Intel® Teach to the Future
Year Three and Consolidated Project Evaluation
South Africa

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CONTENTS

EXECUTIVE SUMMARY

This report presents the findings from the year-three evaluation of the Intel® Teach to the Future programme in South Africa.

The following questions guide the overall South African Intel® Teach to the Future evaluation:

1. How is the Intel® Teach to the Future programme implemented in a range of South African schooling contexts?
2. What are the experiences (positive and negative) of participants (project management, senior facilitators, facilitators, educators and learners) in the programme?
3. What opportunities and pitfalls can be identified in the implementation of the Intel® Teach to the Future programme?
4. Is there evidence of the use and integration of technology at the classroom level after taking part in the Intel® Teach to the Future training?
5. Is there evidence that ICT supports changes in pedagogical practice?

During year one, questions one to three were the focus, but not including the learner level. For year two, the focus shifted to questions four and five. Questions one to three continued to be explored, now including the learner perspective. In year three, a continued focus was placed on questions four and five. In addition, this year the evaluation research has continued to integrate and continue the assessment of impact into the formative study.

A mixed-methodology has been used, and research methods included two surveys, a post training survey and an impact survey, as well as three case studies.

The year three evaluation was dependent on a very small sample size (130), and thus limited the amount of meaningful data that could be extracted. However, it was established that the year three evaluation results would provide further evidence for the year two conclusions. With respect to the Intel® Teach to the Future training itself, trainees found the training to be very useful and noted changes with respect to both ICT and pedagogical competencies before and after training.

Both the survey data and case study provide evidence on the basis of which we can conclude that use and some degree of integration of technology at the classroom level is taking place. From the impact survey 26% of respondents indicated that they implemented a technology-integrated lesson weekly. From the survey data it was reported that 55% of respondents use computers more for presenting information to learners, and that 72% access the Internet more than before. Furthermore, 50% asked learners more often than before to do work on computers in their own classes.

INTRODUCTION

This report is the third and final evaluation report prepared for the Intel® Teach to the Future programme in South Africa. Intel® Teach to the Future in South Africa is implemented by SchoolNet South Africa (SNA). Neil Butcher and Associates (NBA) was contracted in 2003 to evaluate the programme. Working closely with SNSA and the Intel® Regional Educational Manager, the evaluation team seeks to provide data that can be incorporated into programme implementation, thus leading to improvements in delivery.

The year-one evaluation included documentation of the Intel® Teach to the Future programme in South Africa, analysis of post training evaluation forms completed during the facilitator training, and eight case studies. These case studies allowed for a detailed exploration of some of the different contexts in which the programme is being implemented in South Africa. Research methods used included semi-structured interviews, focus groups, a survey of the school's facilities, lesson observations, and Intel® Teach to the Future training observations. For year one, the evaluation was formative, seeking to document lessons that would support programme improvements. We did not include a focus on impact, as it was too early in the implementation of the project to begin assessing impact. In the year-two evaluation, impact of the Intel® Teach to the Future programme at the school, educator, and learner levels was assessed. This report, which is the year three and consolidated project report, continues this assessment.

This report begins by presenting a literature review, followed by the research design and methodology used for the year-three evaluation. This is followed by an overview of the study results, and then the discussion and way forward. The report concludes with a section consolidating conclusions from the three years of the project. Ground that was covered in the year one and year two reports is not covered here, rather the reader is referred to Annexure A - the year one report for additional background information on implementing Intel® Teach to the Future in South Africa. In addition, the executive summary of the year two report is included as Appendix B.

LITERATURE REVIEW

INTRODUCTION

Teacher professional development is essential if technology provided to schools is to be used effectively. Simply put, spending scarce resources on informational technology hardware and software without financing teacher professional development, is 'wasteful'.[1] Experience around the world in developing, industrialized, and information-based countries has shown that teacher training in the use and application of technology is the key determining factor for improved learner performance (in terms of both knowledge acquisition and skills development enabled by technology).[2] Educational technology is not, and never will be, transformative on its own—it requires teachers who can integrate technology into the curriculum and use it to improve learner learning. In other words, computers cannot replace teachers—teachers are the key to whether technology is used appropriately and effectively.

However, designing and implementing successful teacher professional development programmes in the application of technology is neither easy nor inexpensive. There are more cases of inadequate and ineffective training programs than there are success stories. Moreover, success stories are not automatically transferable to other situations, and the total body of experience and knowledge in this field is in its infancy. As such, this section provides an overview of teacher professional development in the use of ICTs. In addition, we also provide a brief overview of the South African schooling context.

ICT LITERACY FIRST?

For the purposes of this document, the answer to the question 'whether to teach ICT skills' is assumed to be yes, but there is nonetheless a significant and ongoing debate about '*how to'* teach ICT skills to teachers. Many people question the relevance of teaching teachers ICT skills without teaching them how to apply those skills to their teaching practice. One school of thought claims that if you teach teachers how to use a computer and give them unlimited access to that computer, they will then figure out for themselves how to apply their knowledge of ICT to their teaching practice. Another school of thought argues that it is necessary to teach teachers how to apply ICT within their teaching practice in an integrated manner and that to simply teach teachers basic ICT literacy without applying it to pedagogy is a waste of time and resources.

The *Imfundo Review of ICT Training for Teachers in Africa* highlights the fact that, in the developed world, specific ICT courses for learners of education and other tertiary level learners seem to be waning. This is largely because formal ICT training has been found to have limited impact in relation to the time spent on teaching ICT skills. The teaching of ICT skills is therefore increasingly being approached differently, driven by the assumption that these skills are best learnt incidentally while focusing on specific education-related tasks and themes.[3]

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[1] Carlson, S, and Gadio, C (2002) *Teacher professional development in the use of Tehcnology.* In 'Technologies for Education: Potentials, Parameters, and Prospects'. Eds Haddad and Draxler. Unesco: Paris

[2] *ibid.*

[3] Several sources: UNIC, the Danish Center for Education and Research, Denmark; Lärarhögskolan Stockholm, Sweden; National Institute for Education Development, Namibia. Quoted in James, T. et al (June 2003): "Imfundo Review of ICT Training for Teachers in Africa"

There is the counterargument that African educators have not had the access to computers that their counterparts in the developed world have had, and that they therefore might not have had sufficient grounding to dispense with the need for basic ICT literacy courses before moving on to specific education-related computer usage. However Jeffrey Goveia and Heidi Soule, in an article entitled: *Why I Don't Want to Take a Course about a Pencil: Three Traps to Avoid When Introducing New Technologies to Educators* strengthen the integration argument in their disagreement that building basic ICT literacy is a necessary pre-cursor to using ICT to support teaching. Based on their experiences working with Namibian teachers, these US educators question why those tasked with teacher training in ICT would want to create stand-alone technology courses when their hope is to help teachers see how technologies can be integrated into their daily lives and teaching practices. Their argument, with which Intel identifies, is that teaching about technologies too easily removes the technologies from the context of their daily uses. Instead of this approach, they recommend considering approaches whose primary focus is almost immediately getting education professionals to use technologies in their daily work and teaching assignments.[4]

> Integration does not mean teaching technologies. It means *using* technologies. Further, it does not mean that we should just use technologies because they are there to be used. It means *using technologies where it makes sense to use them*. With these thoughts in mind, we might avoid wasting time and resources on technology because we feel compelled by hype to spend time and money on technology. Technologies can be very useful when thoughtfully introduced into an education system, but we feel it makes more sense to encourage education professionals to slowly and thoughtfully adopt these technologies into their daily activities rather than forcing them to take questionably effective and pedagogically unsound technology literacy courses.

Wilson-Strydom et al also discuss this issue in a recent article about the Intel project[5]. They contend that the concept of integration as expressed in the South African White paper on e-Education needs to be unpacked or problematised. In practice, the adoption and integration of computers is a challenging and complex process for schools, particularly where there is limited previous experience in the use of ICT to support teaching and learning. Furthermore, at many schools that have had access to ICT, the focus has tended to be on 'learning *about* ICT' rather than learning *with* or *through the use of* ICT.

Historically the concept of ICT literacy as an approach evolved as a reaction to early computer-in-schools programmes where the emphasis lay on developing computer literacy or technical knowledge of computers and the use of various computer applications. More recently ICT integration has been recognised as "using computers to learn, rather than learning to use computers".[6] Thus the focus is on adding value to the curriculum in numerous ways. What is important is that ICT skills are not taught as a distinct activity ("just-in-case"), but are acquired "just-in-time," in the context of activity that is meaningful to learners"(UNESCO/COL, 2004, 45). Indeed, the integrated approach places information technology in a pivotal role in the already transforming learning process. Its success as an approach lies with the ability of teachers to set tasks that require learners to use these information skills. This is appropriate and necessary at this time when South African teachers

[4] Goveia, J and Soule, H (2003) Why I Don't Want to Take a Course about a Pencil: Three Traps to Avoid When Introducing New Technologies to Educators, p.8 (emphasis added).

[5] Wilson-Strydom et al (in print) *Understanding ICT integration in South African Classrooms* Perspectives in Education, Volume 23(4), December 2005

[6] ibid

are being encouraged to adopt new teaching strategies that are outcomes based and learner-centered.

Wilson-Strydom et al (ibid) suggest further that integration can be described in two ways. The first way relates to the stages of integration and is closely associated with adoption. The second way relates to the type or kind of integration and is closely associated with use. They argue that particular stages of integration are more likely to be associated with specific integrative uses.

A COMPLEX SITUATION

SchoolNet Africa conducted a comprehensive research project on ICT professional development in 2004 entitled *Towards a Strategy on Developing African Teacher Capabilities in the Use of ICT*. They emphasized before proceeding with the research that it is important to note that this is an enormously broad topic of research which is complicated by a number of factors. For example, there are a variety of levels at which ICT capabilities can be taught (pre-service versus in-service, primary versus secondary, simple versus advanced skills) and a variety of types of capabilities (pedagogically-linked or de-contextualized ICT skills, subject specific ICT skills, etcetera).

As mentioned earlier, providing technical skills training to teachers in the use of technology is necessary, but not sufficient to ensure educational benefit of the technology. Teachers also need professional development in the pedagogical application of those skills to improve teaching and learning. Traditional one-time teacher training workshops have not been effective in helping teachers to feel comfortable using technology or to integrate it successfully into their teaching.[7] Accordingly, Carlson and Gadio (ibid) note that a new paradigm is emerging that replaces the notion of training with *lifelong professional preparedness and development* of teachers. This approach includes at least three dimensions:

- Initial preparation/training (pre-service) that provides teachers with a solid foundation of knowledge; competency in teaching, classroom management, and organization skills; mastery of the subject matter they will teach; and proficiency in using a variety of educational resources, including technology.
- Workshops, seminars, and short courses (in-service) that offer structured opportunities for acquisition of new teaching skills and subject matter knowledge, as well as skills development in the use of technology in the classroom, that are government certified and linked to teachers' professional career development.
- Ongoing pedagogical and technical support for teachers as they address their daily challenges and responsibilities. While technology increases teachers' training and professional development needs, it also offers part of the solution. Information and communication technologies (ICTs) can improve pre-service teacher training by providing access to more and better educational resources, offering multimedia simulations of good teaching practice, catalyzing teacher-to trainee collaboration, and increasing productivity of non-instructional tasks. ICTs also can enable in-service teacher professional development at a distance, asynchronous learning, and individualized training opportunities. Finally, ICTs can overcome teachers' isolation, breaking down their classroom walls and connecting them to colleagues, mentors, curriculum experts, and the global teacher community.

[7] *ibid.*

Many teachers want to learn to use educational technology effectively, but they lack the conceptual framework, time, computer access, and support necessary to do so. A well-planned, ongoing professional development program, grounded in a theoretical model, linked to curricular objectives, incorporating formative evaluation activities, and sustained by sufficient financial and staff support is essential if teachers are to use technology effectively to improve learner scholarship .[8] When designing or implementing any teacher professional development program for technology, it is important to situate that program within the context of a theoretical framework for adult learning.

Technology can promote effective instruction that is more learner-centered, interdisciplinary, more closely related to real-life events and processes, and adaptive to individual learning styles. Such instruction encourages development of higher order thinking and information-reasoning skills (rather than memorization of facts) among learners, and collaborative learning, all of which are increasingly required in today's knowledge-based global economy. This potential of technology to improve instruction needs to be integrated into the design and delivery of teacher professional development programs in the use of technology. Perhaps most important for the purpose of teachers' professional development, technology implies a shift in the teacher's role from being the sole source of knowledge and instruction to being a facilitator of learners' learning, which is acquired from many sources.

Again, teacher professional development for ICT needs to incorporate and model this shift. This implies that teacher professional development in the use of technology should embody and model the forms of pedagogy that teachers can use in their classrooms.[9] For example, training programs should accomplish the following:

- Empower teachers to develop their knowledge and skills actively and experientially, in a variety of learning environments, both individual and collaborative.
- Include a variety of learning strategies, encompassing direct instruction, deduction, discussion, drill and practice, deduction, induction, and sharing.
- Aim at higher-order thinking skills.
- Provide an authentic learning environment so that teachers engage in concrete tasks within realistic scenarios.
- Emphasize ways that technology can facilitate and enhance teachers' professional lives.
- Encourage teachers to be mentors, tutors, and guides of the learners' education process (rather than simple presenters of knowledge and information).
- Develop teachers' skills in learning how to learn (define learning objectives, plan and evaluate learning strategies, monitor progress, and adjust as needed).
- Promote cooperative and collaborative learning.
- Be sensitive to the culture and diversity of teachers as learners, using a multifaceted approach to respond to different learning styles, opportunities, environments, and starting points.
- Enable learning independent of time and place (anytime, anywhere learning).

More concretely, this means that teacher professional development in the use of technology needs to combine lecture/ presentation modalities with small-group and plenary discussion, individual and collaborative activities, and opportunities for teachers to reflect on their actual

[8] Carlson, S, and Gadio, C (2002) *Teacher professional development in the use of Tehcnology.* In 'Technologies for Education: Potentials, Parameters, and Prospects'. Eds Haddad and Draxler. Unesco: Paris
[9] *ibid.*

teaching practices and how they might do things differently with technology. Such an approach also means that learning materials need to be in several formats: print, CD-ROM, e-mail attachments, online (HTML and Java), and even DVD.

It also implies a need to develop both synchronous and asynchronous modalities, so that teachers can take advantage of training opportunities when they have the time, which is not necessarily when the trainer is available. Key to successful teacher professional development programs is a modular structure, corresponding to different levels of teacher experience and expertise using technology. Adapting materials to teachers' comfort level and starting points is essential. In this way, teachers new to technology can be exposed to the full series of professional development modules, while those further along on the learning curve can enter where their knowledge and skills stop, and help their less technology-savvy colleagues along.[10]

In addition, as mentioned earlier, the basic principles of adult learning should be incorporated into the training program. This implies that the program should be highly social and cooperative, with opportunities to share experiences and combine instruction with discussion, reflection, application, and evaluation. In addition to these principles, technology enables an even more collaborative approach and maximizes peer-to-peer sharing of the challenges, frustrations, advantages, and successes of using technology to teach and learn. Such an approach encourages use of illuminating failures in the use of technology in the classroom as well as examples of best practice.

Finally, these principles imply the need to build ongoing communities and systems of support from peers, mentors, and experts. Single, "one-shot" training events that leave teachers alone afterward should be avoided. As should programmes that teach technology in isolation.

CONTENT OF PROFESSIONAL DEVELOPMENT PROGRAMMES

What should be learned? What skills and attitudes do teachers need to develop? What knowledge do they need to construct to use technology effectively to improve teaching and learning? This topic has been discussed at length over the last ten years as information technology, and particularly the Internet, has been introduced into schools around the world.

To begin with, designers of a teacher professional development program for use of technology need to determine current teacher competency levels in this area. The International Society for Technology in Education (ISTE) has produced a set of standards for teacher skills and knowledge in the use of technology ('Recommended Foundations in Technology for All Teachers'), a useful guide for determining the content of teacher professional development programs.[11] These standards were developed through a multiyear consultative process with thousands of teachers who were using (or trying to use) technology in their practice, principally in the United States and Canada. Another tool, the 'Professional Competency Continuum,' can be used to determine the skill levels of individual teachers and their professional development needs. European, Asian, and Latin American educational associations have developed similar sets of standards adapted to their educational contexts. The UK has a different set of standards which are less technologically focused than the ISTE. SchoolNet evaluates programmes such as the Intel® Teach to the Future against its own set

[10] *ibid.*

[11] http:// www.iste.org/Standards/NCATE/found.html.

of teacher ICT Integration competencies which it developed as a result of analysis of these standards worldwide.

MOTIVATION AND INCENTIVES

A key issue that must be addressed is teacher motivation to participate in professional development activities. While so-called 'champion teachers' ask for and seek out professional development opportunities in the use of technology, the vast majority of teachers do not. Teachers generally are reluctant to change their teaching styles and habits; are cautious of time-consuming activities that may take away from other high-priority obligations (economic, familial, or educational); have difficulty seeing the potential payoff beforehand of this kind of training; and may feel so threatened by technology such that they want to distance themselves from it rather than embrace it. Put simply, many teachers require additional motivation and incentives to participate actively in professional development activities.[12].

BRIEF OVERVIEW OF SOUTH AFRICA'S EDUCATION CONTEXT (SCHOOLING LEVEL)

The South African education landscape is complex, with schools that differ widely with respect to resources, and management expertise, and educator capacity and commitment. Many of these differences are a legacy of the apartheid regime. In addition, provincial differences with respect to management capacity as well as financial status further complicate the situation. The extract below, taken from a report detailing the complexities of the South African situation, is important to consider when interpreting evaluation findings.

> South Africa is a unique country, even in the African context. It is widely, and accurately, regarded as the powerhouse of Africa, the wealthiest country in Sub-Saharan Africa, the most industrialized in Africa, and it produces some of Africa's, indeed the world's greatest innovations. Yet studies have exposed South African education's severe shortcomings, especially in Maths and Science teaching. The average South African educator is less qualified than those in many other African countries. The divisive political past of this country has resulted in the majority of the schools being badly under-resourced, under-supplied and over-crowded. Educators themselves have been disadvantaged through the lack of affordability of and accessibility to pre-service training. On the other hand, South Africa boasts of independent schools that rank amongst the finest in the world. Even in that sector the dichotomy continues, because some of the poorest schools in the country are also independent schools. Some of the finest, most creative teachers in the country will be found in under-resourced township schools – some decidedly ordinary teachers can be found in top independent schools. In essence, it is simply impossible to make assumptions about this educational environment. Similarly, it is simply not possible to reflect experiences of other Third World countries onto the South African context.[13]

Further, since 1994, the South African education system, at all levels, has been in a state of transformation. This transformation has involved all areas of the schooling system,[14]

[12] Carlson, S, and Gadio, C (2002) *Teacher professional development in the use of Tehcnology.* In 'Technologies for Education: Potentials, Parameters, and Prospects'. Eds Haddad and Draxler. Unesco: Paris

[13] Roos, G (2003). Understanding the South African Programme context.

[14] See the 1996 South African Schools Act, No 84 of 1996.

including for example, governance and management, curriculum development, and moves to outcomes-based education and learner-centred approaches. In the area of educator training, a range of policies and new structures has emerged to cover curriculum issues, norms and standards for educators, and the institutional base for educators.[15] However, while there has certainly been an improvement in some schools, many have yet to experience the benefits of new policies.

New Curriculum

In South Africa, revisions and reformulations of the school curriculum began in 1994 when the National Education and Training Forum began a review of the syllabus and rationalisation of subjects. Under the apartheid system there were 19 different education departments organised on the basis of race, geography and ideology. The task as of 1994 was to develop a single national core curriculum. In 1997 the National Curriculum was published, and a Revised National Curriculum was released in 2002. From 2006 a new curriculum for grades ten to twelve (Further Education and Training, FET, level) will be implemented. The types of learners envisaged in this new curriculum are best described with a quotation from the Revised National Curriculum Statements for Grades R-nine.

> The curriculum aims to develop the full potential of each learner as a citizen of a democratic South Africa. It seeks to create a lifelong learner who is confident and independent, literate, numerate and multi-skilled, compassionate, with a respect for the environment and the ability to participate in society as a critical and active citizen.[16]

With respect to educators, the following characteristics are envisaged:

> Educators at all levels are key contributors to the transformation of education in South Africa. Teachers have a particularly important role to play. The National Curriculum Statement envisions teachers who are qualified, competent, dedicated and caring and who will be able to fulfil the various roles outlined in the Norms and Standards for Educators of 2000 (Government Gazette No 20844). These see teachers as mediators of learning, interpreters and designers of Learning Programmes and materials, leaders, administrators and managers, scholars, researchers and lifelong learners, community members, citizens and pastors, assessors and learning area/phase specialists.[17]

In developing such learners and educators, an outcomes based approach to curriculum has been adopted. An outcomes based approach considers both the content and the *process* of learning as critical. Both the content and the process of learning are articulated by the formulation of specific learning outcomes that should be achieved by the end of the learning process for a given phase and subject area. In addition to specific subject-based outcomes, the following critical and developmental outcomes underlie the curricula developed for each learning area. The critical and developmental outcomes are underpinned by the values enshrined in the South African constitution.

The critical outcomes envisage learners who are able to:

- Identify and solve problems and make decisions using critical and creative thinking;
- Work effectively with others as members of a team, group, organization and community;
- Organize and manage themselves and their activities responsibly and effectively;
- Collect, analyze, organize, and critically evaluate information;

[15] Lewin, K; Samuel, M & Sayed, Y (2002). Changing Patterns of Teacher Education in South Africa. Policy, practice and prospects. South Africa: Heinemann.
[16] Department of Education (2002). Revised National Curriculum Statements for Grades R-9 (Schools). Department of Education, Pretoria: South Africa, p. 8.
[17] Ibid, p.9.

- Communicate effectively using visual, symbolic and/or language skills in various modes;
- Use science and technology effectively and critically, showing responsibility towards the environment and the health of others; and
- Demonstrate an understanding of the world as a set of related systems by recognizing that problem solving contexts do not exist in isolation.

The developmental outcomes envisage learners who are also able to:
- Reflect on and explore a variety of strategies to learn more effectively;
- Participate as responsible citizens in the life of local, national, and global communities;
- Be culturally and aesthetically sensitive across a range of social contexts;
- Explore education and career opportunities; and
- Develop entrepreneurial opportunities.

The online thinking tools described above could play a supportive role in helping educators ensure that learners achieve these outcomes.

Infrastructure

The School Register of Needs Survey[18] of 2000 reported that, of the 27,148 schools in the country, 27.3% had no access to water, 42.9% to electricity, 9.2% to toilets, and 35.5% to telephones. In addition, the survey found an increase, compared to 1996 figures, in the number of schools that reported weak and very weak buildings. The country's learner-educator ratio was 32:1 and the learner-classroom ratio was 38:1. While there are wide variations from province to province, these national statistics provide an overview of the extent of the challenges facing the education sector.

In the area of ICTs, while significant divides still exist across provinces and schools, much progress has been made in the past few years. In August 2003, the South African Department of Education released the White Paper on e-Education.[19] This reflects the stated commitment of government to addressing the digital divide within the schooling sector and recognition of the valuable role that ICT can play, when used appropriately, to support teaching and learning as well as school administration and management. The table below provides a breakdown of computer availability in schools across the nine provinces.

PROVINCE	SCHOOLS WITH COMPUTERS	SCHOOLS WITH COMPUTERS FOR TEACHING AND LEARNING
Eastern Cape	8.80%	4.50%
Free State	25.60%	14.60%
Gauteng	90.50%	57.40%
KwaZulu-Natal	16.60%	11.40%
Mpumalanga	13.30%	4.90%
Northern Cape	24.90%	12.40%
Limpopo	30.50%	22.90%
North West	84.30%	49.30%
Western Cape	99.40%	61.80%

[18] Report on the School Register of Needs 2000 Survey. Pretoria: Department of Education.
[19] Department of Education, 2003. Draft White Paper on e-Education. Transforming Learning and Teaching through Information and Communication Technologies.

PROVINCE	SCHOOLS WITH COMPUTERS	SCHOOLS WITH COMPUTERS FOR TEACHING AND LEARNING
National	**43.77%**	**26.58%**

Source: National Department of Education, 2004 statistics on ICTs in Schools

These statistics highlight the diversity of the ICT context of schools across the country. Particularly notable is the low percentage of schools with computers for teaching and learning. A survey conducted in 2000 found that the principal factors preventing schools from using computers as a tool for teaching and learning included: insufficient funds; inadequate numbers of computers; lack of computer literacy among teachers; lack of subject teachers trained to integrate computers into different learning areas; and the absence of properly developed curriculum for teaching computer skills.[20]

While these statistics may seem to portray a bleak picture, it should be noted that the number of schools with computers for teaching and learning has increased by 12.3% between 1996 and 2002. Further, government has committed, in the White Paper, to the goal of ensuring that all schools have computers by 2013.

The concept of e-Education reflects much more than access to ICTs alone, 'e-Education revolves around use of ICTs to accelerate the achievement of national education goals'[21]. E-Education implies that learners and educators are ICT-capable, rather than ICT literate only, and includes the abilities to:

- Apply ICT skills to access, analyse, evaluate, integrate, present and communicate information;
- Create knowledge and new information by adapting, applying, designing, inventing, and authoring information;
- Enhance teaching and learning through communication and collaboration by using ICTs; and
- Function in a knowledge society by using appropriate technology and mastering communication and collaboration skills.[22]

While these are laudable aims, an additional factor to lack of computers that will affect the achievement of the goal of educational improvement is that many educators were poorly trained in the past and as such do not have a good conceptual knowledge of the subjects that they teach nor of teaching methods.[23] Educator professional development, and in the context of this study, professional development in the area of higher order thinking skills development, is an essential aspect of educational transformation in the country.

[20] Lundall, P & Howell, C (2000). Computers in Schools. A National Survey of Information and Communication Technology in South African Schools. Education Policy Unit, University of the Western Cape.

[21] Department of Education, (2003). White Paper on e-Education. Transforming Learning and Teaching through Information and Communication Technologies, p.7.

[22] Ibid, p.7.

[23] See for example:
Adler J & Reed, Y (eds), (2002). Challenges of Teacher Development: An investigation of take-up in South Africa. Pretoria: Van Schaik Publishers.
Lewin, K; Samuel, M & Sayed, Y (2002). Changing Patterns of Teacher Education in South Africa. Policy, practice and prospects. South Africa: Heinemann.

RESEARCH DESIGN AND METHODOLOGY

The evaluation research being conducted draws on both qualitative and quantitative methodologies. As such, a mixed-method approach was used. This was deemed important to understand nuances of project implementation and as a means of triangulating data gathered.

RESEARCH QUESTIONS

The following questions guide the overall South African Intel® Teach to the Future evaluation:

1. How is the Intel® Teach to the Future programme implemented in a range of South African schooling contexts?
2. What are the experiences (positive and negative) of participants (project management, senior facilitators, facilitators, educators and learners) in the programme?
3. What opportunities and pitfalls can be identified in the implementation of the Intel® Teach to the Future programme?
4. Is there evidence of the use and integration of technology at the classroom level after taking part in the Intel® Teach to the Future training?
5. Is there evidence that ICT supports changes in pedagogical practice?

As mentioned previously, during year one, questions one to three were the focus, but not including the learner level. For year two, the focus shifted to questions four and five. Questions one to three continued to be explored, now including the learner perspective. With a focus on questions four and five, the evaluation research has moved to integrate an initial assessment of impact into the formative study.

RESEARCH METHODS

As noted above, a mixed-method approach has been used in this study.[24] Following the requirements of all country implementers of Intel® Teach to the Future to administer the standard 'post training' and 'impact surveys', these surveys were adapted to suit the South African education context with further questions added. Both surveys were largely quantitative and formed the basis of the quantitative data collected.

Both surveys were primarily administered online, but with hard copies posted where requested. This year, although 489 surveys were posted, none were returned.

Post-training Questionnaires

Various Post-training questionnaires should ideally be completed on the last day of every training session. However, we have found that this was not always done as teachers were eager to conclude the programme and do not always see the value of completing such surveys, particularly when they are rushing to complete their portfolios. As such, reminder e-mails were sent to all facilitators during the last two weeks of each quarter in an attempt to improve response rates. Post-training data have been reported quarterly throughout 2005. The cumulative 2005 data set has been used as the basis of the analysis presented here.

[24] Copies of research instruments used are available on request; please email merridywilson@icon.co.za to request copies.

Impact Survey

The following procedure was followed in the administration of the survey:

- Survey was administered online (as in 2004) from September to November 2005.
- Since a new survey was being used, all facilitators and educators who had been trained since 2003 were requested to take part in the survey.
- Email was sent to all facilitators informing them of the survey and requesting their support in completing and getting the educators they have trained to complete the survey. The email also informed people that the first three schools to submit all their responses would qualify for an incentive prize.
- Email was sent to all educators registered on the Intel® Teach to the Future project database (note, this may not be all the educators who have been trained because the database requires that facilitators capture training data and this is not always done).
- Several emails bounced back. All facilitators whose emails bounced back were telephoned where numbers were available and working.
- When telephoned, facilitators gave the following reasons for problems with email communication and reasons for not completing the survey:
    - Some of the email addresses were no longer functional.
    - Facilitators could not remember their email addresses and they do not use them anymore.
    - Several have not run training and some of those who have trained have problems remembering the number of educators that were trained.
    - The internet was not working in some of the schools and facilitators stopped training.
    - Some reported not receiving the materials needed for training.
    - Some facilitators were no longer working in the school or had passed away.
- When email was not working fax versions of the survey were sent. 15 surveys were sent via fax.
    - After two weeks a follow-up phone call was made inquiring why faxes were not being returned. Various reasons were provided; including that the fax was not working and even that the telephone had been misplaced. No faxed surveys were returned.
- Where internet access was a problem, hard copies of the survey were also sent by post to facilitators who ask for them. A total of 489 surveys were sent out in hard copy, with self addressed and stamped envelops for return of the survey. By the survey cut off date (Friday 18th November), no hard copy responses had been received.
- Additional follow-up telephone calls were made where surveys had been posted. Most reported not having time to complete the surveys.
- A final email was sent out to the facilitator and educator mailing lists indicating the low numbers of people who had responded to the email. A further 40 people completed surveys online following this email.

Case Studies

This year, three case studies were conducted on Intel educators who seemed to be doing innovative things with ICT in the classroom. We used the following criteria for choosing the schools/ educators:

1. Educators had to be based in Gauteng. Due to budgeting constraints, traveling for data collection was not possible.

2. Educators had to have been identified by both SchoolNet SA and researchers as people who were doing innovative work with ICT.
3. After an initial phone-call, educators needed to be willing to participate in the research.

Data collection took place as follows:

- The educator was asked to keep a journal in which s/he briefly reflects, approximately weekly, on progress, challenges, examples etc of using ICT for teaching and learning. Examples of lessons, learner's response to lessons, response of other educators in the school, challenges faced, what worked well, what didn't work well were prompting ideas for the journal content. The structure of the journal was kept very open, and determined by the educator/facilitator. The journal was submitted monthly for analysis as part of the case study. However, the three educators only sent a maximum of four journal entries each. Reportedly, this was due to both time constraints, and the limited number of ICT-integrated lessons they used.

- Researchers arranged with the educator to observe three lessons in the course of the year. Following the lesson a short interview was be conducted with the educator.

RESULTS

In this section we present the evaluation results for the post-training survey, impact survey, and case studies. Each is dealt with in turn. Discussion in the following section brings together this range of results to draw conclusions and identify lessons.

At the time this report was written,[25] 849 schools had been accepted into the Intel® Teach to the Future programme and 52 had been rejected. The most common reason for rejection is related to the computer infrastructure available at the school. In addition, 21 schools were pending, i.e. had completed the online registration form and were waiting for acceptance into the programme. A total of 784 facilitators had been successfully trained and 63 potential facilitators had applied to take part in training. Further, 1000 educators had successfully completed their training (note, this number is dependent on the facilitator completing the database, hence the actual number of educators trained is likely to be larger than this) and 1321 were currently taking part in training. Altogether, 224 educators were reported to have dropped out.

When educators drop out of the training the database automatically sends them an e-mail asking a couple of questions about why the person decided to discontinue the training. Of those who have dropped out and completed the withdrawal questions, the most common reason was lack of time. When asked if they would register at a later date for the course, 18 responded yes and two no.

The table below compares 2003-4 and 2005 training statistics.

[25] As per Intel® Teach to the Future South Africa database, available at: http://teach.schoolnet.org.za, 28/11/05. it should be noted that some participants in the Northern Cape are not able to access the online database, thus the numbers presented here do not include a small section of participants.

Table One: Training Statistics

TRAINING STATISTICS	2002-2004*	2002-2005**	DIFFERENCE 2005
Number of schools accepted	754	849	95
Number of schools rejected	52	52	N/A
Number of facilitators trained	623	784	161
Number of potential facilitators registered to take part in training	166	63	-103
Number of educators trained	718	1000	282
Number of educators in training	1802	1321	-481
Number of educators who have dropped out	169	224	55

** As of 13/12/04 – reflecting training that took place up until end of 2004.*
***As of 28/11/05, reflecting training conducted in 2005 only.*

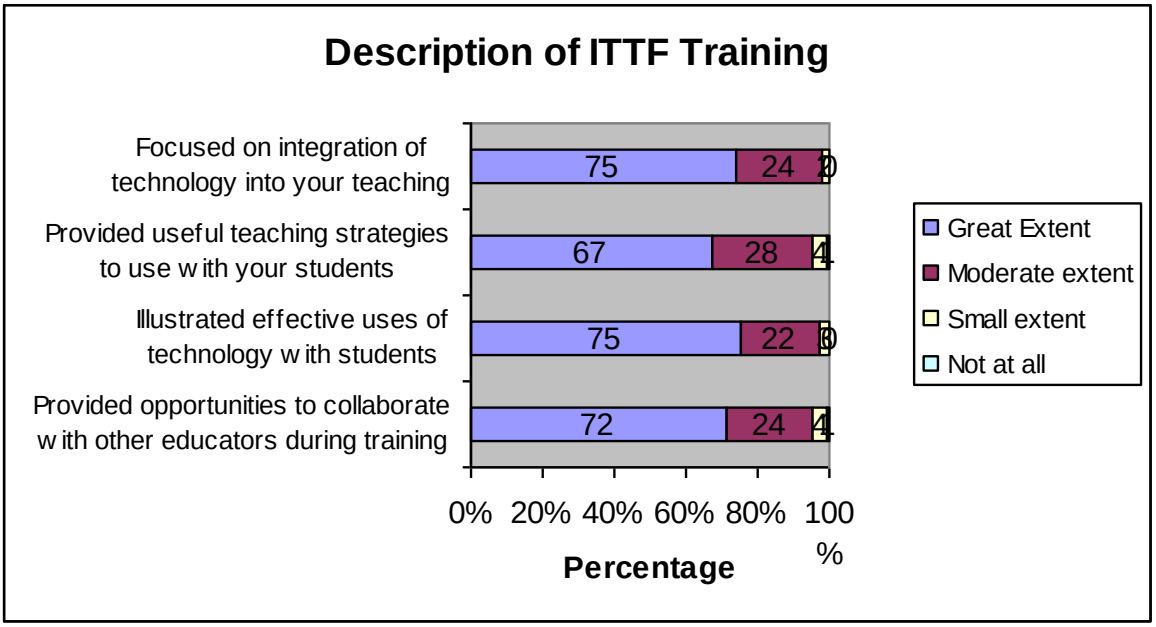
Both Educator and facilitator training numbers dropped in 2005. In addition, since facilitator data is managed by the project manager and the senior trainers following the one-week facilitator training sessions, it can be assumed that this data is largely accurate. However, registering of educators who take part in the training becomes the responsibility of the facilitator once back at school. A lower than ideal use of the database has been found once facilitators returned to school. There were many reasons for this, one of the most common being costs of Internet access to enter data into the online database. Some facilitators have also indicated that they find the database complex to navigate and hence do not add all the data that they should. Nonetheless, statistics available via this project management tool are the best made available and hence are reported here. With respect to the number of schools accepted, there was very little change. In addition, the number of schools that have been rejected remains the same as 2004.

POST TRAINING DATA

A total of 130 respondents completed the post training survey during 2005, (almost 300 fewer than 2004) all online. Based on the 2005 statistics presented above, 443 facilitators and educators completed training. This gives a post-training response rate of 34%. It should be noted due to the likelihood that not all educators who have been trained are reflected in the database, the response rate is likely to be somewhat lower than 34%.

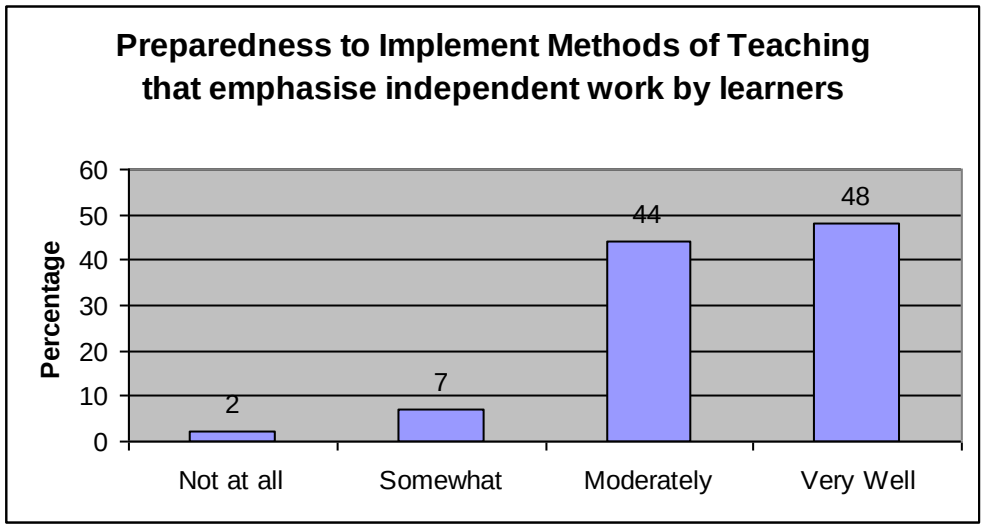
Of this sample, 161 had completed facilitator training and 282 had completed educator training. The number of responses was markedly greater in the 2nd quarter. In Q1, 13 participants completed the survey, (10%) in Q2, 59, (45%) in Q3, 27, (21%) and in Q4 14, (11%).

The post-training results for 2005 were positive, with 75% of respondents noting that the training they had just completed would definitely help them to integrate technology into learners' activities. Positive ratings were provided on questions about the training and the training curriculum, as shown in the graph below.

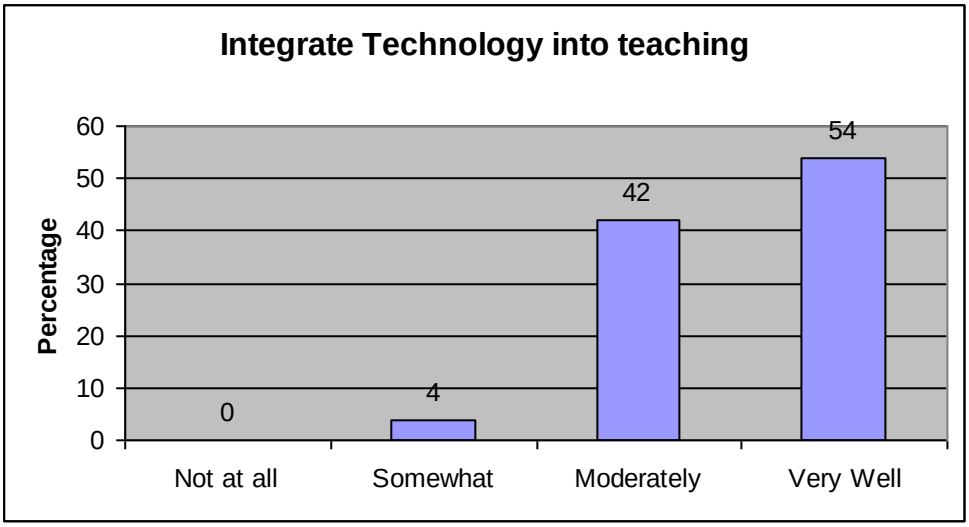


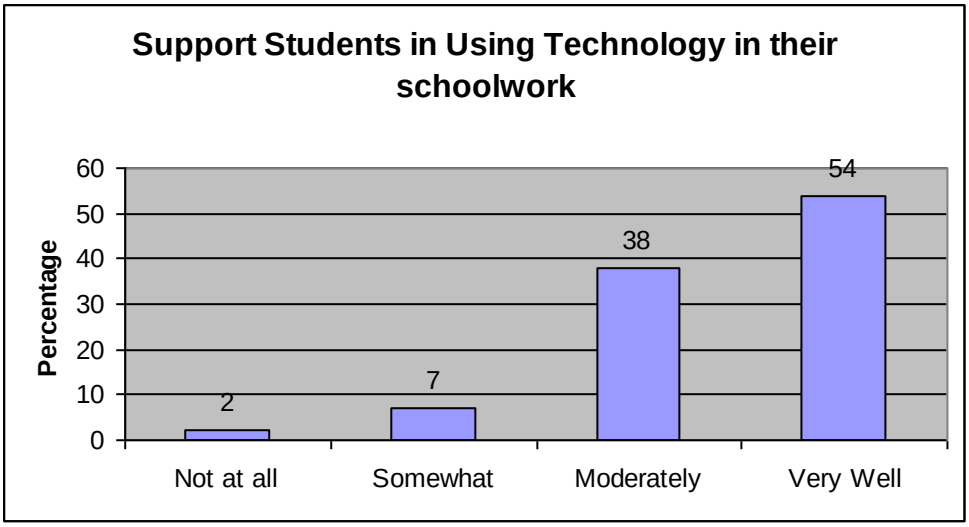
Note: Data values are not shown for 'not at all' and 'small extent' since percentage is so small and numbers did not fit on graph

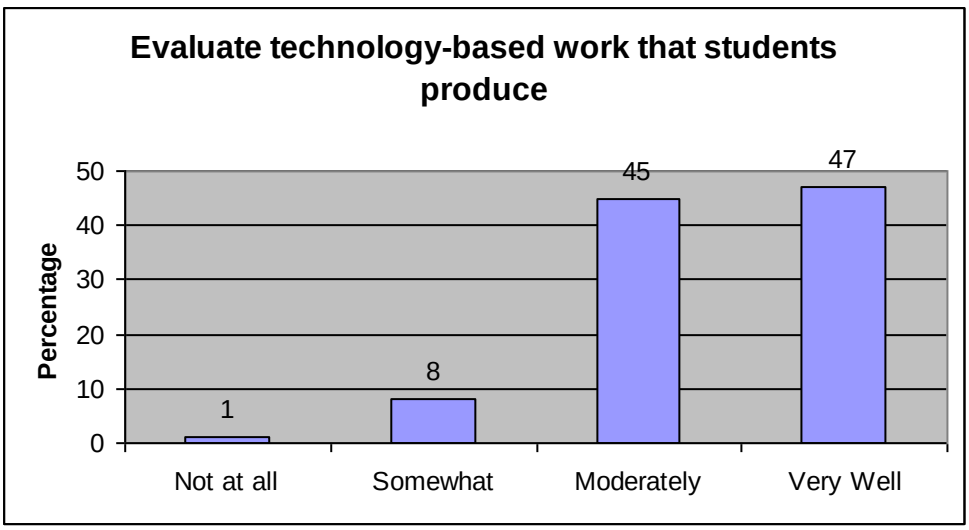
Teachers were asked to rate themselves on how well prepared they felt to implement different aspects of the Intel® Teach to the Future curriculum after completing the training. Responses to each competency are presented in the graphs below.

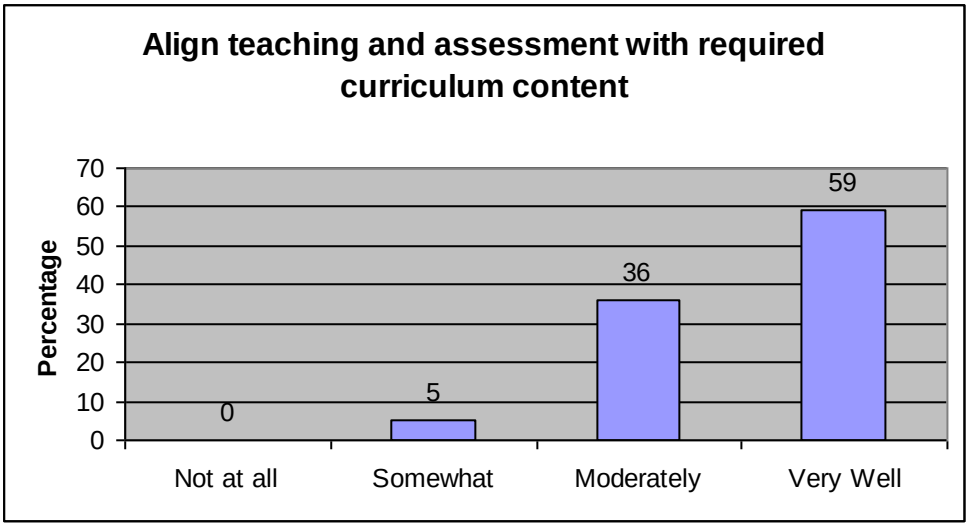


Thus, 48% of teachers indicated that they felt very well prepared to implement methods of teaching that emphasise independent work by learners. Only 2% felt 'not at all' prepared.


Integrate Technology into teaching
Percentage
60
50
40
30
20
10
0
0
4
42
54
Not at all
Somewhat
Moderately
Very Well


Support Students in Using Technology in their schoolwork
Percentage
60
50
40
30
20
10
0
2
7
38
54
Not at all
Somewhat
Moderately
Very Well


Evaluate technology-based work that students produce
Percentage
50
40
30
20
10
0
1
8
45
47
Not at all
Somewhat
Moderately
Very Well



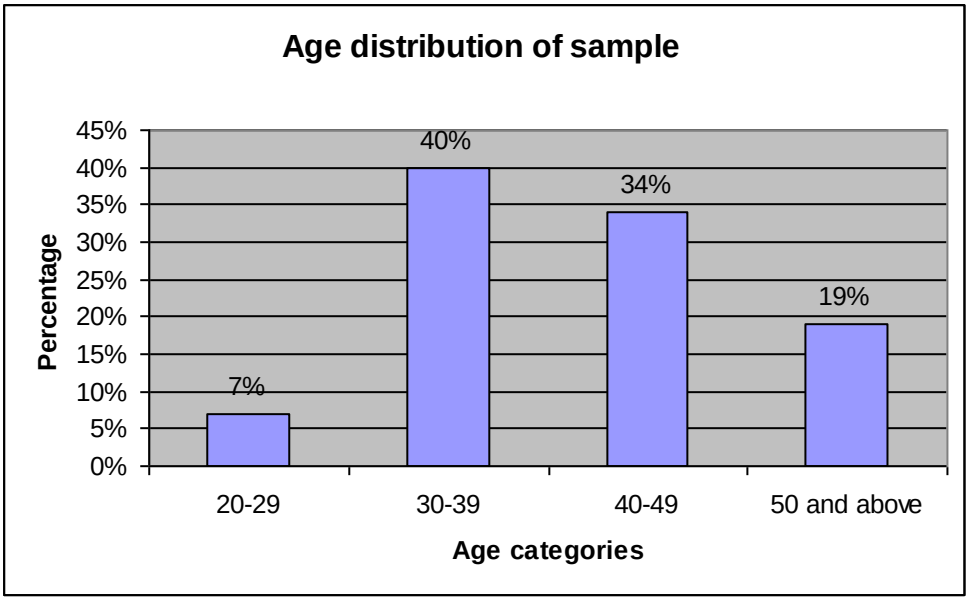
IMPACT DATA

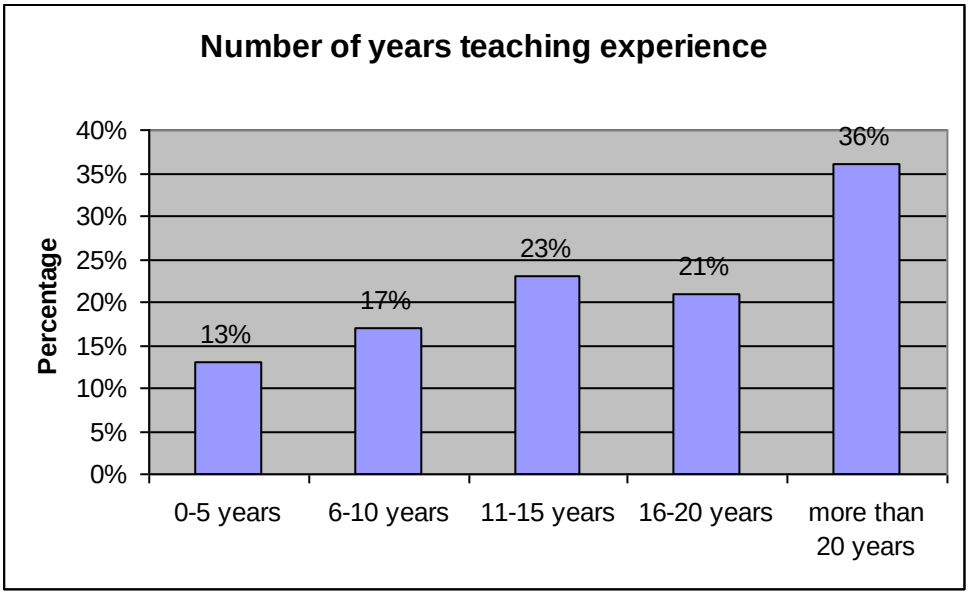
While the post-training results presented above provide an indication of participants' experiences of the Intel® Teach to the Future training and also their self-reported ratings with respect to core competencies developed through the training, the impact survey provides an indication of how teachers implement what they have learned at the classroom level. Further, since at least six months have passed between completion of training and survey completion this data provides a longer term perspective on the impact of Intel® Teach to the Future training.

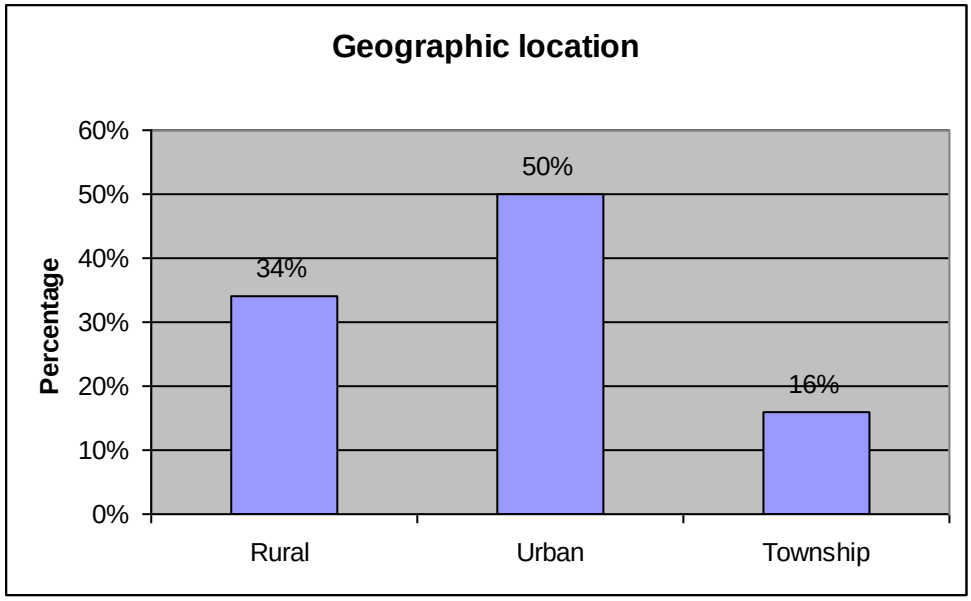
A total of 115 impact questionnaires were completed during the month of data collection. It was difficult to define the total population from which this sample was drawn since, as noted above, not all facilitators make use of the online database.

Sample Description

The sample was made up of 31% men and 69% women. 35% of the sample was General Education and Training (GET) educators and 42% Further Education and Training (FET) educators. Facilitator training had been completed by 26% and educator training by 74%. The diagrams below show the age distribution and number of years of teaching experience of the sample.


Age distribution of sample
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percentage
7%
40%
34%
19%
20-29
30-39
40-49
50 and above
Age categories


Number of years teaching experience
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percentage
13%
17%
23%
21%
36%
0-5 years
6-10 years
11-15 years
16-20 years
more than 20 years

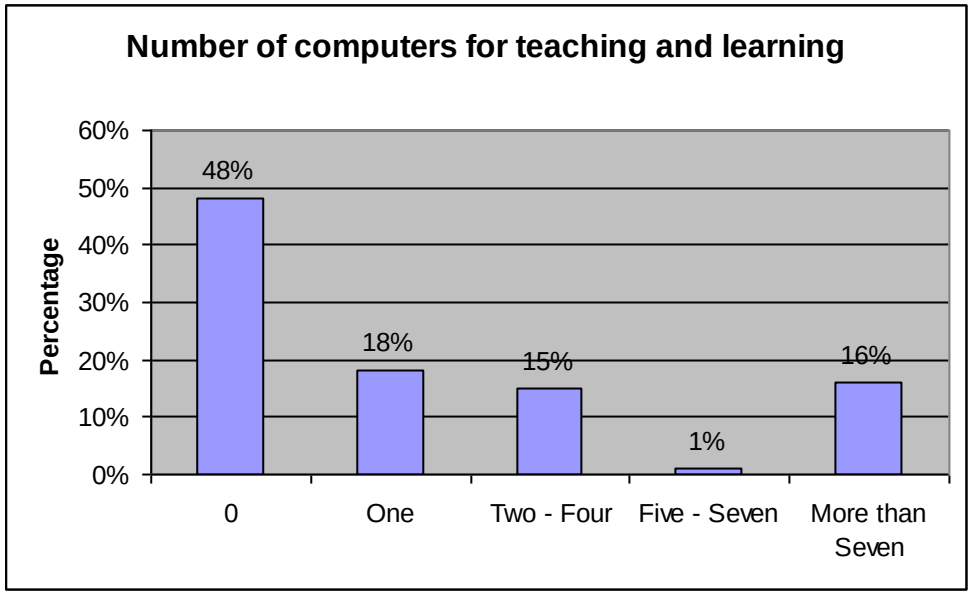


Overview of ICT access

A surprising statistic was the number of respondents who reported having a computer at home (86%) compared to 14% who did not. Since experience of South African schooling implies that few teachers have computers at home, we expect that this statistic may reflect a bias in the data, with those who have a computer at home being more likely to complete the survey.

Overview of ICT access

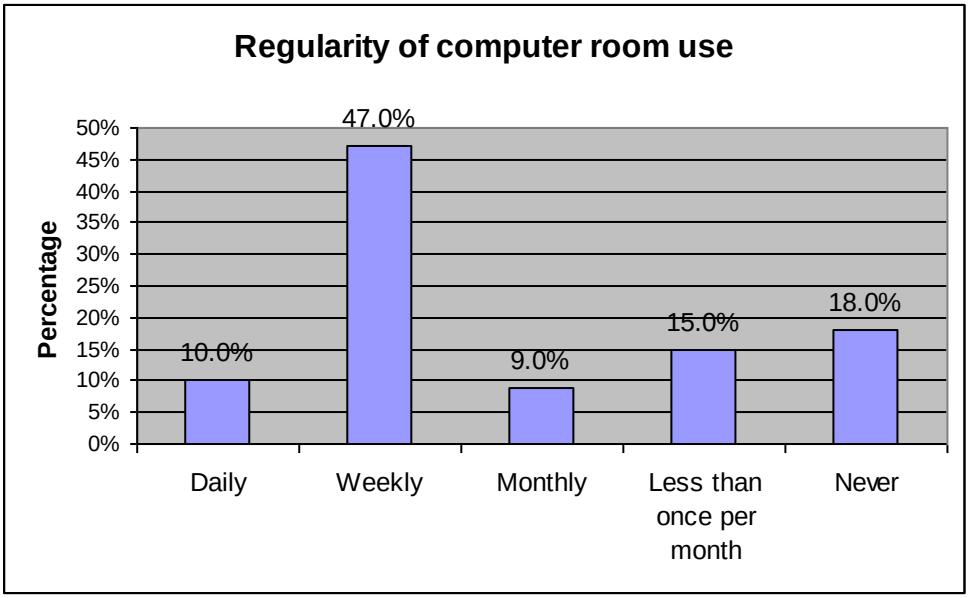
The following graph shows the numbers of computers available for teaching and learning in the classrooms (not including the computer laboratories) of the schools from which this sample of teachers came.



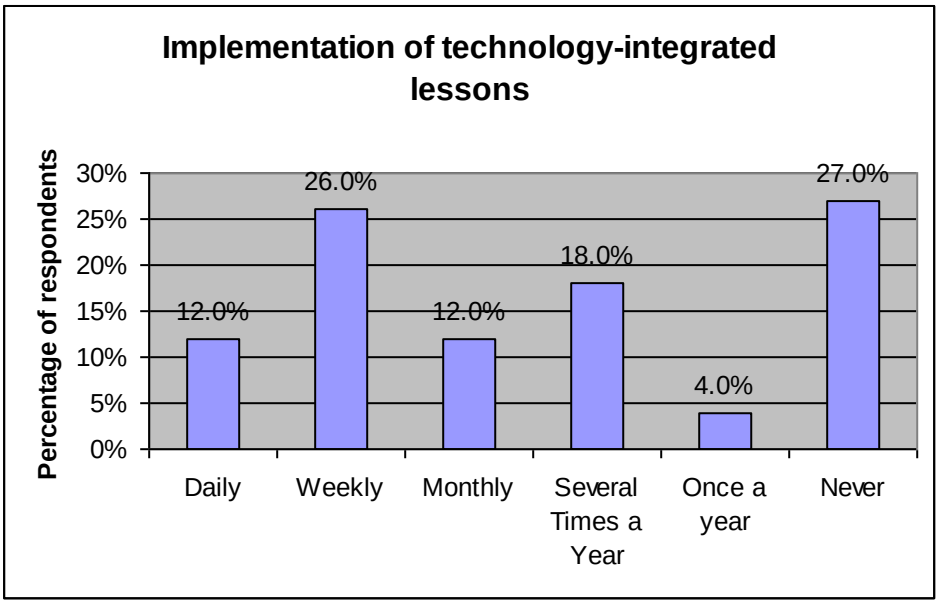
Having no computers was the most common response, (48%), as such, these teachers should not have taken part in the Intel® Teach to the Future training as access to computers is a prerequisite for selection. However, it could also be that the computers from these schools

might have been stolen or perhaps are not working. Similarly, 76% reported having access to a computer laboratory, while 24% do not. In the computer laboratory, 66% reported having Internet access, while 34% do not.

Respondents were asked about how regularly they make use of the computer laboratory. The responses provided are presented below. Weekly use of the computer laboratory was the most common response. What the data does not tell us, however, is for how long each week the computer laboratory is used. Qualitative evidence (see case studies) indicates that, in some cases, only one period (sometimes as little as half an hour) per week per class is available. This makes implementing a technology-based lesson a challenge for teachers, especially in schools where large classes are common.



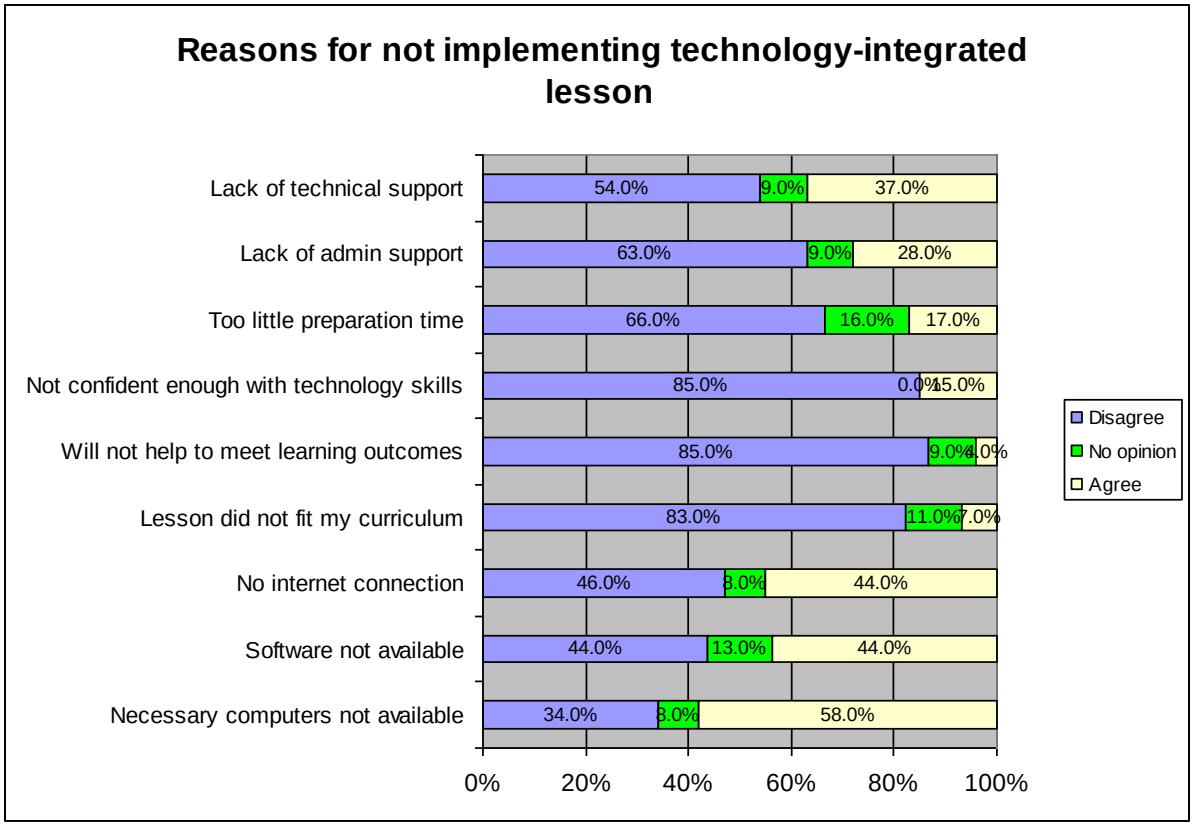
Implementation of Technology-Integrated Lessons



While we see that approximately half of the sample have implemented what they learned in the Intel® Teach to the Future training at least monthly (a reasonable number given the

various contextual constraints at South African schools), in order to ensure that all teachers who are trained go on to implement what they have learned, it would be important that we try to understand who makes up the 27% who have never implemented a technology-integrated lesson. Although we are aware of the value that such an analysis may provide, the sample for 2005 was simply too small to be able to extract any meaningful results from the analysis.

However, those respondents who had not implemented a technology-integrated lesson were asked a series of questions about reasons why they had not yet made use of technology in their teaching. These responses are summarized below.



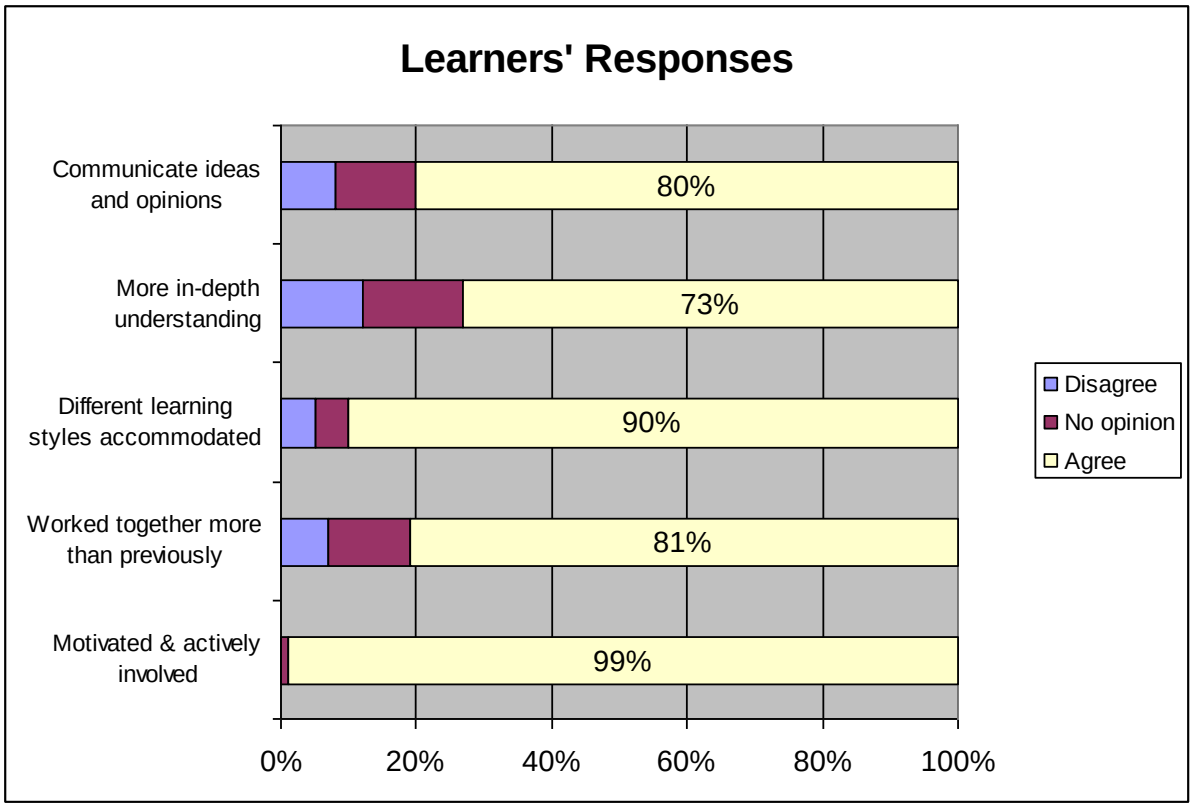
The main reason for not implementing a technology-integrated lesson was that 'necessary computers were not available' (58% agreed with this statement). The other four reasons noted by 30% or more of the sample included:

- Software not available (44%);
- No Internet connection (44%);
- Lack of technical support (37%); and
- Lack of administrative support (33.3%).

Impact of Technology-Integrated Lessons

For those respondents who did implement a lesson in which they integrated technology in a new way, a series of questions was asked about their experience of implementing this lesson and the response of learners to these lessons.

Teachers gave the following responses with respect to how learners responded to the lesson(s) they had implemented:

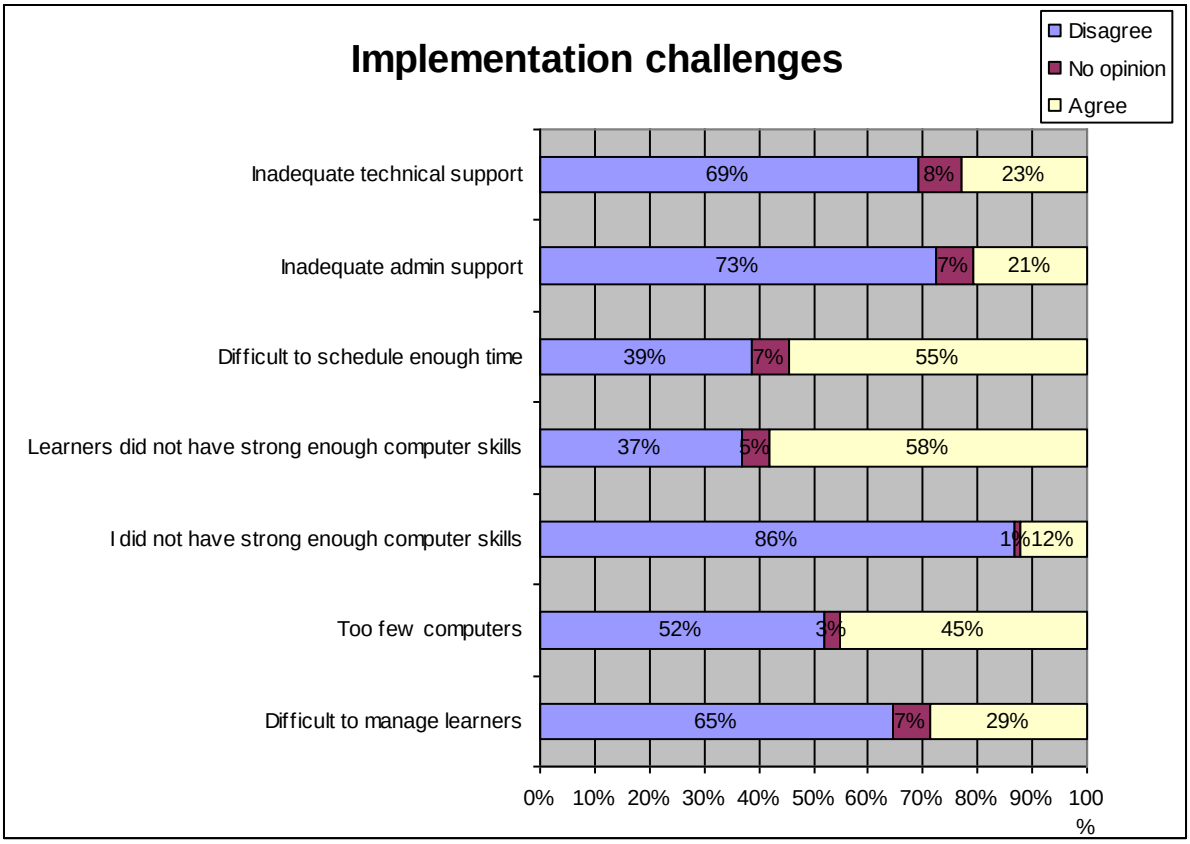


Overall, learners have responded very positively, both in terms of how they responded during the lesson and also with respect to feedback given. Based on these statistics, it appears that the goals of the Intel® Teach to the Future programme with respect to impact on learners are being realized. This result was externally further confirmed by the three observed case study lessons.

When asked about the challenges that were experienced whilst implementing technology-integrated lessons the most common responses included:

- Too few computers;
- Learners did not have enough computer skills; and
- Difficulties with scheduling enough time to complete the lesson.

The full set of responses is presented graphically below.

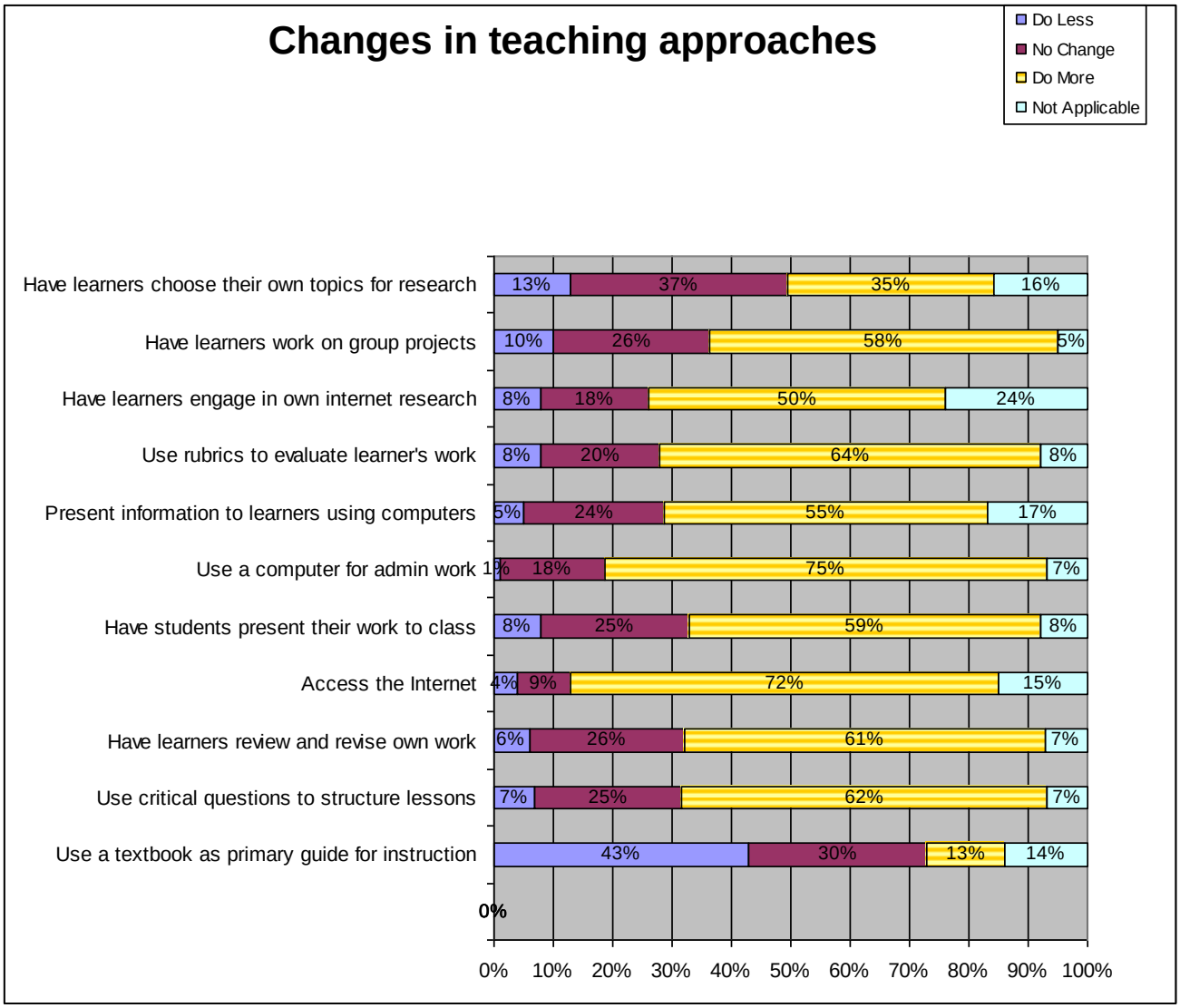


Impact of Intel® Teach to the Future Training on Teachers' Pedagogy

The Intel® Teach to the Future training is about much more than learning ICT skills and integrating technology into one's lessons. A core focus of the programme is on the pedagogical aspects of using technology in the classroom and on new teaching strategies, including approaches such as project-based learning and use of open-ended questions that help learners to develop higher-order thinking skills. In the South African context, such a pedagogical approach is well aligned with the moves to Outcomes Based Education (OBE).

In this final section of impact data results, we consider how taking part in the Intel® Teach to the Future training has impacted on teachers' approaches to teaching and learning. The first set of questions asked teachers whether the teaching strategies that they learnt in the Intel® Teach to the Future programme were new to them. In this regard, 54% of teachers reported that the teaching strategies were somewhat new and 17% found the teaching strategies to be very new. When asked about how relevant the teaching strategies were to their teaching goals, 36% thought the strategies were somewhat relevant and 64% very relevant.

Respondents were then asked to indicate how various pedagogical practices had changed since completing the Intel® Teach to the Future training. Responses are presented graphically below.



As this graph illustrates, 43% of teachers report using a textbook less as their primary guide for instruction. This is noteworthy since, in South Africa, many schools and teachers continue to rely heavily on, often outdated, textbooks as their primary learning material. As OBE requires a more learner-centred approach to teaching and learning, use of a range of learning materials becomes increasingly important. The details of other changes in teaching approaches are not discussed individually here as they are clearly presented in the graph. However, we can note that the majority of respondents appear to be making use of improved teaching practices following Intel® Teach to the Future training. This is, however, self-reported data and the lesson observations conducted as part of the case studies (discussed in more detail later in this document) show that what is reported and what happens in practice are not always the same.

CASE STUDY[26]

In addition to the post-training and impact surveys administered as part of this evaluation, three case studies on educators using ICT in innovative ways in the classroom were also

[26] Please see Appendix Two for full case study. Main conclusions only are presented here.

completed to provide more detailed contextual information about implementation of Intel® Teach to the Future.

EDUCATOR I

Educator I is a Sepedi teacher at a private girls' school in urban Gauteng. There are approximately 900 pupils currently enrolled. ICT access in the school is as follows:

- Although there are no networked computer in the educator's classroom, access is provided to the computer labs at school.
- The senior computer lab is always open for use by the high school girls up to 16h30 Monday to Friday. It is also open in the evenings for the boarders.
- Printing facilities are available
- The junior computer lab is open every afternoon to the primary school girls.
- A resource lab is always available to those educators who would like to bring their learners to work on computers during the lessons when the other labs are in use or occupied.

Examples of ICT integration and use in the classroom:

Making a poster for Sepedi evening: Grade 11

- Take pictures using a digital camera.
- Download pictures to the computer and use them.
- Use Publisher in designing a Poster.
- Print, cut and paste the poster pieces together to make a larger poster.

Making Programme for Sepedi Evening

- Search for pictures on Internet.
- Use Publisher to design the programme

Designing a Sepedi Website

- Hyperlink the pages.
- Insert pictures and use the design checker to guard against the overflowing pictures.

Challenges:

- Some learners were not computer literate and this delayed the progress during the lesson since the educator had to explain and guide them through the process.
- The educator mentioned that the INTEL training was particularly time intensive, and required much perseverance to complete.

Positive results

- 'Giving them projects which required the use of computers has increased their interest in Sepedi. The learners like to play with computers. When I give them anything to do which requires the use of computers, they enjoy it. What they don't realize is that I do everything in order to achieve certain Learning Objectives. I pose questions in such a way that they will meet all the requirements without them being aware of it. e.g. learners do not like to write essays lately. They just don't enjoy it. I then ask them to write their individual biographies from when they were born to where they are now.**'**

- Learners' research skills have improved.
- The school provided the educator with a computer in her classroom, and full access to the computer lab.

Language

Educator I was a particularly interesting case study as she was an African language teacher. It is possible that conducting a lesson in what was to some a second language may have affected learner interaction. The following point was noted by the researcher who observed a lesson:

> Learners were not sharing information during this lesson, rather they sat and concentrated on the tasks at hand. The language seemed to be difficult - as the educator moved around, she corrected spelling errors. It should be noted that the learners could not use a spell check since they were typing in Sepedi. They also did not communicate much with the educator. However, the educator was moving around to see what they were doing.

EDUCATOR II

Educator II is a life-orientation educator at a private all-boys primary school in Gauteng.

Examples of ICT-integrated lessons

Grade 1: using powerpoint and wordart to create a museum display case:

- The theme 'inventions' had been covered in class before, and this lesson furthered the learning outcomes of literacy, and social sciences (concentrating on past and present).
- The project became self-correcting, as when the learners discovered that they had mis-spelt a word in the clip-art search, no results were returned.

Grade 3: Healthy eating

- The educator directed the boys to a pre-selected website where they built a food pyramid and explored the concept of healthy eating.
- The visual aspect appealed to the boys as well as did being allowed a certain amount of freedom in how they structured and presented their pyramid.
- The lesson was clearly well planned and very successful. The following higher-order thinking skills were enforced:
    - Analysis (of Food Pyramid),
    - Synthesis, (reorganise information to construct Super Sarmie),
    - Application of knowledge (naming food groups and giving examples)
    - Evaluation (selecting appropriate foods for school lunch).
- The tasks allowed boys to work at their own level and pace, and boys who worked quickly were given the opportunity to further explore the website and share their findings.

Grade 3: Aesop's Fables

Lesson outline: Session 1

- Read the story of The Hare and the Tortoise;
- Discuss the characters, motives, modus operandi;
- Draw each animal emphasising dominant characteristics;

Session 2
- Show slide show of The Lion and Mouse;
- Discuss what made Mouse a Winner;
- Discuss what made Tortoise a Winner;
- Discuss how you can be a Winner regardless of shortcomings;
- Copy drawings into Powerpoint, add callouts and appropriate text to retell the story in a direct speech;
- In the final slide, the Tortoise must give a moral message to the Hare.

Session 3
- Edit text in speech bubble;
- Add custom animation;
- Add finishes like formatting text, adding features like the race flag/

Show the presentation to a Grade 1 pupil

In an observation of the above lesson, the researcher noticed the following:
- Learners interacted meaningfully with the educator and with one another;
- Valuable learning opportunities arose from these interactions, and the educator exploited these learning opportunities as they arose
- The learners were negotiating the solution to a problem, and exploring the issue meaningfully;
- The educator was acting as a facilitator for the learners as they negotiated and explored.

Challenges

- The educator mentioned that her biggest challenge was keeping in mind the Critical Question, and incorporating higher order thinking skills.

What works well?

The educator made the following point:

> 'All teaching should focus on developing higher order thinking skills, but computers seem to lend themselves to this approach as it involves more problem solving and scope to respond in a way that suits the individual learning and thinking style.'

Learners' benefit and response to ICT integrated lessons:

The educator made the following points in an interview:

- I have found that pupils are more confident to tackle a task and take risks as they know they can edit or undo an unsuccessful attempt.
- Because working on a computer holds their visual attention many boys who normally have problems concentrating seem to be able to maintain focus for longer periods.
- The end result of their project usually looks more impressive than a written one, and so even boys who are untidy workers feel pleased with their efforts and are motivated by this feeling of success.
- Very often a computer based project demands a different type of thinking.
- Resources are more easily available, such as pictures, information etc.
- Projects are more authentic and lend themselves to real-life situations.
- When a learner makes an error, it is easy to remediate his/her specific difficulty immediately on an individual basis.

EDUCATOR III

Educator III is a computer and life-orientation educator at a former model-C primary school in Gauteng. In addition, she is an Intel facilitator. The school has 1200 learners, and a lab with 42 computers, with internet access and printing facilities. She is clearly an ICT champion at her school, and is constantly challenging both learners and educators to think in new and innovative ways. In addition, she has generated much excitement around the use of ICT, such that computer labs are almost always full.

Examples of ICT-integrated lessons

- Grade 6: creating a PowerPoint presentation on different belief systems.
- Grade 7: creating a PowerPoint presentation on civilizations.
- Grade 7: evaluating the Bosai Kitty hoax website. Learners examined the public's outraged response and author motivation.

Challenges

- Getting colleagues to see further than the "Future Kids model to which they are accustomed;
- Persuading colleagues that there is more to IT than printing pictures and nice "cover pages" full of clip art;
- Using rubrics. "These are often for me totally meaningless and do not tell the pupils what is expected of them."

The educator noted the following point in her interview:

> The biggest challenge is getting one's colleagues to understand that IT is not just the printed page on a screen, and that pupils should be encouraged to think critically. Most teachers like to be the source of knowledge and it is quite a leap for them to be able share the power- or even give it to the pupils.

Learner benefits from ICT-integrated lessons

According to this educator's experience, learners:

- Learn to be discerning while searching for information;
- Learn to take responsibility for their own learning process;
- Become comfortable with sharing knowledge and discoveries, and in the process learn many IT skills almost independently

As with the previous case study, the researcher noticed the following in her observation of a lesson:

- Learners interacted meaningfully with the educator and with one another;
- Valuable learning opportunities arose from these interactions, and the educator exploited these learning opportunities as they arose;
- The learners were negotiating the solution to a problem, and exploring the issue meaningfully;
- The educator was acting as a facilitator for the learners as they negotiated and explored.

DISCUSSION

The results presented in this report are mostly very positive, and in general, the year three findings provide further support for the findings of year two. However, more detailed analysis was unfortunately not possible due to the small sample size.

With respect to the Intel® Teach to the Future training itself, we saw that trainees found the training to be very useful and noted changes with respect to both ICT and pedagogical competencies before and after training. The impact data and case study also provided evidence of the value that this programme is contributing to South African schools.

As was noted at the outset of this report, the year three evaluation sought specifically to answer the following two research questions:

- Is there evidence of the use and integration of technology at the classroom level after taking part in the Intel® Teach to the Future training?
- Is there evidence that ICT supports changes in pedagogical practice?

In this section, we discuss the array of results presented above by dealing with each question in turn.

Is There Evidence of the Use and Integration of Technology at the Classroom Level After Taking Part in the Intel® Teach to the Future Training?

Both the survey data and case study provide evidence on the basis of which it can be concluded that use and some degree of integration of technology at the classroom level is taking place. From the impact survey, it was reported that 26% of respondents indicated that they implemented a technology-integrated lesson weekly. From the survey data, it was reported that 55% of respondents use computers more for presenting information to learners, and 72% access the Internet more than before. Furthermore, 50% asked learners more often than before to do work on computers in their own classes, and 62% use critical questions more to structure their lessons.

A 2002 UNESCO report on ICT curriculum and teacher development for schools provides a useful four-stage continuum of ICT integration at both school and teacher levels.[27]

The four stages[28] are:

- *Emerging*

  Schools at the beginning stages of ICT development demonstrate the emerging approach. Such schools begin to purchase, or have donated, some computing equipment and software. In this initial phase, administrators, and teachers are just starting to explore the possibilities and consequences of using ICT for school management and adding ICT to the curriculum…Schools at this emerging phase are still firmly grounded in traditional, teacher-centred practice.

- *Applying*

[27] Several authors and studies have put forward different stages through which ICT adoption takes place. Most models are very similar, making use of different terminologies and sometimes different numbers of stages. For other examples, see UNESCO (2002). *Information and Communication Technologies in Teacher Education. A Planning Guide*; and Haddad, WD & Draxler, A (2002). *Technologies for Education. Potentials, Parameters, and Prospects*. UNESCO/AED.

[28] Descriptions of each stage have been taken directly from UNESCO (2002). *Information and Communication Technology in Education. A Curriculum for Schools and Programme of Teacher Development*, pp. 15-16. This resource presents a very detailed matrix of different aspect of each stage. The matrix can be used to classify schools in terms of the components of technology-integration.

> Those schools in which a new understanding of the contribution of ICT to learning has developed exemplify the applying approach. In this secondary phase, administrators and teachers use ICT for tasks already carried out in school management and in the curriculum. Teachers largely dominate the learning environment.

- *Infusing*

  > At the next stage, the infusing approach involves integrating or embedding ICT across the curriculum, and is seen in those schools that now employ a range of computer-based technologies in laboratories, classrooms, and administrative offices. Teachers explore new ways in which ICT changes their personal productivity and professional practice.

- *Transforming*

  > Schools that use ICT to rethink and renew school organization in creative ways are at the transforming approach. ICT becomes an integral though invisible part of daily personal productivity and professional practice…ICT is taught as a separate subject at the professional level and is incorporated into all vocational areas. Schools have become centres of learning for their communities.

Based on this classification, the case study of educator II could perhaps be placed between the applying and infusing stages. Although it is impossible to rate an entire school from the actions of one dedicated educator, as an individual, educator III's lessons could be considered in the infusing stage.

During the case study research, several lessons were observed during which technology was being used as part of a non-technology or computer studies lesson. In all three schools, more use of technology for subject lessons was in evidence in 2005 than in early 2003 before the Intel® Teach to the Future programme was started at the school.

The most common use of technology in lessons observed and those reported by teachers during interviews was as a presentation tool (PowerPoint). One case study school in the 2004 evaluation had been donated a data projector in mid 2004, thus lessons in which computers were used for presentation were more effective than in 2003 when a standard computer screen in front of the class, which learners could not see, was used. As opposed to those schools observed in the 2004 year, in most lessons this year, learners made use of the computers throughout the class. Due to the small and selective sample however, it is not possible to draw any conclusion from this.

In the 2005 year it was only really educators II and III who actually integrated technology into their lessons. Educator I used technology, but it didn't necessarily enhance the quality of the lesson and learning. In addition, although many educators in the impact survey report that ICT is indeed being integrated into their lessons, this is self-reported data, and we are unaware of the extent of the integration. Certain schools, particularly in rural areas, simply do not have sufficient facilities for real integration to be taking place.

Thus, while technology is being used and, in some instances, integrated, at the classroom level following training, we need to remain aware that schools and teachers pass through different stages along the previously mentioned continuum as they come to integrate technology fully into all aspects of their functioning. Thus, while in a survey, respondents may report that they do technology-integration type activities in their classrooms, it is important to remember that what this means to different teachers is not the same and will depend on the imagination that they have for what ICT can contribute. In conclusion then, with respect to this particular research question, use and integration at the classroom level are indeed in evidence, but the nature and quality of that use is variable.

Is There Evidence That ICT Supports Changes in Pedagogical Practice?

When discussing pedagogical practice in the context of a programme such Intel® Teach to the Future, we need to focus on two different aspects of pedagogy. The first is how teachers can make use of ICT to support their teaching and learning and the second is whether ICT training and use supports changes in pedagogical approach more broadly, in the South African context particularly, and move away from teacher-centred 'chalk-and-talk' approaches to more learner-centred and outcomes-based approaches as required in the new curriculum. The pedagogy promoted through the Intel® Teach to the Future programme focuses on learner-centred teaching, project-based learning, and the role of open-ended questions in developing high order thinking skills.

In year two, various statistical analyses presented of ICT access and implementation of technology-integrated lessons showed that number of computers for teaching and learning and also access to a computer laboratory were significantly associated with more regular technology use in lessons. However, also in year two, we saw that among those who had not implemented a technology-integrated lesson, many did have access to computers, yet were not using them. It is again clear from the year three report that access is a complex concept and implies much more than the number of computers in a school, including such factors as who has access within the school, class size, and how the school priorities access to the computer laboratory. For example, in the case study of educator I, learners who do computer studies tend to have more access to the computer laboratory, both in school time and also after school and breaks. These nuances need to be taken into consideration as we discuss the extent to which ICT supports changes in pedagogical practice.

Both the impact survey and case study research show that introducing ICT, with teacher training, does appear to have an impact on pedagogical practice. This evidence can be seen in the impact survey results showing changes in learner activities, such as an increase in group work, projects, independent Internet research, learners choosing own topics for projects, learners presenting their work, and others. Other examples include a reduction in the use of a textbook as the primary guide for instruction (43%) and a reported increase in the use of critical questions to structure lessons. During lesson observations of educators II and III in school, some evidence of better learner engagement was found.

On this basis, we could conclude that ICT appears to support changes in pedagogical practice. However, we need to consider further whether it is the technology itself or the training of teachers to use ICT in a particular way that leads to these changes. The evaluation data available do not allow us to answer this question conclusively, but at the three case study schools observed, three educators were using ICT in innovative ways which clearly demonstrated an Intel-type pedagogy. However, these are 'best practice' teachers, and don't necessarily reflect the general situation on the ground. In the 2003 case study report, we saw that, despite access to computers and relatively high levels of ICT skills among teachers, no teachers had implemented a class lesson in which computers had been used (excluding computer studies). By the end of 2004, researchers observed seven educators implementing lesson in which they made use of computers. With respect to number of computers in the school, nothing had changed from 2003 to 2004, besides the addition of a data projector which did make ICT lessons more effective and hence attractive for teachers. However, it does appear that it was the pedagogical aspect of the Intel® Teach to the Future training that supported changes in pedagogical practices. Further evidence for this claim can be taken from the post-training data presented in year 2005.

Thus, as in 2004, on the basis of the data available we can conclude that ICT does indeed support changes in pedagogical practice. However, this happens most effectively when training is provided to illustrate how this tool can be used to support changes in pedagogic practice. In 2005 however, this conclusion must be tempered with the acknowledgements that there was a particularly small sample size, and much of the data was self-reported.

WAY FORWARD

This evaluation report has presented a wealth of data on the use of computers in schools, as well as data about the impact of the Intel® Teach to the Future programme at the school level. The post-training data provided evidence of the positive response to the Intel® Teach to the Future training. The case study research provided some contextual information that was helpful in interpreting the statistical data from the two surveys. In general terms, we have seen that the Intel® Teach to the Future programme in South Africa is adding value to teaching and learning within South African classrooms.

However, it is problematic that (comparably) very few people were trained in 2005, and even fewer completed the surveys. The first year report predicted vastly more numbers than materialised in year three, and suggests that the current training model is not working. The necessary numbers of people are simply not being reached. This is due to a number of factors, some of which have been mentioned in the previous evaluations:

- There are too few educators who have the required skills (ICT, but particularly pedagogic) to become good facilitators. This has obvious trickle-down effects on the number of educators who are trained, and who implement what they have learnt. As such, it remains questionable whether the 'train the trainer' model on which implementation is based is most appropriate for the Intel programme.
- A related point is that many educators lack basic ICT skills. This has quality implications as often the training that does take place in schools is focused on ICT skills more than the pedagogic aspects of the Intel programme.
- Many who train as facilitators do not feel comfortable to act as trainers after the intensive one week course they complete. They need time to master the materials themselves in their own classrooms. It is unrealistic to expect teachers who may be new to some of the pedagogic principles and the technology to attend a five day training course and shortly thereafter to run training in their schools without allowing for time to 'practice' and become familiar, in their own classrooms, with the materials they are teaching. Thus often, training does not take place at the school level following facilitator training.
- Time constraints are a major issue that have been cited throughout the project. Facilitators have to complete their own 40 hour training, and then spend at least 40 hours (at most schools it takes more time than this) training other educators. In addition, facilitators are not offered incentives for this time commitment. Also, South African teachers, particularly those currently in the FET band, have had to complete many training programmes and workshops and are therefore not always willing to dedicate more time for further training, particularly when the time commitment is 40 hours of after-school time.
- Insufficient access to computers at many schools impedes educators implementing what they have learnt in the Intel programme. As a result, educators do not always see the value of committing their time to the training as they often do not anticipate having an opportunity to implement what they have learnt.

- Project-based learning and cross-curricular work is not very common in South African schools. This means that the key focus on this approach is not always meaningful or applicable to South African teachers. A more flexible programme, where educators are able to take elements of the various skills and approaches learnt in the Intel programme, might be more useful.

In addition, although the value of providing training, like that of the Intel® Teach to the Future programme is highlighted in this evaluation and evidence for both use of computers for teaching and learning and the role of ICT in supporting pedagogical changes was found; the nature of quality of ICT use in classroom varies widely and impact expectations need to remain flexible and take account of the fact that schools and teachers pass through several stages as they work towards computer integration. This phenomenon has been evident in all three years' evaluations and indicates that although the Intel programme has potentially a large role to play in the South African context, it hasn't quite reached the numbers nor had the wide-spread impact it was intended to have.

In taking the project forward, it may be useful to explore ways of redesigning the Intel materials (CD and manual). For example, only 31% or respondents indicated that they had used the CD more than ten times since the training. This raises questions about whether the CD was lacking in usefulness, not well presented, or difficult to use due to problems with computer access.

In addition, the momentum seems to have waned in the final year of the project. Although this is partly funding-related, the focus in future years needs to be on marketing the program and making it sufficiently attractive to reach the numbers needed to have a real impact. In year three, the focus was to be on sustainability – training departmental officials as facilitators. However, due to budgeting constraints this was not carried through to its full potential.

GENERAL CONCLUSIONS FROM YEARS ONE - THREE

The following questions guide the overall South African Intel® Teach to the Future evaluation:

1. How is the Intel® Teach to the Future programme implemented in a range of South African schooling contexts?
2. What are the experiences (positive and negative) of participants (project management, senior facilitators, facilitators, educators and learners) in the programme?
3. What opportunities and pitfalls can be identified in the implementation of the Intel® Teach to the Future programme?
4. Is there evidence of the use and integration of technology at the classroom level after taking part in the Intel® Teach to the Future training?
5. Is there evidence that ICT supports changes in pedagogical practice?

During year one, questions one to three were the focus, but not including the learner level. For year two, the focus shifted to questions four and five. Questions one to three continued to be explored, but also including the learner perspective. With a focus on questions four and five, the evaluation research has moved to integrate an initial assessment of impact into the formative study. This study was continued in year three.

At the end of year one (2003),[29] 347 schools had been accepted into the programme and 36 had been rejected. In addition, 250 facilitators had successfully completed training, and 237 potential facilitators had indicated their interest to be trained. Further, 426 educators had successfully completed training, 1102 were taking part in training programmes, and 84 educators had dropped out.

During the 2004 period more facilitators were trained than in the 2003 period, but fewer educators were trained. By the end of 2004 a total of 754 schools had been accepted into the programme, 623 facilitators and 718 educators had completed training, and an additional 1802 educators are currently in training.

Both educator and facilitator training numbers dropped in 2005. In addition, since facilitator data is managed by the project manager and the senior trainers following the one-week facilitator training sessions, it can be assumed that this data is largely accurate. However, registering of educators who take part in the training becomes the responsibility of the facilitator once back at school. Throughout the project, a lower than ideal use of the database has been found once facilitators returned to school. There were many reasons for this, one of the most common being costs of Internet access to enter data into the online database. Some facilitators have also indicated that they find the database complex to navigate and hence do not add all the data that they should. Nonetheless, statistics available via this project management tool are the best made available and hence are reported here.

Overall, the evaluation research for all three years showed that the Intel® Teach to the Future programme was regarded favourably by those taking part in the programme. Much learning had taken place, and many educators who previously did not know how to use computers for teaching and learning now had a range of creative ideas and new skills. All participants reported increases in both their ICT skills and pedagogic understanding. In addition, awareness of the potential of computers and the value of linking technology and curricula was raised at the educator and school levels.

In the year one post-training questionnaire, 82% of participants reported that the skills they learned would 'definitely' help them to successfully integrate technology into learners' activities. 92% would definitely recommend the course to a friend or colleague (and some noted in their optional comments that they already have). The facilitators and senior trainers were also highly rated. In no instance was a rating of 'poor' given, and most responses clustered in the 'good' and 'excellent' categories. With respect to the pedagogical outcomes of the Intel® Teach to the Future training, 85% of respondents reported that the training focused on integration of technology into the curriculum to a 'great extent', 65% reported that training provided teaching strategies to apply with learners to a 'great extent', 76% felt that the course illustrated effective uses of technology to a 'great extent' and 64% noted that the training provided opportunities to collaborate with other educators to a 'great extent'. In addition, there were clear self-reported improvements after training for all ICT skills.

This positive post-training response was repeated in year two and three. The post-training results for 2004 showed an overwhelmingly positive response to the Intel® Teach to the Future training, with 85% of respondents reporting that the training would definitely help them to integrate technology into learners' activities, and 91% stating that they would

[29] As per Intel® Teach to the Future South Africa database, available at http://teach.schoolnet.org.za, 29/01/04. It should be noted that participants in the Northern Cape are not able to access the online database, thus these statistics do not include a small section of participants.

definitely recommend the training to a friend of colleague. In the post-training survey teachers are asked to rate themselves before and after training in terms of how well prepared they felt to implement different aspects of the training. A marked before and after difference was found for all competencies and these differences were all found to be statistically significant (Wilcoxon Signesd Ranks Test).

CHALLENGES

The year one case studies highlighted the range of contexts in which the Intel® Teach to the Future programme was being implemented in South African schools. The range of factors affecting the success of the Intel® Teach to the Future programme were evident. While all schools were very positive about the Intel® Teach to the Future programme, several challenges were also noted. These challenges were recurring throughout the three years of the project. The main challenges faced by schools include the time constraints of the training, the low levels of ICT skills of the majority of educators, and the poor ICT resource levels at many schools. The lack of sufficient computers is likely to remain a constraining factor for some time, as will the ICT skills and general educational level of educators. However, as efforts to develop ICT infrastructure and capacity within the education sector proceeds the importance of having educators trained at the level offered by Intel® Teach to the Future should not be underestimated. The Intel® Teach to the Future programme has an extremely valuable role to play – particularly in bringing technology and pedagogy together, and this value was recognized by all in the research process.

In general, the case studies from all three years show that the Intel® Teach to the Future programme was most effectively implemented at the very well resourced independent school facing few of the same challenges as the majority of South African previously disadvantaged schools. A poor rural school was also doing very well with respect to conducting Intel® Teach to the Future training, however, many concerns were raised by educators about implementing what is learnt during training because of the poor ICT resources of the school. This contextual detail is essential as it helps to interrogate the assumptions underlying the Intel® Teach to the Future programme and also highlights that in South Africa there are many factors affecting implementation at the school level over which the Intel® Teach to the Future programme has little or no control.

ICT Literacy and Low Numbers

In addition to factors over which the programme has little control, the findings through all three years of the project have shown that the Intel® Teach to the Future programme in South Africa faces two main challenges to success. These are the relatively low numbers of educators taking part and the overall low level of ICT skills (and general poor quality of educator training in the past) in the country, which means that the majority of educators taking part in the training do not come prepared with the requisite skills levels. There is a shortage of appropriate candidates to be trained as senior facilitators and as facilitators at the school level. Some facilitators fail to start training in their schools. In addition, the participating educators often come with lower than ideal levels of ICT skills.

This is a challenge in and of itself, as the programme assumes relatively high levels of skills, but it also affects the numbers of educators taking part. When educators lack the required ICT skills, they tend to focus on the ICT aspect of the training in order to get through rather than the important pedagogic aspects. As with the problem of lack of computer resources in

schools, this is partly a contextual issue related to the complex South African education landscape and the relative disadvantage of many schools. Research suggests that educators pass through several stages as they adopt and learn to use ICTs[30]. The Intel® Teach to the Future programme assumes that educators are relatively advanced in this progression which is not the case for the majority in South Africa, hence some of the challenges noted in this study. However, as efforts to develop ICT infrastructure and capacity within the education sector proceeds the importance of having educators trained at the level offered by Intel® Teach to the Future should not be underestimated. The Intel® Teach to the Future programme has an extremely valuable role to play – particularly in bringing technology and pedagogy together, and this value was recognised by all in the research process.

Fellow Educators and Principals

The case studies of the three years of the project revealed that while all school principals were supportive of the Intel® Teach to the Future programme, few were aware of exactly what the programme is about. In addition, educators in their year three journal indicated a lack of understanding from other educators about the programme. Developing more active support at the school management level is important and may also help to encourage more educators to take part in training.

Access to ICT Resources

A common theme through the three years of the project was the lack of access to sufficient ICT resources. While government has committed to addressing this issue, it is likely to remain a factor for some time to come. Although the Intel® Teach to the Future programme cannot solve infrastructural problems directly, this constraint needs to be more actively embraced by the Intel® Teach to the Future programme to enhance relevance of the programme, especially for poorer schools. During training, educators need to be provided with more direct support and ideas for how they and their schools can make the most effective use of their limited resources. One component of this support could be some form of ongoing interaction between educators from different schools through which successes, challenges and lessons could be shared. Several educators and facilitators noted that they would value more exchange with other educators. Such support is essential to counter the sense of hopelessness expressed by several educators when asked about implementing what they have learnt in the training.

In addition, in year two, the issue of access and implementation was explored in more detail and showed that there are no simple answers. Increased access was significantly associated with regularity of implementation for those who did implement a technology-integrated lesson. However, for those who did not implement such a lesson tended to higher levels of access to a computer room and also to the Internet. Thus, access discussions are not simply about providing a set of computers to a school, but how the school makes use of them, who has access, when and for how long that is important. Further, class size and learners' ICT skills levels are also important, especially when large classes need to make use of a relatively small number of computers.

[30] See for example, UNESCO (2002). Information and Communication Technologies in Teacher Education. A Planning Guide. Paris: UNESCO.

IMPACT

The value of providing training, like that of the Intel® Teach to the Future programme, is highlighted in all three evaluations, and evidence for both use of computers for teaching and learning and the role of ICT in supporting pedagogical changes was found. However, the nature of quality of ICT use in classroom varies widely and impact expectations need to remain flexible and take account of the fact that schools and teachers pass through several stages as they work towards computer integration.

With respect to evidence of use and integration of technology at the classroom level it was concluded in years two and three that there is evidence of use and to some extent integration, but that the nature and quality thereof is variable. The final research question was whether there was evidence that ICT supports changes in pedagogical practice. The reports from the two years conclude that ICT does support changes in pedagogical practices, however, it is not the technology per se to which change can be ascribed. Once teachers have received context-rich training on how ICT can support or enhance their practice they are much more likely to change their practice to accommodate more effective use of ICT as a tool.