

Multiple factors supporting the transition to ICT-rich learning environments in India, Turkey, and Chile

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ABSTRACT

This research project used instrumental case studies of successful schools from the Intel® Teach Essentials Course in Turkey, India and Chile to examine what contextual factors might facilitate teachers' ability to transfer a professional development program about ICT and innovative teaching strategies into their classrooms given the school contexts in three different developing countries. Seven factors commonly cited in the research literature were used to analyze each case: 1) pedagogical objectives and goals; 2) leadership; 3) professional development and ongoing support; 4) experimentation, adaptation, and critical reflection; 5) time; 6) infrastructure; and 7) financing and sustainability. In all three countries, we found that the educators we interviewed felt the course had helped them change their practice, but we also found that it was a combination additional programs and policies coupled with good leadership that enabled the schools to innovate with the Essentials course.

Keywords: *technology integration, professional development, leadership, pedagogy, systemic reform*

INTRODUCTION

Around the globe, ministries of education are promoting information and communication technologies (ICT) as an element of the modern education systems they strive to build. Governments and international organizations are providing both infrastructure and training to educators in developing countries to achieve this goal, but the research literature highlights the challenges and difficulties of integrating technology into the classroom (Akbaba-Altun, 2006; Cancino & Donoso Díaz 2004; Comenius, 2008; Grant et al., 2005; Light, D., 2008; UNESCO, 2004; Somekh et al., 2003; Vyasulu Reddi & Sinha, 2003). Although, professional development for teachers, such as the Intel® Essentials Course, is a core component of a government effort, professional development alone is not enough. In the wealthy countries, most experts understand that a broader range of factors than just teacher training is needed to support teachers in changing classroom practice. Exploring how technology fits into the complex realities of classrooms in the industrialized nations was a critical step in helping to develop systemic approaches to facilitate this transition (Cuban, 1993; Honey et al., 2000; Somekh et al., 2003). In this study, we set out to explore the important factors in a developing-country context that can facilitate teachers' ability to follow up on professional development and make changes to integrate ICT in the classroom with their students.

We identified successful ICT-using schools from the Essentials Course in Chile, India, and Turkey to explore how schools and teachers have been able to integrate ICT and learner-centered pedagogical approaches into their schools. Using a simple analytical framework of seven key dimensions, described below, the research sought to identify the other resources or supports that were necessary to support the integration of ICT in the contexts of Turkey, Chile, and India. The Essentials Course, a professional development program that offers teachers knowledge and skills to support ICT as critical tools to encourage active student learning, is a core component of Intel's

efforts to partner with national governments to promote educational improvement worldwide. With the collaboration of ministries of education around the globe, Intel has offered the course in more than 30 countries and, by 2008, more than 4 million teachers had taken the course.

To examine the factors that support the integration of ICT into classrooms, we designed instrumental case studies that allow the research team to understand what teachers are actually able to do with their students in each country, to talk with teachers about which aspects of the training were useful to their practice and why, and to learn more about the other factors in each context that have helped these schools begin to integrate ICT tools into their educational programs. In collaboration with local researchers from the Centro Costadigital at the Pontificia Universidad Católica de Valparaíso in Chile and GLOKAL Research Consulting from Eskisehir, Turkey, we conducted case studies of two successful schools in Chile and Turkey. Additionally, we conducted case studies of two schools in India but without the help of a locally based research organization.

THE INTEL TEACH ESSENTIALS COURSE

The Essentials Course is professional development course created by the Intel Foundation and offered in collaboration with ministries of education and local education organizations in over 30 countries. The central content and structure of the course is the same everywhere. The core of the Essentials Course curriculum focuses on preparing teachers to integrate ICT across the curricula as a tool for learning, and to design and implement inquiry-driven, project-based learning activities. The program uses a train-the-trainer model in which Senior Trainers (STs) train Master Teachers (MTs) based in local districts or schools, who then run the course with Participant Teachers (PTs). The standard version of the course is 10 modules over 40 hours, but some countries have expanded the duration of the course (i.e., 60 hours) or have added extra modules before or after the course in response to local needs. However, none of the countries has removed content from the course. Evaluations conducted in many countries have demonstrated the impact of the program (Aydin, Ataizi, & Çalışkan, 2007; Educational Computer Institute, 2003; Kanaya, Light, & McMillan Culp, 2005; Martin & Shulman, 2006; Oakley, 2006; Teacher Foundation, 2005).

The Essentials course is constructed around known attributes of good professional development (Martin & Shulman, 2006), such as focusing on issues that are directly relevant to teachers' everyday work, 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 (Garet et al., 2001; Kennedy, 1999; Loucks-Horsley et al., 1997). The Essentials curriculum guides teachers through a process of developing a complete unit plan using a project-based approach and ICT activities for their students. The implementation in the classroom of the unit plan that teachers designed during the course is a key feature of quality professional development, since it allows teachers to experience and value the new teaching approaches (Guskey, 2002).

ANALYTICAL FRAMEWORK

A large body of research, mostly focused on wealthy countries, has identified a number of common factors shared by projects that successfully integrate ICT into educational programs (Ely, 1990; Fullan, 1991; Hawkins et al., 1996; McMillan Culp et al., 1999). This framework of common factors has begun to be applied to the experience of developing countries (Light, D., et al., 2001; Light, D. 2006). While the exact number of key factors may vary from one writer to the

next, multiple studies have underscored the importance of a minimum core group of factors. We examined seven of these most commonly cited factors to help understand the case studies: pedagogical objectives and goals; leadership; professional development and ongoing support; experimentation, adaptation, and critical reflection; time; infrastructure; and financing and sustainability. This paper reports the studies findings in relation to these seven factors.

METHODOLOGY

We used an instrumental case study approach. In an instrumental case study, the analytical focus is on identifying underlying factors and patterns that can be generalized beyond the case study (Stake, 1995) to inform, in this study, a broader discussion on technology integration and education reform. Chile, India and Turkey were selected because each country has been involved in the program for over five years, and each represents a different region or continent. To identify a sample of exemplary schools, we used an purposive sampling strategy. The cases were selected to represent a *successful ICT-using school* as defined by the national ministry of education and the national Essentials training agency. This process allowed the local stakeholders to determine what they felt would be reasonable expectations for schools and teachers in their country. From the list of schools, the research team made a final selection of two schools in each country.

In India, the local training agency, the Learning Links Foundation, and Intel put together a list of eight schools across India that best exemplified the goals of the Essentials Course in India and, given the context and possibilities in India, fit their own criteria for success. From this list, we selected one urban and one rural school: an English-medium private school in a middle-class neighborhood of Mumbai from pre-kindergarten (pre-K) to Grade 10, and a government-funded village primary school in the State of Gujarat that teaches in Gujarati from Grade 1 to Grade 8.

In Chile, the Ministry of Education, the Intel Education Manager, and local training agency, the Pontificia Universidad Católica de Chile in Santiago, generated a list of schools that met their terms of success. The local evaluation team selected an urban and a rural school: a government-subsidized private school in a lower middle-class neighborhood of Santiago serving pre-K through Grade 12 students and a small municipal school in a rural town from pre-K through Grade 8.

In Turkey, the Intel Education Manager consulted with the provincial education directorates of education to develop a list of potential sites. In Turkey, the directorates of education provide the Essential training. Both selected schools are public schools serving students from kindergarten (K) to Grade 8. One school is in a dense urban environment of an outlying neighborhood of Ankara. The second school is a public school in a small provincial city that serves neighborhood children and has a population of female boarding students who come in from the villages in the province.

For each case study, we conducted interviews, focus groups, and observations with relevant stakeholders. (See Table 1). In every school, we interviewed school administrators, teachers, technology coordinators, students, and the trainers who supported the Essentials Course. Other important actors who were interviewed might include parents and local officials, but these participants varied somewhat in each case depending upon the relevant actors in each location. We also observed standard classrooms as well as the computer lab, if possible. Furthermore, we asked the school to identify some of their best or most innovative teachers because we wanted to see what the best teachers were able to do in each context.

Table 1: Data Collected from all six schools, by country

<i>India</i>		
Mumbai School	Interviews	2 school leaders; 5 teachers
	Observations	5 classes
	Focus groups	14 parents; 37 students; 12
Village School	Interviews	4 school leaders; 3 teachers
	Observations	5 classes
	Focus groups	3 parents; 5 students
<i>Chile</i>		
Santiago School	Interviews	2 school leaders; 3 teachers
	Observations	4 classes
	Focus groups	7 students
Village School	Interviews	3 school leaders; 2 teachers
	Observations	3 classes
	Focus groups	5 students
<i>Turkey</i>		
Ankara School	Interviews	2 school leaders; 8 teachers
	Observations	3 classes
	Focus groups	3 parents; 5 students
Village School	Interviews	5 school leaders; 7 teachers
	Observations	5 classes
	Focus groups	5 parents; 19 students

Although the interview and observation protocols were standardized across countries, both protocols were designed to be flexible given the great variety of contexts among the countries. The observation protocol sought to identify what resources were used and how by capturing descriptive data on classroom learning activities, student-teacher communication, and student ICT use. The observations were conducted by the research team without the presence of school or ministry officials. The interviews were semi-structured with a set of pre-designed prompts but allowing the respondents to answer freely. All teacher and administrator interviews were conducted in private. Parent interviews were done in a group but not in the presence of school personnel. The focus groups were not standardized. They targeted common themes of students' perception of what is a good teacher, and their reactions to ICT in the classroom, but each local researcher decided how best to structure the focus group given the local culture and language.

The field notes were written up and coding using Atlas TI, a qualitative data coding software. We used a deductive coding process using codes were derived from the analytical framework. To ensure greater reliability, we triangulated principal interviews with teacher and parent interviews as well as classroom observation data. When relevant, the student focus groups also provided information that enabled us to cross check the educator interviews and observations. The students interviews were less relevant to our analysis of the factors of success, although that data is discussed in a separate paper on the learning environment (Light 2009)

FINDINGS

In all three countries, we consistently found that no single factor or program accounted for these

schools' ability to move forward. The Essentials Course was one of the factors identified: The educators we interviewed felt they had been able to implement both new ICT activities and new teaching approaches with their students after the course. But, a single course by itself was never sufficient. Instead, a combination of programs and policies, coupled with the motivation and skills of the educators in each building, enabled these schools to innovate. The following sections look across all six cases to outline the findings on the role of each factor in supporting change in the classroom.

1. Pedagogical objectives and goals

The research on educational innovation suggests that it is important for schools to share a reformed vision of teaching and learning in order to create sustainable change at the school and classroom levels. Additionally, in respect to ICT integration, the research suggests that successful projects have clear and consistent messages concerning the role of ICT in supporting that vision, and that teachers see how ICT supports their students' learning.

In all three countries, the ministries of education have undertaken curriculum reforms to promote a variety of constructivist principles (i.e. student-centered learning and a focus on projects, promoting competencies over facts, making learning relevant to the learner) (Cheney, 2005; Valenzuela et al., 2008; Yangin, 2005). However, the research suggests that these reforms have not yet had a widespread impact in schools in these countries (Cheney, 2005; Cox, 2004; Gomleksiz, 2005; Govinda, 2002; Valenzuela et al., 2008; Yangin, 2005). However, the case study schools all appear atypical in this regard. In all six of these cases we found that the teachers and principals articulated similar visions of teaching and learning that were focused on giving students a more active role in their learning, on connecting course content to students lives and supporting student inquiry. Although the vision of teaching and learning present in each school resonated with the national (or state) curricula, each school had interpreted the broad vision into a practical understanding that could be implemented in their context. This process of reinterpretation of an abstract vision of teaching and learning into practical activities appears to be a fundamental step on the process of real classroom reform. Each country was at a different place in their change process, and this was apparent in the case studies.

For example, the Indian education system is moving away from a traditional system based on memorization and testing to support a more student-centered approach to teaching and learning. This change is expressed in the state curricula in terms of curricular frameworks that are often difficult to translate into practice (Rampal, 2002). The educators at both of the Indian case-study schools spoke about their own goals in terms of making learning "joyful" and to "go beyond the textbook." The Head Mistress in Mumbai spoke very clearly about the process of interpreting a goal like "joyful learning" into practical objectives. After she participated in the Essentials Course, the school's leadership realized their mission needed more specificity about the type of learning and the type of activities they sought to create. There are different approaches to teaching that support distinct educational visions, and the school needed to come to a decision about the "best practices" to achieve its vision. The school created two key objectives from the Essentials Course: (1) the school used the Essentials idea about group work to create technology products to promote projects for student teams to create their own products, and (2) the school spread the idea of open-ended questions to invite children to share their perspectives as a way to facilitate classroom discussions.

Carrying these goals into practice promoted two changes in the lives of students: Students were now required to do team projects that were connected to core curricular requirements, but the work was done outside of class time; and, during classes, teachers would invite students to share

their opinions or to bring in their own research on a topic. These are important changes, and ones that teachers are able to understand and put into practice in the classrooms. The students participate more actively in the class and do activities that go beyond the textbook, such as projects and independent research. The students, parents, and teachers all reported noticeable shifts in children's motivation, excitement, and engagement. Parents say their children "no longer fear the teacher," and the students report enjoying the opportunities they get to share their opinions and ideas with the teachers.

The Chilean schools offered an interesting example of the need for schools to reinterpret, or take ownership of, an abstract or broad educational vision. The Chilean ministry has been promoting project-based, student-centered learning since the 1990s, but many experts feel that the changes still have not reached all classrooms (Cox, 2004; Valenzuela et al., 2008). Whereas many schools in Chile appear to have difficulty making changes in the classroom, these two schools reported a deeply felt commitment to this new vision, which they said was based on their students' needs and not the ministry's mandate. Both schools spoke of how the ministry's vision resonated with their ideas of what would be good for students, and of how hard they have worked over the years to put that vision into practice. Both schools had clear sets of practical objectives and expectations for teachers. At the time of our study, the schools had been promoting projects and technology for many years; consequently, they were at a different place than the other schools in the study. This lead was reflected in the types of innovation these schools were now promoting. For example, educators at the school in Santiago were thinking deeply about how to put students more in charge of their learning process and make them responsible for their own learning. Therefore, for this school, student-centered learning means that students should now be involved in establishing the criteria by which their work will be assessed. Teachers were expected to use problem-based teaching approaches, to explain learning objectives to students, and to give students a voice in deciding how to attain those objectives.

2. Leadership

The research literature also indicates that leadership at various levels of the system is important if an innovative project is to take root and grow at the classroom level. Most of these schools function with two levels of leadership—first there is the national or provincial ministry of education that sets overall policy, curricula, and national assessment, and second, there is the building leadership that makes the day-to-day decisions. While issues of national leadership are important for technology projects (Kozma, 2005; Hepp et al., 2004), our research focused particularly on leadership within the schools. Connecting to the discussion in the previous section, the school's leadership is the key nexus in the process of reinterpreting a broad, abstract vision into a practical vision.

The findings from these six schools highlight three aspects of the role of building-level leaders in supporting a process of ICT integration and pedagogical innovation. First, leadership does not come only from the principal. In most of the schools, there were other figures who were strong leaders or advocates for technology and the Essentials Course. And, in each of these schools, the Essentials MT was a key figure in providing ongoing support after the training itself. For example, the Chilean schools had pedagogical coordinators (e.g., the head of the UTP), who were central in encouraging teachers to use technology and new teaching strategies. The school technology coordinators played this role in the Turkish cases. Although the Chilean pedagogical coordinators and the Turkish technology coordinators are official positions in each school, the instructional leaders who proved to be important were not only internal to the school. In two cases, the Essentials STs were important. For example, one of the schools in India was part of a program from a local teacher-education institute, and the program coordinator—who was also the ST—was a strong support for the principal and teachers in integrating ICT and active learning

strategies. And the ST in Çorum, Turkey, worked closely with the teachers as part of the Essentials follow-up programs.

Second, in all of the schools, the leaders of the ICT initiatives do not just set the vision and provide clear expectations for teachers, they provide support and guidance in teachers' classrooms. Most of the teachers had no prior experience with the activities they were being asked to do, and in all six of these schools the principals, technology coordinators, and MTs were often in the classrooms with support, suggestions, and praise. For example, in the school in Ankara, the technology coordinator was a close collaborator with the teachers, planning with each teacher what to do with the students in the computer lab. The principal at the Gujarati village school worked with the students at critical junctures in their projects. And, in the Chilean schools, the pedagogical coordinators were constantly visiting classrooms and planning with teachers.

Third, a central role for the school principal—or the person with administrative authority—is to make key decisions about resource allocation. An instructional leader as described above is very important, but there are also specific administrative and logistic challenges around using ICT that school administrators must solve. All of these schools had resource limitations on time, infrastructure, staff, space, and funding, and the administrators had to find solutions to allow change and innovation to take place with the resources that were available. ICT infrastructure is a constant problem for schools in developing countries, and the decisions administrators have to make are often frustrating because they cannot give all students all the access they would like to give them. For example, one Turkish school has such a large student population compared to the resources of the computer lab that the school felt compelled to make a decision to give priority access to a limited number of grades. Time, also, is a constant challenge in many schools. We have already commented on the strategy of the Indian schools to do the projects as an afterschool activity, and schools in both Turkey and India have made Internet research a core homework assignment (and both schools attempt to make computers available for afterschool use).

3. Professional development and ongoing support

For much the same reasons that supportive leadership is important in helping teachers innovate, ongoing professional development also appears to be a critical factor. In the context of education reform, the tools and teaching strategies are new to many of the teachers; therefore, both the quality of the professional development courses and the presence of ongoing support for teachers in their classrooms are important. First, the case studies suggest that the Essentials Course offers teachers multiple points of entry into practices supporting ICT use and student-centered teaching. This allows teachers to begin changing their practice from whatever point their context and current practice requires. Teachers in India, for example, were using the Essentials Course to support both project-based learning and the use of open-ended questioning strategies, while teachers in Chile were digging into the use of holistic rubric assessments.

The case studies also highlight two features of the teachers' professional learning occurring in these schools: the importance of using the Intel unit in the classroom as part of the program follow-up, and the informal professional communities that exist in these schools.

Designing their own unit plan is a key strategy of the Essentials Course, and the case studies suggest how important it is since it helps teachers bridge the gap between the theoretical discussion of a training course and the practical needs of classrooms. A common feature in all of these case studies was that the schools actively promoted the teachers' use in their classrooms of the unit plans designed during the Essentials Course. The chance to implement an ICT-rich,

student-centered activity allowed teachers to experiment and see for themselves how these new ideas, tools, and approaches could work in the classroom. This happened in each school. In Turkey and India, all four schools participated in the formal facilitation process (with MTs and STs) that is part of the Essentials Course in those countries. The classroom teachers credited the MTs and STs with being a great help and a constant source of encouragement. Chile did not have a formal process, but the pedagogical coordinator in each school supported the teachers in their experimentation with the Essentials-designed unit plans.

Another important characteristic of these schools, which helped them leverage the Essentials Course as a part of the change process, is that each of these schools has established a culture of constant improvement and professional learning. Educators at all of the schools talked about teachers meeting in groups to plan and discuss new strategies and to share challenges and successes. For some schools, these were faculty-wide meetings for sharing and planning; at other schools, it was part of special project teams or grade-level meetings. For example, each year the teachers at one of the Turkish schools and one of Chilean schools plan a common professional-development agenda for the year, and the school creates time for the teachers to meet and discuss new topics or bring in outside speakers to present. The school in Mumbai frequently sends teachers to new professional development programs, and they share new topics with their colleagues when they return to school. And the teachers at the village schools we visited in Chile and India also had common meeting times to discuss their teaching and to plan together.

4. Experimentation, adaptation, and critical reflection

These six schools offer interesting insight on the research literature's perspective regarding the importance of experimentation for ICT integration and education reform. The case studies reveal the role a culture of experimentation plays in school-wide change and its relationship to leadership, pedagogical goals, and professional development. Educators in all of these schools exhibited a willingness to experiment and take on the challenges of trying to do new things. If professional development provides teachers access to information about new tools and practices, there must be a willingness to experiment with novel ideas, and an openness to reflect on the successes and failures, in order to create positive changes.

In these schools, the culture of experimentation is promoted by the leadership and is in line with each school's pedagogical goals. The leadership in Mumbai, for example, was very explicit about piloting new ideas and gathering critical feedback from teachers and students to decide how to proceed. For example, the schools' trustees piloted a computer lab and evaluated its use and, in doing so, discovered that the students liked the lab but the teachers had more reservations. From that finding the school developed a strategy—including the Essentials Course—to promote deeper integration by working with the teachers and providing ICT-based curricular resources.

The leadership of some schools also established a culture that was willing to trying anything that might help their students. For example, the pedagogical coordinator from the Chilean village school expressed her desire to search out and sign up for new programs, commenting, "When you have nothing, you'll put your name in for anything." The faculty at the school also knows that they will get help to try out new things, and there are no negative consequences for them if the experiment is not successful.

The experience of a teacher in Turkey highlights the importance of a culture of experimentation as well as the importance of the broader school community understanding and valuing innovative activities. A classroom teacher at the provincial school had tried a few technology and student-centered activities before the Essentials Course. According to him, "My innovative efforts were

booed. But then Intel gave me the framework to show everyone how [my methods] can be effective.” He reported that teachers’ initial resistance changed once the Essentials Course helped change the broader school culture to value experimentation with ICT. Now he and his colleagues come together and share the experiences they have had with their new strategies, both pedagogically and with technology. They use this to reflect upon and improve their teaching.

5. Time

Much like a physical resource, time is a scarce resource that schools must manage carefully. Time has to be viewed in two dimensions: (1) teachers’ professional development and planning time, and (2) students’ time in the classroom or learning activity. Each school developed their own strategies depending on the particularities of the larger system. Some strategies were teacher-specific, such as a teacher in Turkey who, after experimenting with different divisions between classroom and lab time, decided that weeklong projects worked best, using the first three days for classroom lectures and the last two days in the lab for students to do their research and build a presentation. But most of the schools had to develop a school-wide approach to organizing teacher and student time. For example, to provide sufficient planning time for teachers, the provincial Turkish school used two weeks at the beginning and two weeks at the end of the school year to meet and plan and train together. Because they were unable to make major modifications in the use of time during the class periods, both schools in India integrated project-based activities as afterschool opportunities for their students. The Chilean schools benefited from the government’s expansion of the school day to at least eight hours, and teachers at both schools reported being able to do projects and to easily schedule extra computer time if needed.

6. ICT infrastructure

In most developing countries, ICT Infrastructure also is commonly a limited resource in schools. With limited resources, it is often difficult for schools to provide sufficient access so students can use ICT during their classes. The case studies suggest that no single strategy will work for all schools with resource limits. Instead, each school developed unique strategies to provide meaningful learning activities using ICT tools, whether it was teachers using ICT-based teaching aids or student ICT use.

Although both the Indian schools had computer labs, there were still too many students to give classes consistent and frequent ICT access during the school day. Thus, the schools in India distributed part of their ICT resources in such a way as to enable teachers to use ICT-based teaching aids during class time, and students worked on ICT projects after school. In Mumbai, the school had a computer connected to a large TV in each classroom, and the village school had a computer and projector that could be moved around the school. The Turkish schools sought to integrate student ICT use into the classroom. Although both schools in Turkey had similar problems with limited resources, each school developed its own solutions. One school concentrated ICT efforts on the middle-grades classrooms; the other school assigned certain classes to do ICT projects each semester, and rotated the assignments throughout the year. Chile, in this regard, was atypical: It is a smaller country, and the government has invested heavily in building out the infrastructure. Both schools reported sufficient infrastructure and class time to do ICT activities during class, as the teachers required.

7. Financing and Sustainability

Costs and sustainability are ongoing challenges for all of these schools when attempting to bring in new, complex resources such as ICT. These schools attempt to do two things to manage sustainability of their ICT activities: First, they try to obtain resources from as many sources as possible, and second, they try to control the costs related to ICT activities.

All of the successful schools utilize multiple strategies to obtain funds or ICT resources. There are three basic sources of funding the schools rely on. First, all three countries have government programs that provide an infrastructure to support these schools. The government programs provide the schools with a basic level of resources, but each of these schools has gone farther. A second critical source is the community: These successful schools have developed good relations with the surrounding community, and the communities value the ICT initiatives of the school. The Indian village school, for example, was the first school in the state to raise funds from the community to buy its own computer, back in 2002. The Turkish schools reported strong support from the parents' associations, which provided both schools with broadband Internet access. And the schools also received support from companies, such as Intel, which donated 300 Classmate PCs to the school in Ankara. Finally, some schools had their own small sources of revenue: Some of the public schools have concessions, such as a school café or a photocopy shop.

These schools also attempted to control other costs associated with ICT, such as ink, paper, and peripherals. Some schools limited the amount of printing students and teachers could do. For class projects such as printing a booklet or making posters, schools sometimes required that students purchase the paper. Not all schools had peripherals available, such as digital cameras or scanners, and some principals reported that this was a due to cost factors.

CONCLUSIONS

This paper presents the findings from our fieldwork describing the factors that enable the schools to make changes in the classroom. While it is not surprising that issues such as leadership or infrastructure are important, this paper provides more detail about how these factors must work in coordination to promote success.

Our findings suggest that necessary changes are much broader than just the introduction of a new tool or one new practice through a professional development course. In each context, the teachers found points of engagement between the model of ICT use and teaching in the Essentials Course and the possibilities and limits of their context. For Indian teachers, it was most feasible to integrate aspects of the teaching model (i.e., open-ended questions) into their classroom and the ICT into after-class time. In Turkey, schools brought ICT activities into scheduled lab time and group work into their class activities. And Chilean teachers used holistic assessment strategies and inquiry-based projects in class because their school day provides a block of time for projects. But these changes appear to require the alignment of a number of other factors—from a practical vision of teaching and learning, to supportive leadership, to a strategic utilization of time and resources.

The responsibility for change cannot rest solely on the shoulders of the teachers—bringing about these changes is a long-term, incremental process. There is a broad range of factors, from leadership to funding to effective professional development, that help create and sustain the conditions for change. 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 assessments. In the end, the success of teachers is dependent on the conditions in which they work.

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