Preparing Teachers for the 21st Century Classroom: Current Findings from Evaluations of the Intel Teach to the Future Essentials Course

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Daniel Light, Katie McMillan Culp, Roshni Menon, Simon Shulman
EDC/Center for Children and Technology

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Executive Summary

Intel® Innovation in Education seeks to be a global partner to national governments and to contribute to the development of modern, high-quality educational systems worldwide, to help prepare young people for the 21st century. A core component of Intel's efforts is the development, dissemination and support of the Intel® Teach to the Future Essentials Course, a professional development program that seeks to provide teachers with the knowledge and skills they need to integrate information and communication technologies as critical tools to encourage active student learning.

In five years, this program has reached more than three million teachers in over 30 countries. Through its expanding portfolio of professional development programs, Intel® Teach to the Future also seeks to prepare teachers to develop students' critical thinking skills, develop school leaders, enhance technology education and support educators working in informal learning environments.

Intel® Innovation in Education has consistently invested in the evaluation of the Essentials Course worldwide, both to inform the continuous improvement of the program and its implementation model, and to document and demonstrate the impact of the program on its teacher participants. This report on the global evaluation of Intel® Teach to the Future draws on findings from evaluations of the program conducted around the world during 2005 to discuss the impact of the Essentials Course on teachers' practices, and to describe the relationship of the course to the broader educational reform processes underway in most of the participating countries. EDC's discussion highlights the program's successes to date and identifies key opportunities for and challenges to continued success as the program continues to expand and to reach teachers working in ever more diverse circumstances.

Bringing the Essentials Course to teachers in so many different countries has required worldwide, regional, and country-level program staff to maintain a constant balance between investing in localization of the program and a constant commitment to and focus on the core themes and goals of the program. Although many MOEs share similar goals for creating education systems that meet the challenges of the 21st Century, the process is also uniquely shaped by the current education system, traditional educational practices, and the level of economic development and ICT infrastructure of each country.

Once the Essentials Course is introduced in each country, it intersects with these unique conditions in two ways. First, the messages that participants take away from the program are shaped by the extent to which the program connects with their prior experiences and knowledge. As this report will discuss, the evaluation data demonstrates that teachers come to this training with widely varying levels of prior knowledge, that there are broad national and regional patterns of what teachers know and can do prior to the trainings, and that teacher experience in the training is strongly influenced by their prior

knowledge. Second, the ability of participants to follow up on what they have learned can be both facilitated and impeded by their school contexts. This report will also discuss some of the main obstacles that teachers encounter, across widely varying contexts, when they begin to follow up on their training.

This report on the global evaluation of Intel® Teach to the Future draws on findings from evaluations of the program conducted around the world during 2005. The report first discusses the relationship of the Intel Teach to the Future Essentials Course to the broader educational reform processes underway in most of the participating countries. It then synthesizes evaluation data from multiple countries and presents two types of findings: evidence of program impact, and key challenges to program success that are emerging across multiple sites. The report finally discusses how two forms of intervention in the program localization, and engagement with national policymaking can address the challenges teachers encounter as they try to learn from and follow up on their participation in the Essentials Course.

Key Findings

Key findings discussed in the report include the following:

Program impact

Student use of technology

The Essentials Course invites teachers to involve students in productive, creative uses of ICTs to gather and analyze information and/or to present their own knowledge to others. Survey responses indicate that the program has encouraged teachers to integrate new technology activities into their classrooms. The large majority of respondents (75%) indicate that they are integrating technology into their teaching in new ways upon completion of the training program.

Teacher use of technology

The Essentials Course offers teachers the opportunity to experiment with new ways to use technology for preparation and planning. Survey results indicate that the program is effective at encouraging teachers to increase the use of technology for planning: a large majority of responding teachers (84%) report that they have increased their use of technology for planning and preparation.

Teacher use of new teaching strategies

The Essentials Course introduces teachers to project-based, student-centered approaches to teaching and learning. Survey data indicate that participants experiment with these approaches after completing their training: for example, 61% of teachers reported increasing their use of project-based approaches, and 62% have increased their use of Essential Questions to structure their lessons.

Program localization

As the program expands into new countries and into new areas within countries, it is reaching participants who come to the training with widely varying skill sets and beliefs about teaching. Most importantly, significant minority of program participants begin the

training with very little or no prior experience with ICTs, or with no prior exposure to any models of teaching other than very traditional, didactic approaches.

One of the factors driving the program's broad success has been the ability of local education managers, RTAs, and ministries to localize the program to meet teachers' needs without significantly weakening the program's overall quality or detracting from its core messages. However, several factors are making it more difficult for teachers to engage quickly and productively with the program content:

Teachers' prior technology experience: A significant minority of program participants comes to the course with very little or no prior experience using ICTs. These teachers are over-represented in countries with lower levels of economic development.

Prevalent teaching methods. The teaching methods that are a core component of the Essentials Course are entirely new to significant minorities of program participants. Participants who come to the training with no awareness of these teaching methods find it difficult to master the relevant concepts well enough to be able to experiment with them once they return to the classroom.

Structure of training. Due to logistical constraints, it is relatively common for trainings to be delivered in compressed periods of time. This compounds the difficulty of the training for teachers, particularly for those who bring little prior knowledge of either technology or the targeted teaching approaches into the training.

Trainer characteristics. Many country managers are struggling to find enough qualified candidates to act as Master Teachers. In order to lead the training effectively, Master Teachers need adequate knowledge of both technology and the targeted teaching approaches. Particularly in countries with little prior investment technology for schools or with strong traditions of didactic instruction, Master Teacher candidates may need additional support in their training.

<u>Program relationship to policy context</u>

National and regional policies on education and ICT infrastructure play a significant role in shaping the local and national context in which teachers work. This context, in turn, has substantial influence over whether and how teachers follow up on their participation in the Essentials Course. These contextual factors, including the professional expertise of local leadership, the coherence and depth of national curricula and standards for learning, standards for training of the local teaching staff, and the range and quality of the instructional resources available, all shape teachers' opportunities to innovate and improve their teaching practices, as well as the obstacles they encounter as they pursue these goals.

Several challenges to sustained teacher follow-up to participation in the Essentials Course that were frequently identified in country evaluations have particularly strong roots in local and national policy and are discussed in this report.

Curricular alignment. Teachers in countries that have made significant investments in reforming education policy to advance student-centered models of teaching and learning have consistently more positive and productive experiences of the Essentials Course, and are better prepared to follow up on what they have learned when they return to their classrooms. When teachers are not working in a supportive policy context, they may still react enthusiastically to the content of the Essentials Course, but will quickly encounter obstacles when following up on what they learned after returning to their classrooms. Hurdles such as lack of time in the school schedule for sustained student project work, lack of opportunity to use teacher-developed curricular materials, and required assessment measures that do not capture a wide range of skills make it difficult or impossible for teacher to justify investing time or effort in pursuing classroom activities that cannot be sustained or do not serve their students' immediate needs appropriately.

Multiple country evaluations demonstrate that if education ministries wish to promote the use of ICT for project-based and student-centered learning, national curricula and national assessments must reinforce and support this vision so that innovative uses of technology can be plainly identified as being in the service of core educational goals rather than contrary to them. Many countries are at some point in a process of curricular reform and/or reform of assessment practices, but few countries have moved far enough along in this process to have fully implemented new curricula that might align more closely with the models of teaching and learning emphasized in the Essentials Course

Infrastructure. In order for teachers to follow up on their training and sustain student-driven, well-integrated uses of technology, ICTs need to be easily accessible, reliable and available in large enough numbers to support a variety of student activities. Providing and maintaining an adequate ICT infrastructure is a constant challenge, even for schools with considerable resources. A significant minority of teachers participating in the Essentials Course does not have adequate access to technology, and a small group of participants have no access to technology at all. Many participating countries have established policies to drive the deployment of ICTs and Internet access in schools, but in many cases these policies have not yet been implemented at the local level.

Conclusions

Evaluation of the Essentials Course across many countries suggests that teachers are highly motivated by participation in the course, and frequently follow up on the training by experimenting with new teaching practices and new uses of technology in the classroom. However, every country evaluation suggests that teachers eventually encounter gaps between a vision of teaching promoted by the Essentials Course and the realities of the environment in which they work. Cross-country analysis of the available evaluation data suggests that these gaps emerge at similar moments and in similar ways across countries, although their severity and persistence vary widely. Finally, as the Essentials Course continues to reach teachers in ever more disparate settings, it is clear that it will be both crucially important and increasingly challenging to convincingly illustrate and explain novel images of effective teaching and learning and to ensure a basic level of ICT literacy among program participants.

The evaluation data also suggest that variations in teacher experience of the training, and in their opportunities to follow up on the training, are based in the particular configuration present in each country of the following three factors:

The depth and accessibility of the technological infrastructure. Evaluation data clearly demonstrate that individual teachers' access to hardware and networks plays a significant role in shaping the depth and persistence of the program's impact on those teachers. This impact is not simply a function of the number of computers available, but of their accessibility to the teacher and their reliability. Survey data demonstrate that in-classroom computer access (as opposed to lab access only) makes it significantly easier for teachers to increase their use of technology with students. In schools that have computer labs, it is often difficult for teachers to gain access to the labs for their own use on a regular basis. Additionally, the quality and reliability of computers, and the robustness of Internet access, also play a major role in shaping teachers' judgments about whether they can realistically make ICTs a regular part of their instructional repertoire.

The degree of alignment across national and local goals for education, curricular structure and content, teacher preparation, and assessment. In every country included in this evaluation, at least some elements of the educational system are identified with reform efforts in general and 21st century education in particular. But none of these countries have yet achieved full alignment, in which all elements of the system, policies, resources and concrete practices, are working together toward this common goal. When elements are not aligned, teachers encounter obstacles, such as assessments that do not capture a wide enough range of student knowledge, or requirements for curricular coverage that are in conflict with student-driven models of teaching.

The degree of alignment between the model of teaching articulated in the Essentials Course and the existing, historically and culturally grounded norms for teaching in each country. Comparisons of country-specific evaluations of this course make clear that regardless each country's progress in its broader efforts at reform, every country begins its involvement with the Essentials Course from a unique starting point: norms and expectations about what students should learn, how to teach effectively, and how students and teachers should interact with one another. The localization of the Essentials Course curriculum has been a significant investment in addressing these unique cultural contexts, but has not erased the dramatic contrast, evident in some countries, between the core qualities of good teaching and learning presented in the Essentials Course and the normal practice of teaching and learning that unfolds every day in various countries.

Intel® has taken, and should continue to take, two main approaches to responding to these teachers' encounters with these gaps between their efforts to change their practices and the supports and requirements they encounter in their local environment.

Accommodation of local circumstances, through both adaptation of the curriculum itself and shifts in local program implementation, has been demonstrated in program evaluation to be a highly effective strategy. In many countries where teachers lack ICT literacy, for

example, the local program has added an introductory module to help get those teachers ready for the Essentials Course. Many of the local program managers have been quite successful in creating follow-up programs, and provided additional resources tailored to local needs.

Influencing policy by leveraging Intel's role as a valued and trusted partner to Ministries of Education is a second key strategy. Intel has a track record as an advocate for teachers with a deep understanding of the complexities of how teaching and learning unfolds at the classroom level. Intel also has a significant body of evaluation research that documents not only program impacts but also how factors like access to hardware, flexibility in curricular structure, and alignment between standards and assessments are influencing the program's success. This means that Intel team members can document and advocate for policy changes that will improve the alignment of these elements and, over time, improve the opportunities available to teachers to innovate and improve their practice and, by extension, deepen the impact of the Essentials Course in the classroom.

Introduction

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some of the main obstacles that teachers encounter, across widely varying contexts, when they begin to follow up on their training.

Research in the U.S. on effective scale-up of educational programs suggests that scale-up happens most effectively - maintaining program quality and meeting objectives - when substantial investments are made in local adaptation of the innovation. Education managers have taken on this challenge in many countries, through strategies such as establishing follow-up programs, modifying curriculum examples to be locally relevant, providing additional resources to offer tailored support to the teachers, students, and schools in their countries.

The Essentials Course invites teachers to see ICTs as tools that both they and their students can use on a day-to-day basis to support a range of activities, including gathering and analyzing information, communicating complex ideas to an audience, and collaborating with peers to pose and answer questions. The Essentials Course both engages teachers with the "big ideas" about good instructional practice that drive this vision of technology use in schools, and addresses in detail the concrete challenges involved in making ICTs a part of everyday classroom activity. Throughout the course, teachers are encouraged to view students as active, curious, and engaged learners; to view themselves as facilitators of their students' learning, rather than providers of information; and to view ICTs as rich, flexible resources can support every kind of student, in every kind of classroom.

Evaluation evidence collected to date shows that the Essentials Course gives teachers a particular vision of how to use information and communications technologies (ICTs) and prepares them to follow up on what they have learned in several ways, including:

- Increased use of ICT to support their own professional work, such as lesson planning and creating curricula;
- Increased use of ICT as a tool to support student research, communication, and collaboration;
- Experimentation with specific instructional strategies emphasized in the training, such as allowing students to select their own topics for research projects, assessing student work through the use of rubrics, and encouraging revision of student work over time.

Education Development Center's Center for Children and Technology (EDC/CCT) has been coordinating the worldwide evaluation of the Intel® Teach to the Future professional development program since March 2003. EDC/CCT's role has been twofold. First, EDC/CCT designs and coordinates the implementation of two global surveys: the End of Training survey and the International impact survey. Second, EDC/CCT supports Intel® Teach to the Future national education managers and local evaluators in designing country-specific evaluations and administering the global surveys. This two-pronged approach to evaluation provides Intel® Teach to the Future program managers with information that is particular and unique to the experience of each country as well as gross level data about the implementation around the globe.

This report first presents a brief description of the role of ICTs in international efforts to reform educational systems and an overview of the Essentials Course and its implementation model. The report then presents and discusses high-level findings regarding the impact of the program. Finally, a set of opportunities for and challenges to further program development are reviewed, and discussed in relation to two on-going tasks facing the program team: the localization of the program and influencing the alignment of national policy, local policy and teacher practice. A complete analysis of the survey results is available in a separate report.

Building 21st Century Education Systems

There is an increasing global focus, shared by national governments and non-governmental organizations, on expanding and improving educational opportunities for children. This interest is driven largely by the belief that as the economic systems are globalized, the health of national economies will depend increasingly on the ability of its young adults to take on the challenges of living and working in rapidly changing circumstances, across multiple cultures, and with large amounts of complex, dynamic information about the world around them. An indicator of the international interest in the topic is the broad international consensus, documented in the Millennium Development Goals, to extend universal quality education to all children by the year 2015[1] in order to meet the challenges of the 21st century. Governments around the world are struggling to create 21st Century education systems that have the human capacity, the technical infrastructure and the curricular resources they will need in order to provide young people with the skills and competencies they will need to succeed in the future[2]. At stake is students' ability to become active citizens and to compete in the workplace, which will have significant implications for national competitiveness in countries at all levels of development.

As they respond to this challenge, policymakers and educators all around the globe recognize that educational applications of ICTs are a crucial element in a 21st century educational system. The growing importance of information and communication technology (ICT) to social, political and economic life has encouraged researchers, policymakers, and educators to rethink the intersection of ICT and education, and to shift their focus from simply ensuring that young people learn technical skills to helping them use ICTs to support their everyday engagement with the world around them. Gathering information, analyzing data, representing complex ideas, sharing opinions, and building social networks are both more necessary and more accessible activities than ever, particularly in the careers at the heart of a globalized economy, and young people need to be prepared to conduct these kinds of activities routinely and with the help of ICTs.[3]

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[1] UN Millennium Project. (2005). *Investing in Development: A Practical Plan to Achieve the Millennium Development Goals. Overview.* New York: United Nations Development Programme.
[2] OECD. (2003a). *Financing Education - Investment and Returns, Analysis of the World Education Indicators, 2002 Edition.* Paris: UNESCO/OECD.
[3] International ICT Literacy Panel. (2002). *Digital Transformation: A Framework for ICT Literacy.* Princeton, NJ: Educational Testing Service.

When effectively integrated into a high quality learning environments, researchers have demonstrated that ICT can help deepen students' content knowledge, engage them in constructing their own knowledge and support the development of complex thinking skills.[4] However, ICTs alone cannot create this kind of teaching and learning environment; teachers need to know how to structure curriculum, select resources, guide activities, and support this learning process, and many more traditionally-trained teachers are not prepared to take on these tasks. As Bransford, Brown, & Cocking[5] point out, to use technology effectively, the pedagogical paradigm needs to shift toward more student-centered learning, and this shift is not trivial or easily accomplished, particularly in countries with teacher-centered educational traditions.

This intersection of active, student-driven learning experiences and the day-to-day use of ICTs to gather and analyze information, communicate, and collaborate is at the core of many countries' visions of a 21st century education system. In brief, such a system might be characterized as including the following:

- A well-trained professional teaching force with a solid knowledge of their content areas, how children learn, and how to structure rich learning environments.
- A curriculum (or curricula) that moves beyond memorization to targeting more complex cognitive skills; and that allows students to go deeper into understanding the concepts, principals and procedures at the core of each subject[6], instead of overburdening students with vast amounts of superficial or fragmented content knowledge.
- A culture of teaching that supports student-centered teaching methods and inquiry driven learning processes, since these types of learning environments are most likely to encourage student development of critical thinking skills, and interpersonal and communication skills[7].
- The integration of ICT as a learning tool to enhance the learning environment by allowing students to explore and master content areas and to build their own understanding of the world.[8]

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[4] Kozma, R. (2005). National Policies that Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology, 1*(2), 117-156, Kulik, J. (2003). *Effects of Using Instructional Technology in Elementary and Secondary Schools: What Controlled Evaluation Studies Say* (Final Report No. P10446.001). Arlington, VA: SRI International, Webb, M., & Cox, M. (2004). A Review of Pedagogy Related to Information and Communications Technology. *Technology, Pedagogy and Education, 13*(3), 235- 286.

[5] Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (1999). *How People Learn: Brain, Mind, Experience, and School*. Washington, DC: National Research Council/ National Academy Press.

[6] Ibid, Kozma, R. (2005). National Policies that Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology, 1*(2), 117-156. Hepp, P., Hinostroza, J. E., Laval, E., & Rehbein, L. (2004). *Technology in Schools: Education, ICT and the Knowledge Society*. Washington, DC: World Bank.

[7] Kozma, R. (2005). National Policies that Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology, 1*(2), 117-156. OECD. (2003b). *Learners for Life: Student approaches to learning. Results from PISA 2000.* Paris: OECD.

[8] Hepp, P., Hinostroza, J. E., Laval, E., & Rehbein, L. (2004). *Technology in Schools: Education, ICT and the Knowledge Society*. Washington, DC: World Bank. Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (1999). *How People Learn: Brain, Mind, Experience, and School*. Washington, DC: National Research Council/ National Academy Press.

But creating such a system requires making broad, systemic shifts in approaches to teacher training and certification, to curriculum and assessment frameworks, and to the overall vision of good teaching and learning that is promulgated within an educational systems. Bringing about these changes is a long term, incremental process. Reform cycles can extend over decades: consider United States, which is still reforming its education system in response to the 1983 report, *A Nation at Risk*. The Latin American experience with education reform would suggest that the reform process is further complicated in countries with a weak tradition of local educational management and administration, since reform efforts need to attend to changing learning and teaching as well as developing the institutional capacity to support those changes[9]. Effective reform requires sustained investment and support along multiple dimensions of the educational system, including physical and technical infrastructure, human resources, curricular frameworks, standards and assessment. Policy research[10] demonstrates that successful reform of educational systems requires both close alignment of missions, investments and goals across these dimensions, and well-specified and coordinated short- and long-term goals and benchmarks to track and monitor progress throughout the reform process.

The Role of Intel® Teach to the Future Essentials in Preparing Teachers for 21st Century Classrooms

Research demonstrates that the effective use of ICTs is dependent on teachers' ability to select instructionally appropriate ICTs and to use them in the context of effective instructional strategies.[11] Therefore, nations engaged in educational reform must make teacher education, both pre-service and in service, a high priority for investment, since the quality of instruction is central to improving academic achievement.[12]

The Intel® Teach to the Future Essentials Course offers ministries and other educational authorities a program intended to help meet their goals of creating a well-trained cadre of teachers who are able to integrate ICTs into student-centered and inquiry-driven learning activities. The core of the Essentials Course curriculum focuses preparing teachers for a 21st Century education system by training them to integrate ICT across the curricula as a tool for learning, and to design and implement inquiry-driven, project-based learning

[9] Navarro, J. C., Martin, C., & Moura Castro, C. d. (2000). La reforma educativa en América Latina: Temas, componentes e instrumentos. In J. C. Navarro, K. Taylor, A. Bernasconi & L. Tyler (Eds.), *Perspectivas sobre la reforma educativa* (pp. 129-146). Washington, DC: Inter-American Development Bank.

[10] Lee, J. (2001). School Reform Initiatives as Balancing Acts: Policy Variation and Educational Convergence among Japan, Korea, England and the United States. *Education Policy Analysis Archive, 9*(13). Kozma, R. (2005). National Policies that Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology, 1*(2), 117-156, Osín, L. (2000). Dimensiones de cambio en los sistemas educativos de América Latina: América Central en el contexto de políticas de educación en las Américas. In J. C. Navarro, K. Taylor, A. Bernasconi & L. Tyler (Eds.), *Perspectivas sobre la reforma educativa* (pp. 129-146). Washington, DC: Inter-American Development Bank.

[11] Webb, M., & Cox, M. (2004). A Review of Pedagogy Related to Information and Communications Technology. *Technology, Pedagogy and Education, 13*(3), 235- 286.

[12] Cohen, D., Raudenbush, S., & Ball, D. (2000). *Resources, Instruction and Research* (CTP Working Paper No. W-00-2). Seattle: Center for the Study of Teaching and Policy.

activities. The curriculum also discusses crucial factors for creating high quality student-centered learning environments, including the classroom management issues associated with using technology with students, conducting research on the Internet, assessing students' technology-rich work products, and managing intellectual property issues.

The implementation model for the Essentials Course uses classroom teachers and other local educators as trainers, both to develop local capacity and to make the program more sustainable. The curriculum is delivered through a train-the-trainer model, with senior trainers from ICT training a cadre of senior trainers in each country, who then train Master Teachers from local districts or school. The training uses commonly available Microsoft software, focusing primarily on how to use Windows-based versions of PowerPoint and Publisher to support students in creating presentations, web pages, brochures and newsletters.

The Essentials course is constructed around known attributes of good professional development, such as focusing on issues that are directly relevant to teachers' everyday work, [13] offering a well defined concept of effective learning, and, offering opportunities for teachers to develop knowledge and skills that broaden their repertoire of teaching approaches. Research has also demonstrated that professional development programs that offer teachers time to explore new content and actively engage with the ideas presented to them were more successful than programs that presented prescriptive approaches to teaching. [14]

Divided into ten, four-hour modules, the Essentials curriculum guides teachers through a process of developing a complete unit plan. Organized around a single research question, the unit engages teachers in the use of technology to conduct research, compile and analyze information, and communicate with others. This structure allows teachers to expand their technical skills in the context of a curriculum development process. Teachers learn from other teachers how, when and where they can incorporate these tools and resources into their work with students, particularly, in order to support students' work on sustained projects and original research. In addition, teachers are instructed on how best to create assessment tools and align lessons with local and national standards. For more information about Intel® Teach to the Future and the Essentials Course, visit www.intel.com/education.

[13] Garet, M., Porter, A. C., Desimone, L., Birman, B., & Yoon, K. S. (2001). What Makes Professional Development Effective? Results from a National Sample of Teachers. *American Educational Research Journal, 38*(4), 915-945, Kennedy, M. (1999). Form and Substance in Mathematics and Science Professional Development. *NISE Brief, 3*(2), 7, Loucks-Horsley, S., Stiles, K., & Hewson, P. (1996). Principles of Effective Professional Development for Mathematics and Science Education: A Synthesis of Standards. *NISE Brief, 1*(1), 7.

[14] Kennedy, M. (1998). *Form and Substance in In service Teacher Education*. Madison: National Institute for Science Education, University of Wisconsin-Madison, Kennedy, M. (1999). Form and Substance in Mathematics and Science Professional Development. *NISE Brief, 3*(2), 7.

Data Sources

This report draws on three types of data: evaluation reports from other participating countries, EDC's own interactions with participating countries, and responses to the international impact and end-of-training surveys.

Evaluation Reports

The main source of information for this report is a group of twelve reports submitted by national evaluators working in those countries that are conducting evaluation activities beyond the administration of the impact and End of Training surveys. These reports vary considerably in their format and depth, ranging from PowerPoint presentations and text narratives of the impact survey findings to multiple narrative reports submitted over a year or more. All of these reports offer insights into the particular strengths and challenges of the program's implementation in each of these countries.

Table 1: Countries submitting qualitative reports in 2005

Regions			
APAC	**EMEA**	**LAR**	**US**
India	Egypt	Argentina	United States
Japan	Israel	Brazil	
Korea	Jordan		
Thailand	Russia		
Vietnam			

EDC Interactions

EDC/CCT has interacted with evaluators, program managers, and practitioners in many participating countries, through field visits, phone, and electronic and face-to-face exchanges. This year, EDC/CCT evaluators have made site visits to two countries and have worked to help plan for evaluations or interpret evaluation data with education managers in fifteen other countries.

Survey Data

EDC aggregates and analyzes all data from both the end-of-training and impact surveys submitted by participating countries. The training survey covers the teachers' experience in the training, their prior technology experience and their perceptions of the quality and utility of the training. The impact Survey covers issues such as teachers' implementation of a technology-rich lesson; obstacles and challenges to implementation; changes in teacher practice; and technical infrastructure in the schools in which the respondents work. Between December 2004 and December 2005, 16 countries submitted impact survey data on the Intel® Teach to the Future Essentials program that could be analyzed for this report (See Table 1). The database contained 11,780 respondents as of December 15, 2005. This represented the most recent survey results for each country. In cases where impact survey data have been submitted to EDC/CCT in both 2004 and 2005, only the 2005 data are used.

In addition to being integrated into this report, responses to these surveys are presented in more detail in a separate report.

Table 2: Countries that submitted 2005 survey data

Country	End of Training Survey (N)	Impact Survey (N)
Australia	1,334	435
Brazil	5,382	318
Chile	529	511
China	99,110	2,485
Costa Rica	486	
Egypt	406	183
India	9,547	1,563
Israel	316	
Italy	534	139
Japan	593	
Jordan	1,331	1,454
Korea*	2,145	261
Malaysia	222	
Mexico	2,305	972
Pakistan	2,337	565
Philippines	69	391
Russia	4,933	322
South Africa	58	77
Taiwan	1,329	
Thailand	2,601	252
Ukraine	922	206
United States	5,860	1,907
TOTAL	**142,349**	**11,780**

* Korean survey was missing a key variable used in EDC's analysis; therefore this data was not included.

Findings

Helping Teachers Prepare for the 21st Century Classroom: The Impact of the Essentials Course

This section presents high-level findings related to the core goals of the Essentials Course: to promote effective technology use by teachers and students, and student-centered approaches to teaching and learning. The evaluation data suggest that the Essentials Course is helping countries move toward achieving the characteristics of a 21st century education system by enhancing teachers' abilities to integrate technology into student-centered learning activities. These findings draw on the End of Training surveys, the impact surveys and the qualitative reports submitted by the local evaluators.

Effective use of ICTs

Through the use of sample lesson plans, model activities, and group reflection as the participants create their unit plan, the Essentials Course presents two types of educational technology usage models to the teachers: one for students and one for teachers. This section reviews findings regarding both student and teacher use of technology after teachers have participated in the Essentials Course.

Student use of technology. Survey responses indicate that the program has encouraged teachers to integrate new technology activities into their classrooms. The student usage model the program presents places students in a productive relationship with technology, in which they use ICTs to gather and analyze information and/or to present their own interpretations to others. This usage model is supported by research establishing these types of uses of technology in classrooms, when supported by effective instructional practices, can have a positive impact on a variety of indicators of students achievement such as students' ability to engage in scientific inquiry and other activities that involve higher-order thinking skills,[15] students' motivation and organization skills;[16] and students ability to think critically and to collaborate.[17]

From the survey data, EDC created an indicator of how teachers are using technology with their students to identify if teachers are integrating technology in *new ways* upon completion of the program. The large majority, 75.3% of teachers indicate that they are integrating technology in new ways upon completion of the training program. This compares to 13.2% of teachers who are using technology but have not integrated any new activities, and 11.5% of teachers who are not integrating technology at all.

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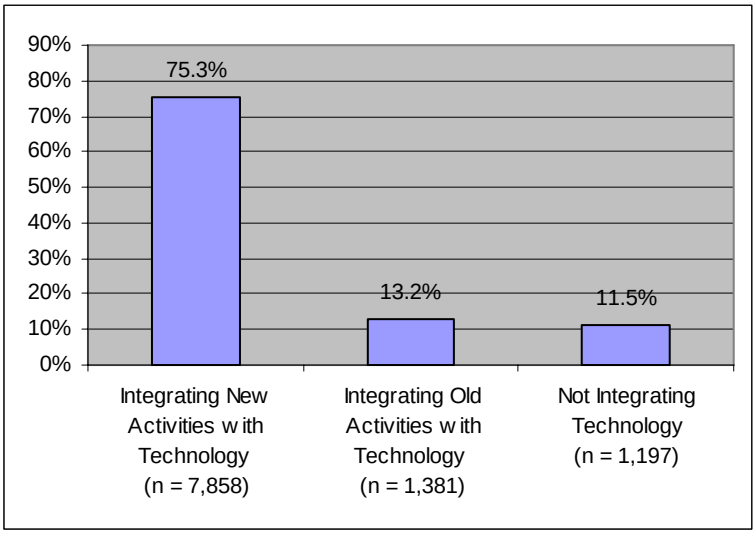
[15] Hunt, E., & Minstrell, J. (1994). A cognitive approach to the teaching of physics. In K. McGilly (Ed.), *Classroom Lessons: Integration Cognitive Theory and Classroom Practice*. Cambridge, MA: MIT Press, White, B. Y., & Frederiksen, J. R. (1998). Inquiry, modeling, and metacognition: Making science accessible to all students. *Cognition and Instruction, 16*(1), 3-118.

[16] Cradler, R., & Cradler, J. (1999). *Just in time: Technology innovation challenge grant year 2 evaluation report*. San Mateo, CA: Blackfoot School District No. 55, Educational Support Systems.

[17] Means, B., & Olson, K. (1997). *Technology and education reform. Studies of Education Reform*. Washington DC: US Government Printing Office, Sandholtz, J., Ringstaff, C., & Dwyer, D. C. (1997). *Teaching with technology : creating student-centered classrooms*. New York: Teachers College Press, Scardamilia, M., & Bereiter, C. (1996). Computer support for knowledge-building communities. In T. Kaschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm*. Mahwah, NJ: Erlbaum.

Figure 1: Teacher Use of Technology with Students
(n = 10,436)

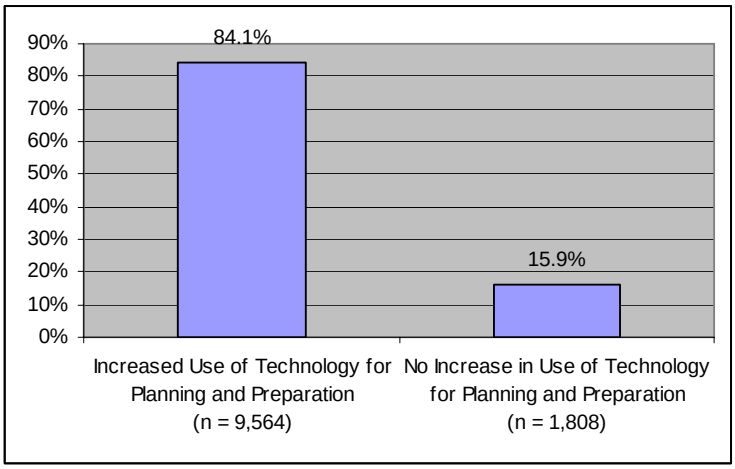


The model of student technology use introduced in the Essentials Course is different from other student usage models, in which students respond to prompts from the computer (integrated learning systems) or student learn to control the computers (programming and basic computer literacy). For many teachers the idea that students can be productive agents with technology is new. For example, the Korean evaluation, by the Korean Institute of Curriculum and Evaluation (http://www.kice.re.kr/kice/eng/index.jsp), marks as a highlight of the Essentials Course that it helped teachers change their "old perception of ICT as teacher-directed one-way communication" to see that students can use technology to research, explore and direct their own learning.

Teacher use of technology. The Essentials Course offers teachers the opportunity to experiment with new ways to use technology for preparation and planning. In addition to creating their unit plan on the computer, teachers learn how to use the Internet to find information and classroom resources and create teacher support materials. Teacher use of technology for planning and preparation is not centered on the student but rather the teacher's use of computers for their own research or for administrative purposes.

Survey results indicate that the program is effective at encouraging teachers to increase the use of technology for planning. The majority of teachers report that they have increased their use of technology for planning and preparation. Approximately 84% of teachers answered that they have increased their usage of technology for practices revolving around their administrative and preparatory practices. Thus, it would seem that the teachers are leaving the training program with the tools necessary to further employ technology for practices related to their job preparation.

Figure 2: Increased Use of Technology for Planning and Preparation
(n = 11,372)



The survey does not capture how teachers are using technology in their planning, or whether their planning involves the development of curriculum that is aligned with the teaching methods promoted through the training. But regardless of the substance of their planning activities, using technology for planning is an important first step for teachers that they can begin without changing their teaching methods. The country reports suggest that many teachers' initial use of technology for planning and preparation is, in fact, in support of prior, less student-centered teaching methods. For example, one of the issues addressed in a report that the Indian evaluator, the Teacher Foundation, (www.teacherfoundation.org), prepared for Intel® and the State of Gujarat was the role of reforming teaching methods to use ICT to qualitatively improve student learning. The Teacher Foundation found that moving toward student-centered methods was a crucial to effective integration, but one that was often preceded by teachers integrating ICT in to traditional practices. In one of their case study schools that was just beginning the long process of reform, they found that:

> …the actual teaching-learning process does not seem to have changed in the way that effective technology integration should bring about.[…] the infrastructure provision and presence of technology has not dramatically changed the system of education.

The Teacher Foundation concluded that both Intel® Teach to the Future and the state government needed to help participant teachers understand the value of new teaching methods. Indian teachers, they suggest, are not very familiar with new theories of how the children learn, concepts like multiple intelligences, or the value of constructivist practices. The Foundation recommended integrating a short workshop on new advances in the learning sciences into the Essentials Course to help teachers understand how contemporary research on cognition and learning can translate into changes in their classroom practice and, in turn, into an improved learning environment for students.

New teaching approaches

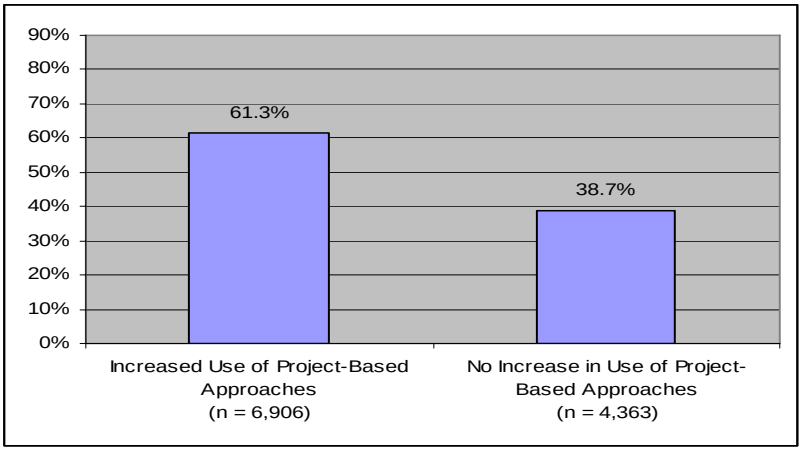
A growing body of research suggests strong connections between the use of constructivist pedagogy and the effective use of technology as a tool to support student inquiry and

substantive project-based work.[18]. The country reports also indicate that many MOEs are attempting to shift their teachers' pedagogical approaches towards student centered active methods (i.e. Jordan, Thailand, India, and Colombia). While the training does not promote one specific learning theory, the Essentials Course supports teachers with new teaching practices that fall into four broad categories:

- Project-based approaches: these are student-centered strategies that promote learning through student inquiry.
- Collaborative group work: students work as a team to complete a learning activity. It differs from traditional group work because the group has shared responsibility for completing the project and each student may have different roles.
- Questioning strategies: the use of essential and unit questions to structure the lesson, and the use of teacher questioning strategies that promote deeper student reflection.
- Lesson planning practices: the unit planning process in the Essentials Course models the techniques of backwards design to create an effective lesson plan.

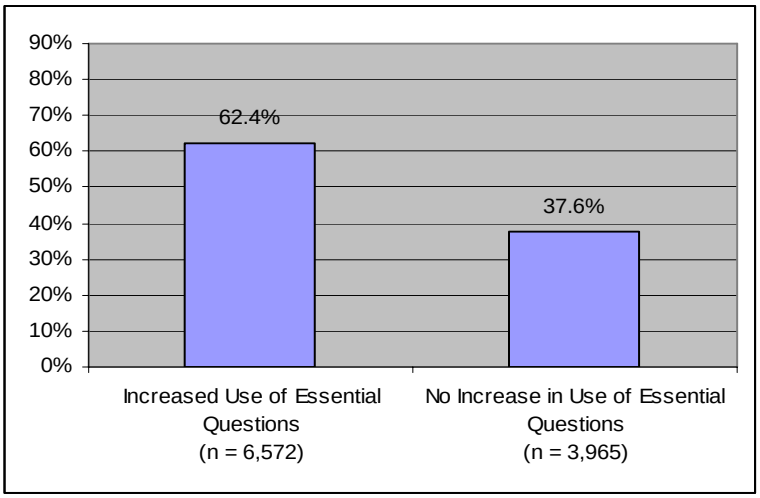
The global surveys track two components of these new practices presented in the Essentials Course: project-based approaches and Essential Questions. The data indicate that participants are experimenting with both of these strategies. The survey results show that the program is supporting teachers in increasing their use of project-based approaches. A greater percentage of teachers reported increasing their use of project-based approaches (61.3%) in comparison to teachers who did not (38.7%). Similar percentages of teachers also report using Essential Questions to structure student activities.

Figure 3: Teacher Increased of Project-Based Pedagogical Strategies
(n = 11,269)



[18] Becker, H. J., & Ravitz, J. (1997). *The Equity Threat of Promising Innovations: The Internet in Schools*. Irvine: University of California, Irvine, Riel, M., & Becker, H. J. (2000). *The Beliefs, Practices, and Computer Use of Teacher Leaders*. Irvine: University of California, Irvine.

Figure 4: Teacher increased use Essential Questions to structure lessons
(n = 10,537)



Ongoing Challenges to the Effective Implementation of the Essentials Course

This section of the report presents a synthesis across the survey data, the qualitative reports and the EDC's site visits to look across a set of core issues that are common to each program yet manifest themselves differently in each country. EDC's review of the reports suggests that while each country's experience is unique, country programs face similar issues and there are predictable features to successful modifications. In many instances where a country program faces a challenge, another national program has already begun implementing a solution. A role of the evaluation process has been to both monitor these adaptations and to document their success to share with the other countries.

For each issue presented in this section, a range of examples of successful program adaptation of the program to fit local texts are discussed. Issues are organized into two categories, describing the two main types of challenges country managers are encountering as the program scales up in current countries and expands to new countries:

1. Program fit: adapting and localizing the curriculum and organization to meet local needs and conditions;
2. Policy setting: aligning the program and the policy context to allow the participant teachers to follow up on what they have learned in the training.

Program fit: One program for many countries

Intel® Teach to the Future has an ambitious goal for the Essentials Course: to carry two key messages (ICTs and student-centered learning) to teachers in an enormous range of contexts. One of the factors for its success is the ability of local education managers, RTAs, and ministries to localize the program without weakening the program's overall quality or detracting from its core messages. The qualitative reports and the survey data identify several factors that seem to mediate the fit between the program and local

teaching populations. Here EDC discusses four notable factors influencing program outcomes: a) teachers' previous exposure to and familiarity with technology applications, b) local culture of teaching, c) training and trainer characteristics, and d) localization of the curriculum.

Teacher technology experience. Teachers' prior technology experience is a key factor shaping their experiences with the workshop. The initial design of the program assumes participants will already have basic ICT literacy. The results from the training survey indicate that there is a wide range of experience levels among the participants. The training survey results indicate that there is an even spread of experience with technology among all respondents, with about a third each describing themselves as new or novice technology users (33.4%), intermediate users (35.3%), or experienced users (30.5%).

Table 3: Level of technology experience for participants by country

Countries (Total)	Percentage of teachers in each category				
	Never Used	New User	Intermediate User	Advanced User	Expert User
Australia (1,334)	4.6%	17.2%	42.3%	24.8%	11.1%
China (99,108)	7.7%	13.9%	40.6%	31.6%	6.2%
India (8,808)	67.8%	15.8%	8.4%	5.4%	2.6%
Japan (593)	19.4%	30.0%	38.4%	6.7%	5.4%
Korea (2,145)	9.0%	46.3%	34.5%	7.4%	2.8%
Malaysia (222)	0%	55.9%	41.9%	1.4%	0.9%
Pakistan (2,331)	78.5%	17.7%	3.3%	0.3%	0.3%
Philippines (68)	20.6%	20.6%	50%	8.8%	0%
Thailand (2,564)	49.1%	24.0%	23.2%	3.3%	0.4%
Egypt (406)	12.8%	16.3%	40.4%	21.2%	9.4%
Israel (316)	22.5%	25.9%	25.3%	17.4%	8.9%
Italy (534)	4.5%	25.3%	45.9%	20.4%	3.9%
Jordan (1,331)	36.1%	22.2%	30.1%	8.7%	2.9%
Russia (4,933)	65.0%	21.0%	10.2%	3.0%	0.9%
S. Africa (58)	53.4%	5.2%	29.3%	10.3%	1.7%
Ukraine (293)	45.1%	34.1%	10.2%	6.1%	4.4%
Brazil (5382)	11.8%	33.9%	42.2%	9.9%	2.2%
Chile (528)	6.8%	10.2%	45.6%	17.8%	19.5%
Costa Rica (486)	60.1%	18.1%	16.9%	4.9%	0%
Mexico (2,305)	14.1%	27.2%	39.2%	6.4%	13.1%
United States (5,446)	9.8%	28.4%	36.7%	17.0%	8.0%

Data Source: 2005 End of Training Survey, Q1, Q2 and Q3

There are distinct regional patterns in teacher's prior technology experience that indicate that certain countries have a larger share of novice technology users in their programs. For example, data from the APAC region (excluding China) showed about half (52.3%) of their respondents as having no prior experience with technology, and their share of new users was 21.9% bringing their total of new and novice users to almost three quarters (74.2%) of their sample. About half (50.8%) of EMEA respondents also indicated no prior experience using technology. The majority of the respondents from China was at the intermediate (40.6%) or advanced (31.6%) levels of prior experience, whereas in LAR the greater part (40.2%) of the respondents was at the intermediate level. The respondents from US also followed a similar pattern with a bulk of them (36.7%) at the intermediate level, closely followed by new users (28.4%) (see Table 3).

Many of the qualitative reports examined the issue of teachers' technology experience, and illuminate the way this might affect what participants learn from the workshops. For example, the Thai evaluation research, by the Thailand Education Development Alliance, found that trainees with weak ICT skills and poor understanding of student centered teaching approaches could not keep up with the training pace, and often feel behind in their assignments. In such situations where participants were confronted with two new topics, many of them attended to the technology skills to the exclusion of the teaching strategies. The Thai evaluator felt this situation was compounded by the shortening of Thai training cycle from nine to seven days. Data from the Japanese evaluation, by Nikkei Research, Inc (http://www.nikkei-r.co.jp/english/index.htm), found similar concerns among the Japanese participant teachers. In a focus group, Japanese participants discussed difficulties in the trainings that they attributed to the experience levels of the participants recruited. The Japanese survey results indicate that 37.9% of respondents did not use their Intel® designed unit; half of those said it was because of their low technology skills.

The level of ICT skills of the participants is connected to the quality of the program. Basic ICT skills are important for the participants to be able to follow the course and complete the unit plan instead of spending the training session learning basic operation of the software. For many teachers the Essentials Course is their first exposure to new teaching methods (See discussion below) and if the Course is also the teacher's first exposure to technology as well, this will affect the quality of the training experience for the participant teacher. There are different localization strategies that education managers have used. The program in many countries has added a "Module 0" on basic technology literacy and MOEs in other countries have basic technology literacy course that teachers can take prior to the Essentials Course. Similarly, establishing more stringent criteria for participants, adding additional resources or components to the training, or other similar modifications could help to ensure that the training remains focused on its core principles and does not, over time, shift toward providing basic computer literacy skills.

Local culture of teaching. One contextual factor that needs to be addressed when localizing the Essentials course is the local culture of teaching that defines the expectations that teachers (and students) have of their roles and their own beliefs about

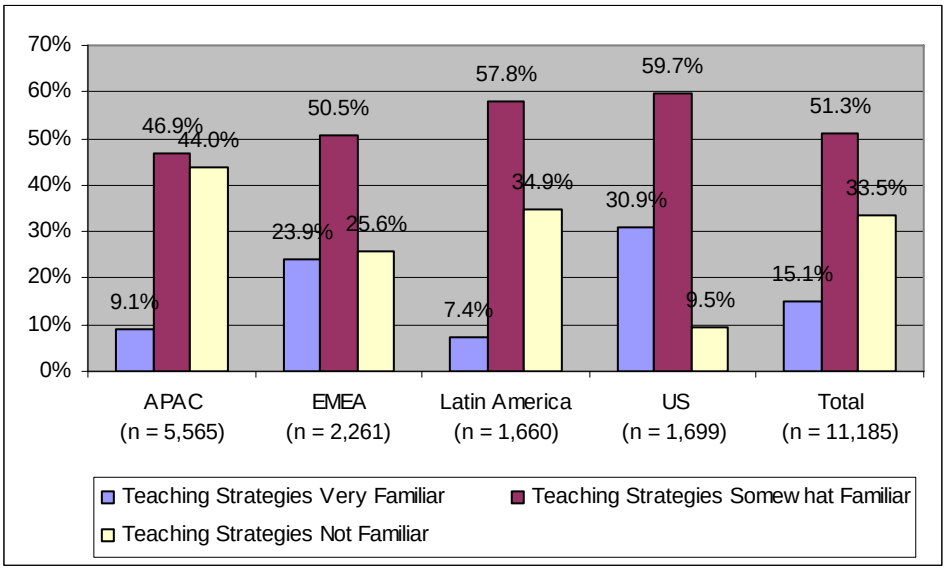
appropriate professional behaviors[19]. The Essentials course seeks to promote a shift in teaching methods and practices, and change teacher and student roles to allow student-centered learning to happen. The initial training program, developed in the US, was localized to US cultural norms of teaching. The evaluations done across the globe shed light on how other countries have localized the program and where they still face challenges.

Prevalent teaching methods. Research suggests that there tend to be common teaching methods within countries[20] that are supported by pre-service education, national teacher assessment policies and teachers' own expectations and sense of professionalism. Traditional instructional practices may need to change in a 21st Century education system. In particular, as students become more active in the classroom, traditional teacher-centered lecture formats may need to give way to student-centered teaching approaches[21], a fact that more countries seem to be increasingly recognizing. However, this represents a fundamental shift in the teacher's role, and the inherent difficulties for educators as they try to make this transition, and the extent of the support they will need, are often underestimated. Intel® is involved with countries that are at different moments in the process of changing teacher practice. Some countries are at a very early stage, with local teacher educators who have little experience with student-centered pedagogy and project-based approaches. Some countries have begun to make the necessary policy changes, but these changes have yet to reach classroom teachers, while yet other countries have been engaged in education reform for many years.

The combined evaluation results present a complex picture of when the Essentials Course can enable teachers to introduce new teaching methods, preparing them for more advanced pedagogical training, and when the course introduces them to new strategies but leaves them struggling with some of the basics. The pivotal issue is the alignment between teachers' prior knowledge of teaching and the material contained in the training. Data from the follow up survey indicate that the teaching methods at the core of the Essentials Course are often new to many of the participants. Only 15% of survey respondents report being very familiar with the methods covered in the trainings, and 34% are not familiar with the methods. But this varies greatly by region; for example, only 9.5% of US respondents were not familiar with the pedagogical strategies described, while the number is 44.0% in APAC. The qualitative reports discuss issues around theses innovative teaching methods. In this report we review student-centered learning, collaborative group work and questioning strategies.

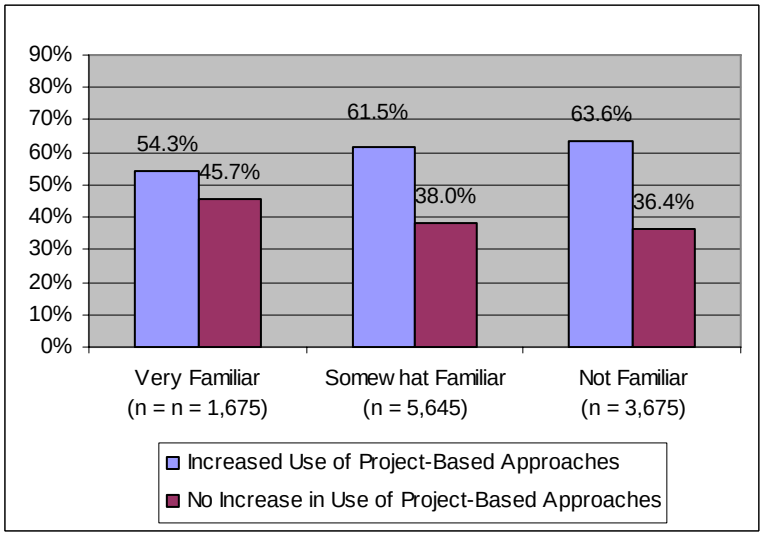
[19] Alexander, R. (1999). Culture in Pedagogy, Pedagogy Across Cultures. In R. Alexander, P. Broadfoot & D. Phillips (Eds.), *Contexts, Classrooms and Outcomes* (Vol. 1, pp. 149-180). Oxford: Symposium.
[20] Ibid. In, Givvin, K. B., Hiebert, J., Jacobs, J., Hollingsworth, H., & Gallimore, R. (2005). Are there National Patterns of Teaching? Evidence from the TIMSS 1999 Video Study. *Comparative Education Review, 49*(3), 311-343.
[21] Kozma, R. (2005). National Policies that Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology, 1*(2), 117-156.

Figure 5: Familiarity of Teaching Methods by Region
(n = 11,185)



Project-based approaches and student centered learning. The evaluation data offer the most insight in relation to project-based approaches to teaching. The impact survey data indicates that teachers with little familiarity with the teaching methods presented in the training are experimenting with project-based approaches. Over 60% of teachers with little or no familiarity with project-based approaches report increasing their use of projects in the classroom. This suggests that the Essentials course is helping teachers try new methods.

Figure 6: Increased use of project-based learning by familiarity with teaching methods
(n = 10,995)



The qualitative reports and the country visits made by EDC provide a deeper view of relationship between the Essentials Course and teachers' ability to begin experimenting

with project-based approaches to teaching. In the LAR region, where countries like Brazil or Argentina have been involved in reform for awhile, the survey responses report higher levels of familiarity (See Figure 5). Local evaluations indicate that teachers felt that the Course provides very practical knowledge about how to lead student projects in the classroom, as well as time to develop a project-based lesson plan. The data from those two countries suggest that the program allows teachers to take the first steps to implement in the classroom and leaves teachers ready for more advanced work.

The qualitative reports from APAC countries present a different pattern. In many of these countries, teachers are only now beginning to get the support they need to rethink their practice, and APAC survey results (See Figure 5) indicate a low level of familiarity with these ideas. The local evaluations from Thailand, India or Vietnam indicate that a particular challenge for countries at the early stage of pedagogic reform tends to be communicating the value of new teaching methods. The Thai evaluation found that teachers are excited to learn about these new methods but need more training to be prepared to address challenges such as managing an active classroom or developing basic collaborative and communication skills among their students. In an in-depth study on schools in the Indian state of Gujarat, the Teacher Foundation came to similar conclusions. Teachers in India were enthusiastic about integrating ICT and new teaching methods into their classroom, but most of their efforts replicated traditional teacher-centered teaching. The Teacher Foundation recommended incorporating new theories of how children learn (multiple intelligences and collaborative learning) so that Indian teachers could understand the importance of new teaching methods.

The Vietnamese pre-service report, by the Center for Higher Education Research, Ho Chi Minh City University of Pedagogy offers a dramatic example of a country just beginning to change teaching methods. The prevalent teaching model in Vietnam is described as "didactic," instruction, based on teacher lectures and a one-way flow of information. Teachers do not adjust instruction for differing student abilities and the students are treated as a "whole body:" any individualization would be seen as unprofessional or favoritism. The student-centered, project-based teaching strategies offered in the training are very different from prevalent Vietnamese practices and describe very different relationships and forms of interaction between teachers and students. But the distance between the new strategies and common practice is so large that some participants fail to see the program as relevant to teaching at all. The report indicates that eight of fifteen participants interviewed did not see any "pedagogical relevance" to the program or perceive that it had presented any new teaching methodologies. These participants appeared to value the aspects of the training that fit with a teacher-centered method since they valued how the training helped them learn to make teacher materials on the computer. The evaluators feel that, given the participants' absolute unfamiliarity with student-centered teaching, the program needs to do more to bridge this gap. The Vietnamese evaluators suggest two changes to the workshop curricula to address this issue: one, adding more materials on new teaching methods to the training; and two, improving the ability of the trainers to model these new teaching methods during the training.

Jordan is a country that is also beginning to reform its education system. There, the MOE responded to the same challenge by creating a prerequisite training to the Essentials Course that focused on the new teaching methods, so that the participants could become familiar with the student-centered and project-based approaches.

Group work. Student-centered learning is not the only new teaching strategy presented in the training. The Russian evaluation report, by the State Institute of Information Technologies and Telecommunications (http://www.informika.ru/text/index.html), comments on a different challenge. According to the evaluator, the teaching culture in Russia values individual work over group work and teachers have little experience either working in groups themselves, or having their students work in groups. A key component of the training program is the moments when teachers come together as professionals. However, this unfamiliarity with group work affects participant teachers' experience of the trainings and their ability to follow up in the classroom. To support this cultural shift, the Russian evaluator suggests increasing the materials in the workshop about effective group work.

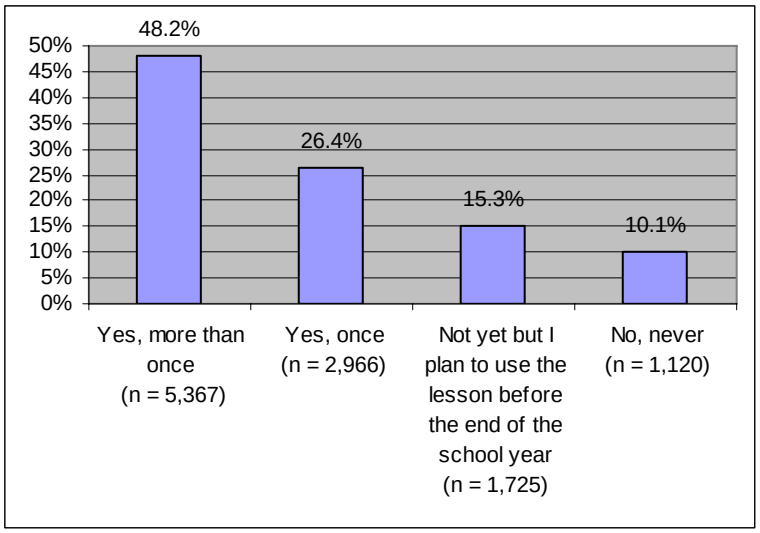
Critical questioning. The use of curriculum framing questions and critical questions is an important feature of the Essentials Course, and is exciting and challenging for many teachers. Over the years the US evaluations have shown the importance of supporting US teachers in thinking deeply about essential questions. Critical questions are also difficult concepts for teachers in other contexts. The Thai evaluators, Thailand Education Development Alliance, report on one aspect of the training that is challenging for the Thai teachers. The evaluation reports that the Thai teachers are unfamiliar and uncomfortable asking critical questions. The evaluation report found that "most teachers could not ask questions or asked non-critical questions" after the training. The Thai evaluation team felt that the issue is not only that of a new teaching method but also that teachers do not have a habit of asking this type of question. Broader than specific teaching methods that students and teachers expect to find in their classrooms, there are also sets of norms and expectations that structure teacher and student interactions.[22] Norms and expectations are shaped, in part, by teaching methods, but they are mutable. The Thai evaluators suggest that the teachers need more support while they learn more about the role questioning strategies and can assure themselves that their students truly do learn more from questions than from answers.

Lesson planning practices. One of the central elements of the Essentials Course is the creation of a unit plan by the participants that they can take away from the training. Previous evaluation reports have noted that teachers from a number of countries (U.S. and Chile for example) identify this as a powerful part of the training experience because it enables them to bring their new skills and ideas back to the classroom. From an evaluation standpoint too, the unit plans serve as significant pieces of evidence of what participants are learning in the program.

[22] Alexander, R. (1999). Culture in Pedagogy, Pedagogy Across Cultures. In R. Alexander, P. Broadfoot & D. Phillips (Eds.), *Contexts, Classrooms and Outcomes* (Vol. 1, pp. 149-180). Oxford: Symposium.

Currently in most trainings around the world, the process of unit plan development is structured around the completion of a unit plan template provided in the training materials. The global data indicate that about three quarters of the participants (75%) have implemented some or all of their unit plan; 48.2% of them having implemented it more than one time, while 26.4% of them having implemented it once (see Figure 7). Teachers who implement their unit plans attest to the fact that they found it useful.

Figure 7: Teacher implementation of their Essentials course unit plan
(n = 11,178)



However, some country reports also mention problems with alignment of the unit plan template with local policies. Teachers in many countries work within well-established planning processes that they must adhere to and larger educational structures with which they must align their instructional planning. Previous evaluation reports have indicated that some aspects of the design of the template do not mesh smoothly with various country contexts. Last year's evaluation from Thailand identified that the unit plan template did not align with local requirements and it was difficult for Thai teachers to develop and implement the unit plans. However, after changes in the Thai program, this year's evaluation found that MT's felt the new curriculum helped them design unit plans that met local requirements.

One approach to all of the above mentioned issues would involve better identification of what teachers in these different contexts currently know about some of the key teaching methods and the establishment of "next steps" that are appropriately challenging but not completely disconnected from prevalent approaches to teaching. This would require examining the range of pedagogical approaches teachers are already familiar with when they come to the training. Master Teacher training could then be designed to help these trainers diagnose teachers' needs and tailor the training to draw explicit connections between their existing practices and novel but accessible strategies.

Training and trainer characteristics. How the training itself is conducted and certain characteristics of the trainer are other factors that can impact later implementation of concepts learnt in the Essentials Course.

Structure of training. The research is fairly consistent on the logistical aspects of effective professional development.[23] One of these factors is the duration and intensity of the training. Research in the US found that relatively more intense delivery of the Essentials Course (those three months long or under) was more effective than trainings spread out over longer time spans.[24] However, appropriate intensity of a training has to be determined in relation to the amount and difficulty of the material to be presented. Some of the local evaluation studies suggest that there may durations that are too intense given the amount of material being covered and its novelty to many teachers.

The Thailand evaluation report of the Master Teacher training noted that the Master Teacher training in 2004 was shortened to seven days from nine days. Although the shortening of the training period reduced costs and made it feasible to conduct the training during the school year, it had the unintended effect of being too intensive for some teachers. There was not enough time for the Master Teachers to finish their unit plans, or for the Senior Trainers to give them proper feedback and revision opportunities. Also, some of the Participant Teachers found it stressful to have to learn the pedagogy and technology pieces in so short a time, especially those for whom both concepts were new. This meant that teachers could realistically focus on only one of these topics, which for most meant focusing more on technology than pedagogy. The evaluators suggest either lengthening the training or creating a basic ICT literacy and a basic pedagogical training as a prerequisite to the Essentials Course.

Trainer Characteristics. A critical element of a successful implementation of the Essentials Course in any country is the program's ability to select and train high-quality Master Teachers, and for these Master Teachers to become part of a sustainable professional development process. The trainer needs to be able to support the participants of the Essentials Course as they engage with two potentially new areas – the use of technology and new teaching methods. This means the trainers themselves need to be well versed in both the technology applications and the pedagogy to be able to train others.

The initial Essentials Course was originally designed to have classroom teachers of core content areas become Master Teachers. In countries where both the pedagogy and the technology are relatively new, it is hard to find trainers who are knowledgeable in both; classroom teachers do not typically use technology applications in their teaching or for their lesson planning, and the computer teachers are often not skilled at teaching core content.

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[23] SRI. (2002). *Technology-related Professional Development in the Context of Educational Reform: A Literature Review*. Arlington VA: SRI International.

[24] Kanaya, T., Light, D., & McMillan Culp, K. (2005). Factors Influencing Outcomes from a Technology-Focused Professional Development Program. *Journal for Research in Technology Education, 37*(3), 313-329.

There is no easy solution to this dilemma. Some countries in this situation select classroom teachers for their Master Teachers, but then have difficulty with the preparing them to teach the technology skills or to model technology integration adequately. The 2003 Jordan evaluation, by Jordan University and the Ministry of Education, for example, indicated that the trainers' technical skills were not strong enough for them to provide the necessary guidance to Participant Teachers. Other countries have selected computer teachers as their Master Teachers, but they often lack a rich teaching background that makes it difficult for them to support the Participant Teachers in learning new instructional methods. The Russian and Thai evaluation reports indicated that computer teachers and technology coordinators who are Master Teachers struggled with the pedagogical components of the training and were not very effective with the pedagogy piece when they turn around the training. Both evaluation reports describe these Master Teachers focusing more on the technology aspect of the Essentials training, and undervaluing the importance of the pedagogical piece of the Essentials course and.

The recent experience of the program in the US provides an interesting example of the complexity involved in this issue, and the relationship between participants' prior knowledge and necessary trainer skills. The 2005 United States evaluation report demonstrates that in the case of the U.S., there are some benefits to recruiting technology educators as Master Teachers. Over the years, the US has, like other countries veered away from the initial program design to recruit more technology-focused educators to be trained as Master Teachers. Prior U.S. evaluation reports raised concerns similar to those seen in Russia about the possible dilution of the training program that might result from this strategy. These concerns have not been borne out indicators of teacher impact have remained unchanged while the proportion of Master Teachers involved in the program has grown. This may have happened in part because in the U.S., compared to most countries, participants have a high level of prior experience with project-based teaching, and many of the technologists becoming Master Teachers are former classroom teachers who have a strong experience base in education that eventually led them into becoming computer coordinators.

The most recent US evaluation report for the Essentials Course indicates that there have been some positive consequences to including these technology educators in the program, particularly by helping to build connections between the Essentials course and the broader technology-related professional development programs in their respective schools or districts. This could result in a much wider circle of influence for the program than individual teachers or schools

Master Teacher candidates with varying skill sets may need different kinds of support in their training. Some will need more training in the technology, some will need extra pedagogical training, and some will need to build their understanding of classroom management techniques. By clarifying the qualities and support strategies that are necessary for Master Teachers to be effective, countries will be better able to make informed adaptations.

Policy setting

The professional context in which teachers work has substantial influence over whether and how teachers follow up on their participation in any professional development program. Professional context is made up of factors such as the professional expertise of local leadership, the coherence and depth of national curricula, the stability of the local teaching staff, and the range and quality of the instructional resources available. These factors are shaped, in large measure, by the national and regional policies on education, and ICT infrastructure. Currently, around the globe many countries are engaged in extensive policy changes to support educational reform. Indeed, the presence of the Essentials Course is often part of an MOE's policy response to education reform.

The country reports indicate that these kinds of factors are influencing the overall success of the program, in two primary ways:

1. As teachers experiment with teaching practices that require more flexible curricula, or that expect more autonomy and creativity of students, they are likely to find that in order to sustain such practices, they need new forms of support and more flexibility. Longer blocks of instructional time, freedom to modify curricular sequences, and endorsement of innovation and experimentation in the classroom are typical issues that arise in schools where teachers are beginning to shift their practices.
2. Both increased use technology for professional activities and increased student use of technology increase teacher demand for access to ICTs. Teachers are likely to want more frequent access, robust Internet connections, and access to more individual machines as they expand their use of ICTs in their teaching. Access outside of school hours and outside of the building is also likely to become more desirable as teachers expand their professional use of ICTs.

Every country participating in the Essentials Course has its own unique set of educational policies in place, which mesh with these shifting needs in different ways. But in every country, the shift toward 21st century teaching and learning is incomplete, and teachers seeking to make use of the ideas they encountered in the Essentials Course are likely to run into circumstances in their teaching too few computers, too brief a class period, too rigid a curriculum sequence. These obstacles may limit the scope or depth of an individual teachers' follow up, discourage a teacher from sustaining new practices over time, or simply prevent a teacher from ever beginning a process of change.

This section discusses specific points of tension that are most commonly arising between national educational policies and the conditions that best support teachers' efforts to follow up on what they learned in the Essentials Course.

Curricular alignment. Intel® Program evaluations are documenting how much variations in teachers' experiences of the Essentials Course depend on length and scope of country investments in moving education reform forward through policy. In Thailand, for example, which has been reforming its national curricula since the passage of the 1999 Thai Education Act, requires that teachers use project-based approaches into their

teaching. Consequently, the Thai evaluation has found that Thai teachers are very receptive to the training since it helps them to achieve a goal set by their Ministry of Education. The Korean evaluation talks about a different scenario with a mismatch between national curricula and the new teaching methods, despite the presence of ICT resources. Korea has a well-developed educational ICT infrastructure, with all surveyed teachers reporting computer labs and almost all having at least one classroom computer. But, the local evaluators report that one of the major barriers to implementation is the misalignment between the national curriculum and the teaching methods presented in the training. The rigidity of the current curriculum (The Seventh National Curriculum[25]) and its tight division into grade and subject areas create a "gap between the Korean national curriculum framework and the *new* way of teaching and learning." This presents a problem for teachers trying to do project-based lessons that lead students into interdisciplinary work. But, Korea is currently engaged in revising its national curriculum, and the local evaluators suggest tightening the alignment between the Eighth National Curricula and the Intel® materials.

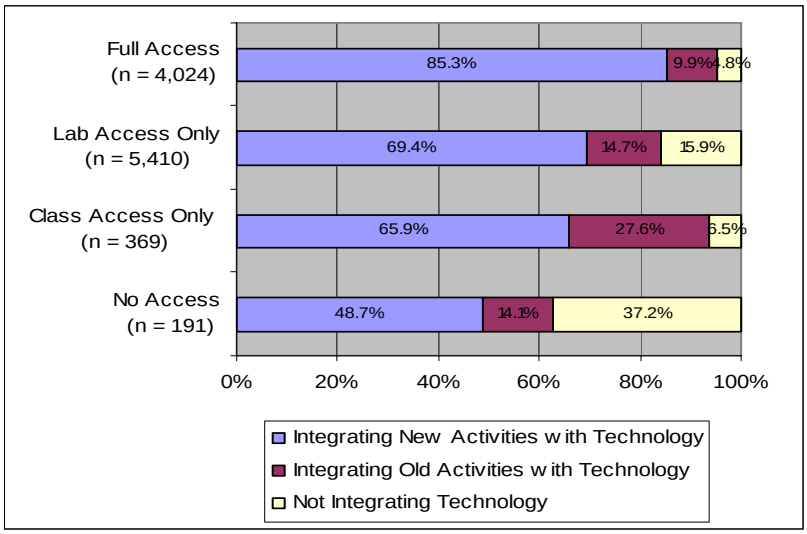
The required curriculum (if there is one) may complicate teachers' ability to follow up on the training. To achieve the objectives of ICT as a tool to support project-based learning, the required curriculum needs to align with those goals as well.[26] Traditionally, curricula have emphasized memorization of discrete facts and processes to provide broad coverage, with little focus on either connecting this knowledge back to the real world of learners' lives or connecting it to the skills and competencies that enable students to become critical thinkers and problem solvers. In order to achieve that breadth of coverage teachers are often pressed to present as much information as possible and students are accustomed to memorizing a vast amount of facts. Project-based learning takes more time but allows students to go deeper into the material and to develop a different set of skills. As education ministries promote ICT use to support project-based and student-centered learning, the national curricula also needs to target these more complex skills and privilege depth of learning over breadth of coverage. When curricula are not aligned with innovative ICT uses, teachers are hesitant to make changes.

Infrastructure. The technological infrastructure on the ground has to align with the strategies and practices that teachers are learning in the Intel® training in order for teachers to easily follow up on the training. Providing and maintaining an ICT infrastructure is a constant challenge, even for schools with resources.

Survey data suggest that teachers' ability to incorporate new technological activities might be related to the technological resources available to the teacher. The data referring to teacher integration of technological activities was assessed with regards to teacher access to technology.

[25] International Review of Curriculum and Assessment Frameworks Internet Archive. (2005). *South Korea Curricula (age 3-19)*. Retrieved January 3, 2006, from http://www.inca.org.uk/1396.html#5.2.5.
[26] Kozma, R. (2005). National Policies that Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology, 1*(2), 117-156.

Figure 8: Computer accessibility and teacher integration of technological activities
(n = 9,994)



Teachers with access to computers in a lab and in their classroom (Full Access) exhibit the greatest percentage of integrating technological activities in new ways (85.3%) in comparison to teachers with only have access through a lab (69.4%), and no school-based access (48.7%). [See Figure 8].

A common problem in many of the local reports is simply the lack of any computers or connectivity in the schools. Many participating countries have government-sponsored computerization programs or networking programs that have not yet reached the participating schools. The evaluation reports from Jordan, Russia, and Thailand all mention this problem and they suggest increased coordination between Intel® Teach to the Future and the MOEs to better align schools participating in the program and schools receiving infrastructure. Brazil went further; and the Brazilian evaluation of the Essentials Course in the rural state of Espiritu Santo, by the Carlos Chagas Foundation, discusses how the program and the state education authorities collaborated to create an effective synergy between them to support the participant teachers. The schools that were targeted for the training also received computer laboratories from the state secretariat of education. In addition, the state created technical support network for the schools using student technicians. The program in Espiritu Santo even began to impact the community as the schools opened their labs for access in the evenings, and invited parents in to view student presentations.

Table 4: Technology infrastructure by country

Country	n	Computer Access				Total
		None	Class Only	Lab Only	Full Access	
Australia	399	0.0%	8.0%	23.3%	**68.7%**	100.0%
Brazil	318	7.2%	2.2%	**54.1%**	36.5%	100.0%
Chile	511	0.8%	1.2%	**73.2%**	24.9%	100.0%
China	2173	1.3%	2.5%	**50.4%**	45.8%	100.0%
Egypt	183	0.5%	0.0%	**88.0%**	11.5%	100.0%
India	1563	1.5%	3.1%	**90.9%**	4.4%	100.0%
Italy	139	9.4%	3.6%	**61.9%**	25.2%	100.0%
Jordan	1303	2.5%	5.8%	**76.5%**	15.1%	100.0%
Mexico	949	0.9%	2.1%	46.3%	**50.7%**	100.0%
Pakistan	565	6.5%	3.2%	**78.8%**	11.5%	100.0%
Philippines	388	2.3%	0.0%	**82.5%**	15.2%	100.0%
Russia	314	4.5%	2.5%	40.8%	**52.2%**	100.0%
South Africa	69	4.3%	5.8%	31.9%	**58.0%**	100.0%
Thailand	244	2.5%	1.6%	**57.4%**	38.5%	100.0%
Ukraine	206	3.4%	11.7%	30.6%	**54.4%**	100.0%
US	1726	0.5%	4.9%	10.8%	**83.9%**	100.0%
Total	11050	2.0%	3.5%	**55.6%**	38.9%	100.0%

Infrastructure issues also exist in schools that have computers. The majority of the schools do not have classroom computers; instead they have computer labs, which may create tension between computer teachers and the classroom teachers for access if the same lab has to be divided between both. The Argentine evaluation found this to be the case in some of the schools visited where participant teachers had to try to schedule lab time around the Computer classes. Also, the computer labs are often perceived as off-limits to non-computer science teachers or non-technology educators. For example, in Thailand the computer labs have specific computer teachers assigned and they have to be present for anyone to be using the computers. Elsewhere, some countries like Japan and Russia reported having a priority system by which teachers in certain subject areas like science or social sciences get precedence over other subject areas such as the languages. This means that the low-priority subject teachers seldom get to use the computer labs. This lab access issue has two ramifications: 1) the teachers are unable to access it for their students, so the students do not get to use the computers, and 2) the teachers themselves are not able to access the computers, so they are not able to use a computer for their lesson planning activities and other administrative chores.

The evaluation report from Egypt, conducted by the National Centre for Examinations and Educational Evaluation, mentioned that most government schools in Egypt were not equipped with classroom computers, but had well-equipped computer labs and media centers. However, they seem to have some kind of system in place, for they do not report

any problems with scheduling lab time. The Korean evaluation report mentioned a very different kind of issue with computer access, in that the teachers had computers for their use in the classroom, and there were computer labs for student use, but the computer labs were not conducive to group work, they were set up for individual student use. This hindered the ability of the Korean teachers to implement student group projects.

Even if lab access is not so much a problem, other issues may stand in the way of adequate access. For example, an evaluation report from India mentioned a school where they had a well-equipped computer lab but still could not use it because of frequent electricity failures. The school had a back-up generator, but the generator fuel was quite expensive and the school did not have adequate funds to buy enough fuel and keep the generator running for long periods.

School leadership support. The school level leadership can also play an important role in ensuring that the school premises and classroom conditions allow teachers to experiment and innovate. The Argentine interview study of 50 participant teachers, conducted by Dr. Schweizer at the University of Cordoba, found that those teachers who had made the most progress in changing their practice were in schools with supportive leadership. The issues that emerged in this study were infrastructure issues around access to the computers for classroom teachers, time issues related to joint planning time for teacher teams, and integrating innovative projects into the school's culture. The Argentina evaluator considers school leadership to be an essential change agent and that "the institutional support does a lot to strengthen the training's processes from supporting innovative lesson plans to facilitating the infrastructure resources, but also in school organization and incentivizing the teachers".

The Thai evaluators also spoke about school leadership. They found that most school administrators were struggling to provide effective support but many did not know how alleviate teachers' competing time demands or solve computer access problems. On closer inspection, the evaluators found that some of the tensions were connected to decisions the school leadership had made. The researchers found that in many schools the same teachers were given a lot of other responsibilities. For example, most of the Intel® Master Teachers had so many other responsibilities they were too busy to train participants. The evaluator also another Thai program that placed one computer in each classroom as a strategy that might alleviate some of the computer access issues.

Conclusion

Intel® Innovation in Education seeks to enhance the role of technology in teaching and learning and to contribute to the improvement of instruction in classrooms worldwide through the Intel® Teach to the Future Essentials Course. The vision of quality instruction that the Essentials Course promotes, which links project-based teaching strategies with student-driven technology use, is closely aligned with the image of 21st Century education that many Ministries of Education and multi-lateral organizations are seeking to achieve.

In every country, establishing a 21st Century educational system that can adequately prepare young people for the challenges and opportunities of a globalized economy requires long-term, incremental change. The countries currently participating in the Essentials Course are each at a unique point in the process of building the human capacity, technical infrastructure, and policy environment that will enable educators to make real, lasting changes in how teaching and learning occurs in their schools and classrooms.

Evaluation of the Essentials Course across many countries suggests that teachers are highly motivated by participation in the course, and frequently follow up on the training by experimenting with new teaching practices and new uses of technology in the classroom. However, every country evaluation suggests that teachers eventually encounter gaps between a vision of teaching promoted by the Essentials Course and the realities of the environment in which they work. Cross-country analysis of the available evaluation data suggests that these gaps emerge at similar moments and in similar ways across countries, although their severity and persistence vary widely. The evaluation data also suggests that these variations are based in the particular configuration present in each country of the following:

The depth and accessibility of the technological infrastructure. Evaluation data clearly demonstrate that individual teachers' access to hardware and networks plays a significant role in shaping the depth and persistence of the program's impact on those teachers. This impact is not simply a function of the number of computers available, but of their accessibility to the teacher and their reliability. Survey data demonstrate that in-classroom computer access (as opposed to lab access only) makes it significantly easier for teachers to increase their use of technology with students. In schools that have computer labs, it is often difficult for teachers to gain access to the labs for their own use on a regular basis. Additionally, the quality and reliability of computers, and the robustness of Internet access, also play a major role in shaping teachers' judgments about whether they can realistically make ICTs a regular part of their instructional repertoire.

The degree of alignment across national goals, local goals, curriculum, teacher preparation, and assessment. In every country included in this evaluation, at least some elements of the educational system are identified with reform efforts in general and 21st century education in particular. But none of these countries have yet achieved full alignment, in which all elements of the system, policies, resources and concrete practices,

are working together toward this common goal. When elements are not aligned, teachers encounter obstacles, such as assessments that do not capture a wide enough range of student knowledge, or requirements for curricular coverage that are in conflict with student-driven models of teaching.

The degree of alignment between the model of teaching articulated in the Essentials Course and the existing, historically and culturally grounded norms for teaching in each country. Comparisons of country-specific evaluations of this course make clear that regardless each country's progress in its broader efforts at reform, every country begins its involvement with the Essentials Course from a unique starting point: norms and expectations about what students should learn, how to teach effectively, and how students and teachers should interact with one another. The localization of the Essentials Course curriculum has been a significant investment in addressing these unique cultural contexts, but has not erased the dramatic contrast, evident in some countries, between the core qualities of good teaching and learning presented in the Essentials Course and the normal practice of teaching and learning that unfolds every day in various countries.

Intel® has taken, and should continue to take, two main approaches to responding to these teachers' encounters with these gaps between their efforts to change their practices and the supports and requirements they encounter in their local environment.

Accommodation of local circumstances, through both adaptation of the curriculum itself and shifts in local program implementation, has been demonstrated in program evaluation to be a highly effective strategy. In many countries where teachers lack ICT literacy, the local program has added an introductory module to help get those teachers ready for the Essentials Course. Many of the local program managers have been quite successful in creating follow-up programs, and provided additional resources tailored to local needs.

Influencing policy by leveraging Intel's role as a valued and trusted partner to Ministries of Education is a second key strategy. Intel® has a track record as an advocate for teachers with a deep understanding of the complexities of how teaching and learning unfolds at the classroom level. Intel® also has a significant body of evaluation research that documents not only program impacts but also how factors like access to hardware, flexibility in curricular structure, and alignment between standards and assessments are influencing the program's success. This means that Intel® team members can document and advocate for policy changes that will improve the alignment of these elements and, over time, improve the opportunities available to teachers to innovate and improve their practice and, by extension, deepen the impact of the Essentials Course in the classroom.

Each of the challenges discussed in this report is being addressed, or can be addressed, through some combination of these two strategies. The following paragraphs revisit these challenges and note how Intel® is or could be responding to them, to increase teachers' opportunities to follow up on their training and, in turn, to advance each countries' efforts to build a 21st century educational system.

Accommodating local circumstances

Teachers' limited prior experience with technology

The Essentials Course was initially designed for educators who had already acquired basic technology skills. However, the Essentials Course is now offered in many countries where large portions of teacher corps do not have such experience, and the proportion of teachers involved in the program who do not have these skills is already large and is likely to grow. Evaluation data demonstrate that teachers' prior technology experience is a key factor shaping their experiences with the Essentials Course: for example, survey data show that teachers with little or no prior technology experience gain less from the pedagogical messages of the course than their peers, possibly because they are focused on learning new technical skills.

Intel® team members have responded to this challenge with a range of modifications to the program implementation model. For example, in some countries, program administrators seek to recruit only teachers who have already taken a technology literacy training. Other country managers have lengthened the trainings to add an introductory module (sometimes known as Module 0), or have modified Master Teacher trainings to focus more on preparing Master Teachers to support teachers' acquisition of basic skills throughout the training.

Each of these strategies seems to have had limited success. Teachers are best served by the Essentials Course when they have basic ICT skills, but it is unlikely that every local implementation of the program will either be motivated to maintain that standard, or will even have enough teachers available who can meet the standard. For long term, the program staff will need to consider how to work in conjuction with Ministries of Education to develop coherent sequences of preservice training and inservice professional development, so that teachers can come into the Essentials Course at an appropriate moment in their professional career path.

Limited prior knowledge of featured teaching strategies

The Essentials Course engages teachers in an exploration of four dimensions of student-centered instruction: project-based approaches to curriculum and student activity, the use of collaborative group work among students, critical questioning and discussion, and teacher-driven, standards-based curriculum development. These approaches to instruction are not ubiquitous in any country and are almost unknown in some. Teachers' familiarity with these approaches varies widely from one country to another.

Survey data show that after completing the Essentials Course, large numbers of participants in many countries do experiment with these instructional strategies in their classrooms. However, case studies and other qualitative evaluation efforts show that in every country, teachers encounter obstacles to sustained innovation in their instructional practice. These findings also show that in countries where these approaches to teaching are least familiar, teachers are struggling to envision how isolated strategies - such as having students work in groups - can become integral parts of a coherent shift in overall classroom practice. All of these teachers need more supportive policy environments that will provide them with the resources and flexibility they need to continue innovating in their classrooms, and with access to sustained follow-up and guidance, particularly in the form of images of good practice, to guide their efforts to improve their teaching.

Logistical and scheduling constraints

The implementation model of a professional development program are often key to its success. The structure of the Essentials Course in each country is shaped by multiple factors outside the program's control such as holidays, costs associated with covering for teachers' time away from the classroom, and regulations governing teacher professional development. In each country the education managers need to strike a careful balance between constraints created by these external forces and the program requirements that need to be maintains to ensure quality. This program covers a significant amount of material and involves a significant time commitment of teachers, and keeping the program feasible for participants while protecting enough time to ensure adequate coverage of the content is challenging. Local evaluators are providing valuable insight to country managers about the specific issues that have emerged in various countries: their local knowledge and close examination of the training process mean that they can provide valuable insight into local needs and how best to meet them while maintaining program quality.

Characteristics of the trainers

A critical element of a successful implementation of the Essentials Course in any country is the program's ability to select and train high-quality Master Teachers, and for these Master Teachers to become part of a sustainable professional development process. Master Teachers need to have a solid knowledge of technology and of teaching to conduct effective trainings. The country programs consistently face challenges recruiting quality Master Teachers who have sufficient preparation in both areas. Intel® Teach to the Future may need to review whether an adequate review process is in place to assess the readiness of teachers to act as Master Teachers, and may need to address this issue by offering extra training or supports to Master Teachers in any areas where they lack sufficient prior experience.

Policy Setting

These challenges to effective implementation and sustained program impact are best addressed through policy change. Each describes a circumstance that creates an obstacle to teachers' efforts to follow up on what they have learned from the Essentials Course.

Curricular alignment

The countries that are involved with Intel® Teach to the Future include many with national curricula which vary widely. But few of the national curricula currently in place easily accommodate the project-based approaches to student activity or the substantial investment in teacher-developed curricular units that are featured in the Essentials Course. The evaluation data suggests that teachers' ability and willingness to make change is limited by the gaps they encounter between the nature of project-based learning and the real curricular requirements they face in their home schools. If education ministries hope to reap benefits from their promotion of ICTs as supports for project-based and student-centered learning, in large part through their investment in the Essentials Course, it will be crucial for them to work simultaneously to revise national

curricula and learning standards. ICTs can only be expected to have an impact on teaching and learning when they are used in a coherent curricular context that is built on a common set of priorities and goals for both how and what students should be learning.

Infrastructure

In order for teachers to follow up on their training, they must have adequate and reliable access to the technologies they need. Evaluation reports have documented teachers' ample creativity and high levels of motivation, as they have consistently found ways to make good use of very limited numbers of computers. But a minimal level of access, as well as access to the Internet, must be available if Intel® or sponsoring Ministries of Education expect to see sustained program impact in classrooms. In addition to basic numbers of computers available, issues including amount and frequency of time available for computer use, adequate space to allow for group work around computers, and reliability of electrical power and Internet connectivity are all immediately relevant to a teacher's or a student's experience of the quality of their access to technology. To support teacher innovation and changes in what and how students work in schools, resources should be sufficient enough to allow classrooms to divide in groups and work on computers, enough time should be planned into the school day for both classroom teachers and computer teachers to engage their students in ICT supported activities, and access within the school to Internet connected computers for students to use throughout the school day.

School leadership support

The building-level leadership can also play an important role in ensuring that the school premises and classroom conditions allow teachers to experiment and innovate. In various Intel® teams have developed forums and other trainings for school leaders to help them learn how to develop and maintain technology infrastructure and to support their teachers' efforts to change their teaching practice. But, to promote and sustain changes in leadership, these changes need to reflected in government policy.

Implications for Evaluation

Two inter-related challenges to the continued evaluation of this program are increasing the coordination and alignment of evaluation efforts across disparate countries, and tailoring evaluation to address appropriate issues as the program matures in each country.

Increasing evaluation coordination and alignment

Maintaining the fundamental independence of each country's evaluation of this program will ensure that local evaluators will be able to do their work in ways that are locally relevant and appropriate, and will allow education managers to continue to tailor evaluations to address questions they choose to pursue. However, as the program continues to scale, educators and policymakers in many countries are interested to see a coherent set of evaluation findings that can adequately represent the scope and depth of the impact of this program across these different settings.

Striking a balance between independence and coordination in the evaluation of this program will require creating shared resources that illustrate the stages of program evaluation and provide possible instrumentation that can be used in various countries as part of an overall evaluation plan. As common questions, approaches, and even specific questions are used across country evaluations, over time, common forms of data will accumulate, allowing for increasingly uniform and coordinated analyses of findings emerging in different countries.

Tailoring evaluation to program maturity and individual country needs

As education managers in each country set strategies for their program evaluations, they will need to consider the maturity of the program in their country and the audiences they hope to reach with the results of their evaluation. During the first stage of program implementation, evaluation is likely to be a primarily formative enterprise intended to guide refinement of the implementation model and further localization of support materials. This may require, for example, a mix of broad-based feedback from program participants and limited, intensive examination of the delivery of the training. In later stages, evaluation may need to shift its focus to monitoring initial evidence of program follow up among teachers, to generate both evidence of program impact for external audiences and further formative feedback to guide further adjustments of program supports, follow-up programs, or longer-term strategic planning for program delivery in a given country. Finally, evaluation may be used to provide deeper or more detailed insight into particular challenges or successes that have arisen in a given country, to provide feedback to Intel® staff and to MOE staff about the need for further policy reform to support program impact over the long term, or to generate detailed evidence of program impact for dissemination to broad external audiences.

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Appendix

Argentina
Assessment of the courses' pedagogic-didactic impact (Word document)
Intel® Teach to the Future
Prepared by Prof. Dra Margarita Schweizer

Brazil
Evaluation of the Intel® Teach to the Future Program in Brasil (PowerPoint)
Prepared by Foundation Carlos Chagas

Egypt
Evaluation of the Intel® Teach to the Future (Word document)
Prepared by National Centre for Examinations and Educational Evaluation (NCEEE)
http://www.nceee.edu.eg

India
Intel® Teach to the Future (India) Program Report
An understanding of the programme (Word document)
Prepared by PQR, a specialist qualitative unit of IMRB International

A Comparative Study of ICT Leadership in Schools: A Case Study of 4 Government-aided Schools in Gujarat. (Word document)
Prepared by The Teacher Foundation

Israel
Intel® Teach to the Future Assessment Report on Assimilating the Program (Word document)
Prepared by Department of Assessment, Achva, Academic College of Education

Assessment of the "Intel® Teach to the Future" Program (PowerPoint)
Prepared by Department of Assessment, Achva, Academic College of Education

Japan
Survey on the Intel® Teach to the Future Program (Powerpoint)
Prepared by Nikkei Research Inc.

Jordan
Impact Survey Report, Intel® Teach to the Future (Word document)
Prepared by Dr. Younes Al Younes, & Mr. Haidar Zaza, Jordan University; and Mr. Ziad El-Nsour, Ministry of Education

Korea
2005 Final Report for Impact Evaluation on Korea Intel® Teach to the Future program (Word document)
Prepared by Korea Institute of Curriculum and Evaluation (KICE)

Russia
Intel® Teach to the Future Program in Russia (Word Document)
Prepared by State Institute for Information Technologies and Telecommunications
http://www.informika.ru/text/index.html

Thailand
Analysis of the EDC After 6 Month Survey for the Intel® Teach to the Future Program (Word document)
Prepared by Thailand Education Development Alliance (TEDA)

The Analysis of (The Result of) the MT Training 2004 (Word Document)
Prepared by Thailand Education Development Alliance (TEDA)

Vietnam
Final Report Intel® Teach to the Future Evaluation
Pre-Service Component at Ho Chi Minh City University of Pedagogy
Prepared by Kim Dung Nguyen and Trung Nguyen Le Nguyen

United States
Intel® Teach to the Future Essentials Course, U.S. Evaluation: 2005 End of School Year Survey Report
Prepared by Education Development Center/Center for Children and Technology