

**Emerging changes in ICT-rich learning environments:
The Intel® Teach Essentials Course
and changing teacher practice in
India, Turkey, and Chile**

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Executive Summary

Understanding how technology fits into the complex realities of classrooms was a critical factor in creating real change in the industrialized nations,¹ yet little is known about how educational technology projects are impacting the classrooms of the developing world. This study looked at successful schools from the Intel® Teach Essentials Course in Chile, India and Turkey to explore how schools and teachers have been able to integrate ICT and the pedagogical approaches from the Essentials Course into their schools and how these changes are, in turn, changing what happens in the classroom. The Essentials Course, a professional development program that offers teachers the knowledge and skills to integrate information and communication technologies (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.

The Education Development Center (EDC) decided that instrumental case studies of successful schools would be most informative at this early stage of emerging knowledge of the use of ICT in classrooms of developing countries. This allowed the research team to understand what teachers are actually able to do with their students in typical schools 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 factors in each context that have helped these schools begin to integrate ICT tools into their educational programs. In collaboration with the Centro Costadigital at the Pontificia Universidad Católica de Valparaíso in Chile and GLOKAL Research Consulting in Eskisehir in Turkey, EDC conducted case studies of two successful schools in Chile and Turkey as well as in India to examine how they created change in *their* contexts. In each case *success* was defined by the local stakeholders - the Ministries, training agencies and Intel Education managers - to represent what they felt would be reasonable expectations for schools and teachers in their country.

This project addressed two research questions regarding the impact of the Essentials Course on classroom learning in a diversity of national contexts.

- **Supporting change at the school-level.** What are the factors that facilitate teachers' ability to follow up on the training with their students?
- **Changes in the learning environment.** Within each context, how are teachers able to follow up on the training with their students in their classrooms and in their schools?

¹Cuban, L. (1993). *How teachers taught: Constancy and change in American classrooms 1890–1990*. New York: Teachers College Press; Honey, M., McMillan Culp, K., & Carrigg, F. (2000). Perspectives on technology and educational research: Lessons from the past and present. *Journal of Educational Computing Research*, 23(1), 5–14; Somekh, B., Lewin, C., Mavers, D., Fisher, T., Harrison, C., Haw, K. et al. (2003). *ImpaCT2—Pupils' and teachers' perceptions of ICT in the home, school and community*. London: British Educational Communications and Technology Agency.

Although each country is unique and each school is at a different starting place, all are moving toward more student-centered, project-based, and ICT-rich classroom learning activities. Across the diversity of their situations, educators in each school connected the ideas and tools offered in the Essentials Course with their own needs.

In all three countries, we found that 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. Additionally, we consistently found that no single factor or program accounted for these schools' ability to move forward. Instead it was a combination of programs and policies coupled with the motivation and skills of the educators in each building that enabled the schools to innovate. The ICT activities and teaching approaches that teachers applied to their work with students varied, however, due to differences in each country's broader educational context.

The Intel Teach Essentials Course

Over the years, program evaluations have found that teachers across a variety of countries value their experience in the Essentials Course and report using ICT and/or making changes in their teaching practice following the program.² 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, 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.³ 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.⁴

Methodology

EDC 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 study⁵ to inform, in this instance, a broader discussion on technology

² Light, D., McMillan Culp, K., Menon, R., & Shulman, S. (2006). *Preparing teachers for the 21st Century classroom: Current findings from evaluations of the Intel Teach to the Future Essentials Course*. New York: EDC/Center for Children and Technology; Light, D., Menon, R., & Shulman, S. (2007). *Training Teachers across a Diversity of Contexts: An Analysis of International Evaluation Data on the Intel® Teach Essentials Course, 2006*. New York: EDC/Center for Children and Technology.

³ 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.

⁴ Guskey, T. R. (2002). Professional development and teacher change. *Teachers & Teaching*, 8(3/4), 381–391.

⁵ Stake, R. E. (1995). *The art of case study research*. Thousand Oaks: Sage Publications.

integration and education reform. The cases are selected to represent the desired outcome. For this study, the schools were selected because of the strides they have made in integrating ICT and innovative teaching practices into their classrooms.

For each case study, we conducted interviews, focus groups, and observations with relevant stakeholders. In every school, we interviewed school administrators, teachers, technology coordinators, students, and the MT or ST who supported the Essentials Course. Other stakeholders might include parents and local officials, but the stakeholders varied somewhat in each case depending upon who were the relevant stakeholders 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.

Selecting case study countries and schools

India: Given the context of India's educational challenges, EDC sought to identify schools that were attempting to change both teaching practices and the use of ICT with students. To identify a sample of exemplary schools, 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. The list contained both government-funded and private schools. Some schools were English-medium, meaning they taught in English, and others taught in local language. The research team made the final selection. The schools selected were the Ashok Nagur campus of the Children's Academy in a middle-class neighborhood of Mumbai, and the Fatehpura Anupam Primary School in the Gujarati village of Fatehpura. The Children's Academy is an English-medium private school from pre-kindergarten (pre-K) to Grade 10, and Fatehpura is a Grade 1 to 8 Gujarati-medium public school.

Chile: The Ministry and the Pontificia Universidad Católica de Chile in Santiago, which oversees the program nationally, and the Intel Education Manager met with the local evaluation team to generate a list of schools that met their terms of success and were "typical" Chilean schools. The local evaluation team reviewed the list to make the final selections. The schools selected represented a government-subsidized private school in a lower middle-class neighborhood of Santiago Chile and a small municipal school in a rural town. The private school, Colegio El Sembrador, has students from pre-K through Grade 12, and the village school, Escuela Pedro Aguirre Cerda, goes from pre-K through Grade 8.

Turkey: The Intel Education Manager worked with the local evaluators and EDC to discuss selection criteria, considering issues of location, size, and level. The Education Manager consulted with the STs and provincial directorates of education to develop a list of potential sites, and the final selection was made by the Turkish evaluation team. Both schools are public schools serving students from kindergarten (K) to Grade 8. Burak Reis School, in an outlying neighborhood of the national capital Ankara, is in dense urban environment. The second school, Mustafa Kemal School YIBO, is a public school in the

small city of Çorum. This school serves neighborhood children and has a population of female boarding students who come in from the villages in the province.

Factors that facilitate change at the school level

To answer the first research question about the factors that support change, we focused on examining seven 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.⁶ The data from the six schools we visited provide insight into the mechanics of how these factors function in the context of developing country schools.

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. In all six cases we found that the educators we interviewed talked about a vision of education that was student-centered, encouraged projects and student inquiry, and supported students doing research and bringing their perspectives into the classroom. Additionally, the visions of learning that these educators articulated were tailored to their particular schools. The schools were able to translate a broad, abstract vision, such as “student-centered learning,” into a set of practical goals and objectives that were relevant to actual classroom practices and meaningful to teachers in their schools. And technology was seen as a learn tool that would support this vision.

2. Leadership

Leadership at various levels of the system is important if an innovative project is to take root and grow. 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-

⁶See Ely, D. (1990). Conditions that facilitate the implementation of educational technology innovations. *Journal of Research on Computing in Education*, 23(2), 298–305; Fullan, M. (1991). *The new meaning of educational change*. New York: Teachers College Press; Hawkins, J., Panush, E. M., & Spielvogel, R. (1996). *National study tour of district technology integration summary report* (CCT Reports No. 14). New York: Center for Children and Technology; Kozma, R. (Ed.). (2003). *Technology, innovation and educational change—A global perspective. A report of the second information technology in education study: Module 2*. Eugene, OR: ISTE; Light, D., & Manso, M. (2006, April). *Educational technology integration in developing countries: Lessons from seven Latin America SchoolNets*. Presentation at the Annual Meeting of the American Educational Research Association, Seattle; McMillan Culp, K., Hawkins, J., & Honey, M. (1999). *Review paper on educational technology research and development*. New York: Center for Children and Technology; Pérez, P., Light, D., Vilela, A. & Manso, M. (2003). Learning from the pioneers: A study on the best practices of the network TELAR. *Interactive Educational Multimedia*, 6, 17–39.

day decisions. While issues of national leadership are important for technology projects,⁷ our research here 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 suggests three observations 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.

Second, in all of the schools, the leaders of the ICT push 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.

Third, there are also specific administrative and logistic challenges around using ICT that school administrators have to 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 that they would like to give them.

3. Professional Development and Ongoing Support

For much the same reasons that supportive leadership is important to 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 in these schools. Therefore, both the quality of the professional development course 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.

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.

⁷ 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.

Designing their own unit plan is a key strategy of the Essentials Course, and the case studies suggest how important it is. A common feature in all of these case studies was the teachers' use of the unit plans designed during the Essentials Course in their classrooms. 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.

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, and at other schools, it was part of special project teams or grade-level meetings.

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 schoolwide 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. In these schools, the culture of experimentation is promoted by the leadership and in line with each school's pedagogical goals. If professional development provides teachers access to information about new tools and practices, there needs to be a willingness to experiment with novel ideas and an openness to reflect on the successes and failures in order to create positive changes.

5. Time

Much like a physical resource, time is a scarce resource that schools need to carefully manage. Time needs 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, where an individual teacher might make their own arrangements to find extra time on the computers. But, most of the schools needed to develop a schoolwide approach.

6. ICT Infrastructure

In most developing countries, ICT Infrastructure is also commonly a limited resource in schools. With limited resources, it is often difficult for schools to provide sufficient access so that 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.

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 now have government programs that provide an infrastructure to support these schools. But 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 schools also received support from companies, such as Intel, which sometimes donate computers or other resources. Finally, some schools had their own small sources of revenue from school concessions, such as a school café, or from fees.

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. And for class projects like 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.

Changes to the classroom learning environment

The previous section discussed the common factors across all six schools that supported teachers and schools in making change, here we address the changes that are emerging in classrooms after the Essentials Course, given the diversity in local contexts. Turkey, India, and Chile represent three different regions of the world; each country has a different history, different education system, and different challenges, yet from our case studies of the six schools, we identified four common dimensions of change that are emerging to support more project-based and ICT-rich activities in the classroom: changes in teachers' knowledge, beliefs, and attitudes; changes in how students engage with content; changes in relationships among teachers, students, and parents; and changes in the use of ICT tools to promote students' learning.

1. Changes in Teachers' Knowledge, Beliefs, and Attitudes

Because all schools in the study were considered successful, we explored what teachers had changed in their own practices. In the interviews, we asked teachers to discuss what they had learned from the Essentials Course that was useful for their classroom practice. Three themes emerged across all six schools as the teachers spoke about what they found to be valuable for their teaching: (a) their beliefs about how students learn were shifting; (b) they had a deeper understanding of new teaching strategies; and (c) they had improved their knowledge of how to use ICT as a learning tool, as well as strengthening their ICT skills.

a. Teachers' beliefs shifted to a constructivist paradigm of teaching and learning.

Teachers expressed a growing belief that students could learn through exploration and discovery. The Essentials Course and, more importantly, the experience of implementing a project-based or ICT-rich learning activity appeared to influence teachers' understanding of how children learn. The interviews suggested the teachers began to value learning as different from memorization and to see that students could learn by exploring content, conducting research, and applying knowledge to real problems. In all six schools, teachers also expressed their belief that students learn more than just content with projects and Internet research. Many teachers recounted what they did "before" and "after Intel," and their descriptions consistently included how students "learn more deeply," "have more confidence," and "are more motivated" by the new ways of learning. They reported that students were developing skills and attitudes such as self-assurance, curiosity, collaboration and teamwork skills, presentation skills, and organizational skills.

b. Teachers deepened their understanding of student-centered practices. Teachers reported improving their skills with innovative teaching practices. Although some countries had more experience than others, across the board, nearly all the teachers we interviewed valued project-based approaches and reported doing projects with their students. Teachers had very clear ideas about how project-based approaches could support student learning by allowing students to explore content as they respond to a research question or problem posed by the teacher. They felt the project approaches made the content more relevant to students and required greater intellectual effort for students to find and synthesize information, which led to students learning and retaining more information.

While teachers from all three countries agreed that the Essentials Course supported their use of student-centered practices, each country's context and educational goals influenced which topics were of most interest to teachers. For example, while all the teachers spoke about using group work and collaborative learning, the teachers in Turkey were very excited about the collaboration strategies presented in the Essentials Course. Turkey's traditional approach to teaching is lecture-based and emphasizes individual student activities, and teachers reported that they did not have any previous experience with collaborative learning. Group work and collaboration are, however, part of the new Turkish curriculum and reform efforts, and teachers expressed appreciation for how the two programs supported each other.

In India, teachers found the "Essential Questions" strategy to be compelling. Essential Questions (e.g., Why do we need others?) are intriguing, open-ended questions that organize a project and are an effective way to encourage students to think deeply and to provide them with a meaningful context for learning.⁸ The Indian curriculum is very demanding and the school day is crowded, so teachers felt that they could not easily integrate project work into every class. While they could not do projects during the class

⁸ Wiggins, G. P., & McTighe, J. (1998). *Understanding by design*. Alexandria, Va.: Association for Supervision and Curriculum Development.

period, they were, however, exploring the use of questioning strategies to push students' critical thinking and to allow students to share their perspectives and formulate their own conceptual understandings of the content.

In Chile, where schools had previous experiences doing projects, teachers focused on the use of rubric assessments presented in the Essentials Course. The teachers were facing increasing challenges in assessing students' work as the school moved toward complex, technology-rich student products, such as presentations and websites. Through these products, students mastered more than just content, and teachers wanted to value all aspects of students' learning and rubrics are designed to capture the range of skills, attitudes, and content that students develop.

c. Teachers improved their ICT knowledge and skills. Teachers reported that they had developed the skills needed to initiate or increase the use of ICT with students. Regardless of they were new to ICT or experienced ICT users, all teachers we interviewed who took the Essentials Course reported they increased their knowledge of how to use ICT as an educational tool. The strategy of having teachers design a model unit of their own choice appears to allow teachers to work on skills and areas that are new and challenging for them.

2. Changes in How Students Engage with Content

The introduction of ICT into schools and the use of project-based approaches and Internet research have changed how students interact with the content in a number of ways. In the site visits, teachers and students spoke about three types of new learning activities that would, according to the literature, contribute to a constructivist learning environment: (a) learning through projects, (b) conducting Internet research, and (c) connecting school content to students' lives.⁹

a. Project-based work gave students a chance to collaborate, use multiple resources, and direct their own learning. In all the schools, student projects were fundamental to bringing student-centered instructional strategies into the classrooms. The Essentials-trained teachers we interviewed spoke of doing projects with their students. Despite variations among project designs, a few core features emerged. In almost every site, projects gave students chances to work collaboratively and challenged them to take on new roles and responsibilities; students worked in groups and often had to coordinate efforts to complete the projects. Also, all of the projects described included research and culminated in a final product that required students to synthesize and share what they learned.

b. Independent Internet research gave students autonomy and a chance to develop and share their own perspectives. Internet research was a constant theme in these schools. Teachers, students, and parents all spoke about having students do Internet research for

⁹ Windschitl, M. (2002). Framing constructivism in practice as the negotiation of dilemmas: An analysis of the conceptual, pedagogical, cultural, and political challenges facing teachers. *Review of Educational Research*, 72(2), 131–175.

homework and as part of the projects. Teachers often asked students to bring in additional information on topics in the textbook, or to research additional topics or themes.

c. Connecting school content to students' lives made learning more meaningful to students. We found that many of the projects teachers designed connected students' school work to their home life and their community. In a very simple sense, the increased use of practices such as open-ended questions and group work allowed students to share the perspectives and knowledge they bring from home. Yet many of the project topics also engaged students in examining real-world issues or concerns that gave them an opportunity to connect "school learning" with the real world and allowed them to develop their own opinions and perspectives about the issues. For example, students did projects on clean water and public health or collected stories and images from the community to publish in a booklet for their families.

Our interviews with parents in the Indian and Turkish sites also supported the perception that students were becoming a source of new information for their families. Parents credited their children's increased use of Internet research with providing them with current information to which they would not otherwise have had access. Students are generally more excited by information they find themselves than the contents of a textbook, and parents reported that their children were rushing home, eager to share what they had discovered.

3. Changes in Relationships among Teachers, Students, and Parents

In keeping with the new activities and roles for students, the teachers and students in the schools we visited reported that they were transforming how they interacted. The changes in teaching practices in these schools are part of a broader change in relationships within the school and between the school and the community. The educators and students described changes in the ways they collaborated with each other that grew out of the new teaching practices (e.g., project-based approaches, open-ended questions), integrating ICT into the schools (e.g., Internet research or presentations), or both. We noticed that teachers, students, and parents reported changes in three sets of relationships: (a) among the students; (b) between students and teachers; and (c) between the school, the parents, and sometimes the community.

a. Projects and ICT activities fostered collaborative relationships among students. Many of the teachers and parents interviewed said that students were developing a range of social and interpersonal skills that they attributed to the projects and the new roles that students were taking on. As noted, students in every school were taking on new responsibilities as they worked on projects—leading teams; conducting research; writing reports; debating with peers; and making presentations to peers, teachers, and parents.

b. New teaching strategies allowed teachers to develop more collaborative and interactive relationships with their students. The teachers reported that, as their teaching practices changed, their relationships with their students also became more open and supportive. Teachers began to allow more intellectual discussions between themselves

and their students, and students were more willing to approach teachers and share concerns and opinions.

c. Innovating with projects and ICT strengthened the relationships between the school, parents, and the community. The parents we interviewed were excited by the introduction of community-focused projects and student research, and they expressed pride in what the schools were doing for their children with technology. Parents and the community frequently initiated efforts to bring additional ICT resources to the schools by donating equipment or paying for improved Internet connections.

However, the parents also remarked on the new teaching practices and what these changes meant for their children. All of the parents we interviewed commented on how the school was developing the whole child since the project work was supporting teamwork, independence, and self-confidence. Parents highlighted their children's growing confidence and independence to do research or make public presentations, and they also noted the caring relationships between students and teachers.

4. Changes in the Use of ICT Tools to Promote Students' Learning

A core aim of the Essentials Course and a central objective for the ministries in Chile, Turkey, and India is to encourage the use of ICT as a learning aid for students. Although the administrators and teachers we interviewed in all six schools told us they wished they could do more, to the extent permitted by resources, space, and time, students were using ICT for learning activities. PowerPoint presentations and Internet research were, by far, the most common ICT tools that students used.

All six schools promoted student use of ICT, but each adopted different strategies to realize its goals. In Turkey and India, with short school days and tight schedules, the teachers had to strategically make time—either by working outside of class or rationing access—for students to complete their ICT projects. The Chilean teachers had more flexibility to schedule lab time during school hours, although they also did afterschool activities. Perhaps the clearest change is that, in all six schools, teachers gave students Internet research activities for homework.

Conclusion

This paper presents the findings about the nature of the changes taking place in the classrooms in these six schools and the factors that enable the schools to make these changes. Since the governments point to these schools as positive examples, their experiences can help contribute to an understanding of the process of integrating ICT into the schools of developing countries.

While some educators we observed are more skilled than others, and some changes in practice are just emerging, all six schools are making changes beyond just the use of new tools. The teachers are developing new beliefs about teaching and improving their knowledge of new practices; their students are engaging with content in new ways; and the relationships between teachers and students are changing relationships. And, both

groups are using new ICT tools to support learning. That three of the four common dimensions of change are pedagogical shifts, and that they are changes in pedagogy that are supported by the ICT, illustrate the paradigm shifted required for effective ICT integration.¹⁰ These findings illustrate the complex sets of changes that have to occur for ICT to be deeply and meaningfully used to support student learning. This would explain why technology integration is so difficult to achieve but also points the way forward.

Our findings suggest that necessary changes are much broader than just the introduction of a new tool or one new practice. Instead, change begins by deeply reshaping life in the classrooms—from educators’ beliefs about learning to the relationships that make up the school community. 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 the responsibility for change cannot rest solely on the shoulders of the teachers—bringing about these changes is a long-term, incremental process. There are 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. If those conditions foster innovation and change, then teachers will be able to use a program like the Essentials Course to change the classroom learning environments they offer their students.

¹⁰ Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How People Learn: Brain, Mind, Experience, and School: The Expanded Edition*. Washington, DC: National Research Council/ National Academy Press; ; Hepp, Hinostrroza, Laval, & Rehbein, 2004.