planning (Texas Center for Education Technology).
   This is a listing of internet-based resources for technology planning, including tools, publications, templates, surveys, and checklists.
   http://www.tcet.unt.edu/START/progdev/planning.htm last accessed October 16, 2005.

5. Online Assessment Tools (enGauge) (North Central Regional Educational Laboratory).
   This contains online assessments for use by districts or schools to conduct online assessments of system-wide educational technology effectivness. It includes sample surveys and profiles for educators, district & building administrators, district & building technology coordinators, board members, community members, students, and parents.
   http://www.ncrel.org/engauge/assess/assess.htm last accessed October 16, 2005.

Chapter 5. Capacity Building and Management in ICT for Education

1. Educator Development for ICT Framework, Assessment and the Evaluation of the Impact of ICT (SchoolNet South Africa).
   An educator development program that focuses on integrated, formative assessment of practice and competencies on four levels: ICT skills, integration, growth in the educator as a professional, and the whole school. Some indicators of competencies include: levels of computer efficiency; practical, foundational, and reflexive competencies; and self-assessment.
   http://www.school.za/edict/edict/assess.htm last accessed October 16, 2005.

2. Three-Step Technology Evaluation, Are Your Schools Getting the Most of What Technology Has to Offer? (Sun Associates).
   With the goal of examining technology's impact on student achievement district-wide, this evaluation focuses on three steps: setting goals, collecting and analyzing data, and recommendations and reporting, with several sub-steps.
   http://www.sun-associates.com/3steps.pdf last accessed October 16, 2005.

3. Computer Background Survey, Global Networked Readiness for Education (Harvard University/World Bank).
   This Survey Toolkit is designed to collect experiential data about how computers and the Internet are being used around the world and in developing countries. The four surveys comprising this toolkit seek to address data deficits at both the school and policy levels, and give useful and actionable information about the integration of ICT in education. The four surveys are: teacher, student, head of school, and computer background.
   http://cyber.law.harvard.edu/ictsurvey/ICT_Computer-background-survey.pdf last accessed October 16, 2005.

Chapter 6. Pro-Equity Approaches to Monitoring and Evaluation: Gender, Marginalized Groups and Special Needs Populations

1. Advice on Special Education Needs (SEN) and Inclusion (National Grid for Learning).
   A web site offering research, products, legislation and guidance materials, case studies, "ask the experts," online communities, and recommended web sites for special educational needs and inclusion.
   http://inclusion.ngfl.gov.uk/ last accessed October 16, 2005.

2. Networking Support Program (Association for Progressive Communications).
   A web site promoting gender equity in the design, development, implementation, access to and use of ICTs and in the policy decisions and frameworks that regulate them. It offers information on activities/conferences, policy, evaluation, training, and resources.
   http://www.apcwomen.org last accessed October 16, 2005.

3. GenderIT.org
   A web site focusing on ICTs' contribution to the economic, political, and social empowerment of women and the promotion of gender equality, offering information on activities/conferences, policy, evaluation, training, clearing houses, and resources. The range of topics and accompanying resources include: economic empowerment, education, health, violence against women, women in armed conflict, cultural diversity and language, communication rights, universal access, strategic use and FOSS, and governance.
   http://www.genderit.org/en/index.shtml last accessed October 16, 2005.

Author Bios

Bob Day directs the consulting firm Non-Zero-Sum Development (based in Pretoria, South Africa), and contributes to national, regional and international initiatives aimed at alleviating poverty and promoting socio-economic development throughout Africa (currently in Kenya, Uganda, Ethiopia, Ghana, Senegal, and Mozambique). He is involved in action research initiatives and policy development related to the Knowledge Society, Foresight, Innovation, Knowledge Ecology and Organizational Transformation. He has consulted with a wide range of organizations, including UNESCO, UNDP, UNECA, IDRC, World Bank (InfoDev), Imfundo (DFID), ILI, CGIAR, ILRI, USAID, HSRC, as well as several private sector South African organizations. His most recent institutional post was with the University of South Africa (UNISA) from 01/2000 to 04/2003, as Executive Director of ICT.

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Tina James is a founder member of Trigrammic, a consultancy group based in South Africa. From 1997 - 2001 she was Programme Officer and Senior Advisor to the Canadian International Development Research Centre's Acacia Programme in Southern Africa. Previously she worked in various management positions for the South African Council for Scientific and Industrial Research (CSIR) and initiated the Information for Development Programme in the early 90s. She has more than twenty years experience on ICTs in Africa, including a review of the IT sector in South Africa for the President's Office in 2004. She is

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Jonathan Miller is a founder member of Trigrammic, a consultancy group based in South Africa. For nearly 20 years, Miller was a senior faculty member of the University of Cape Town Graduate School of Business, where he taught and conducted research into ICT policy and practice. He gained his PhD in the definition and measurement of ICT effectiveness and has published over 20 refereed articles and many professional articles, book chapters and conference papers. His work has included ICT policy formulation in South Africa, Namibia, and the Eastern Caribbean States; E-readiness assessments in several African countries; assessment of ICT investment opportunities in East Africa; devising ICT funding programmes for the European Commission; and in South Africa: technology roadmapping, ICT diffusion studies, a major census of ICT firms, formulating policies for ICTs in SMEs and policies for Open Source. A Fellow and formerly President of the Computer Society of South Africa, he currently chairs the Board of the International Computer Driving Licence Foundation.

Tim Unwin is Professor of Geography at Royal Holloway, University of London, where he was formerly Head of Department. From 2001-2004 he led 'Imfundo: Partnership for IT in Education', a UK Prime Ministerial initiative designed to create partnerships that would use ICTs to support educational activities in Africa. Since returning to academia, he has created an ICT4D collective, doing research, teaching and consultancy in the field of ICT4D (http://www.ict4d.org.uk). He has undertaken research in some 25 countries, and is the author or editor of 13 books and over 150 academic papers or chapters in edited collections.

Daniel A. Wagner is Professor of Education and Director of the National Center on Adult Literacy at the University of Pennsylvania, which includes the federally-funded National

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about *info*Dev

infoDev is an international partnership of bilateral and multilateral development agencies and other key partners, facilitated by an expert secretariat housed at the World Bank. Its mission is to help developing countries and their partners in the international community use information and communication technologies (ICT) effectively and strategically as tools to combat poverty, promote sustainable economic growth and empower individuals and communities to participate more fully and creatively in their societies and economies.

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