Chapter 7
Information and Communication Technology

Education systems across the globe are beginning to reap the benefits of ICT. In Bangalore, India, students at the Indus International School are using technology to accelerate learning and develop critical thinking and problem solving skills. Students across the entire state of Pernambuco, Brazil, are preparing to participate in a global economy through technology transformed learning and teaching. And Peru is transforming the port city of Callao into a Digital City. These are but a few examples of how technology is being leveraged to transform society and spark economic growth.

Whether you are in a country with robust infrastructure and investment in technology, or if you are currently without Internet access or technology, there are steps you can take to move toward Project RED's 1:1 model for academic and economic success.

Starting the ICT Journey

Many education systems are just beginning the ICT journey. In these situations, a good first step is to take an inventory of the technology, software, and infrastructure that is currently available, and maximize the potential of what you currently have.

The Importance of Basing Device Choice on Learning Goals

Budget-conscious schools and educational systems might be tempted to purchase inexpensive devices with fewer features than full-functioning computers, but such a move can actually cost more if the new devices do not meet all the needs of students or teacher.

In selecting a mobile device for classroom use, it is important to view it as a total learning platform and look for a device that supports the learning goals.

Auburn City Schools (Alabama, U.S.) engaged in a comprehensive approach to their 1:1 program. They focused on student and district goals to drive their practices, decisions, and related assessments. The administration tasked teachers and students with defining what success will look like at their schools and how the devices will be used. Then teachers and students were empowered to choose the device they preferred to meet their usage needs and that would help them achieve the success they envisioned.

See more about Auburn, Alabama's technology program

View video

Value of Cloud Infrastructure

Uninterrupted access to the Internet is an important goal for a globally competitive education system. Within an education system, the main objectives are to leverage ICT to accelerate learning, and enable greater efficiencies that lead to cost savings.

In countries with universal access to the Internet, cloud-based management solutions can be used to provide better services to the schools while at the same time reducing ICT requirements and costs at the school and national level. As all the main administration and education applications are setup and managed in the cloud, minimal infrastructure and applications need to be installed at the school level. This reduces costs in installation and maintenance, school IT staff, as well as school electricity requirements. Furthermore, this model reduces risks of school/teacher/student data being lost or damaged. While many of these functions can happen in the cloud, privacy and security concerns may require this functionality on local school or district/municipality servers.

Resource: Transitioning from 20:1 to 1:1

Intel created the following Technology Adoption Model to guide strategy and planning for moving from a student computer ratio of 20:1 to 1:1.

Intel's Education Transformation Technology Adoption Model

The objective of introducing an education cloud is to provide a highly available and advanced service of software applications to:

- Accelerate students learning and development through personalized, adaptive, and active learning tools and methods.
- Provide up-to-date online curriculum content at lower cost than print materials.
- Enable teachers to create their own lessons, assign tasks/projects, and monitor progress.
- Enable online communication and collaboration among teachers, students, and parents.
- Allow safe student access to the Internet and content (prohibited sites and based time of day).
- Facilitate more efficient school administration and teacher productivity.
- Provide management information and analytics for monitoring the effectiveness of the school system and to make decisions for continuous improvement.
- Provide these applications in a cost-effective and optimized way with security and high availability.

Advantages of Standardized Platforms

There are numerous advantages to standardizing platforms and moving to the cloud, if possible. Standardized platforms create efficiencies, provide unique learning opportunities, provide avenues for better school management, create cost savings that can be moved to digital content budgets, and provide quality assurance across the entire system. The following are some of the platforms used to achieve these goals.

Learning Management System (LMS)/Personalized Learning Environment (PLE)

1. Enables teachers to:
   - Create lessons, quizzes, surveys, blogs.
   - Set up schedules/courses including creating lessons and quizzes.
   - Assign online/offline assignments to students and groups of students to track students' progress, completion, and results of lessons, quizzes, and assignments.
2. Enables students to:
   - Work through and manipulate content, anytime, anywhere.
   - Receive immediate feedback on formative and summative assessments.
   - Link to advanced eLearning applications.
   - Submit assignments.
   - Stay organized.
3. Enables parents to:
   - Communicate with teachers.
   - View curriculum and content.
   - Monitor child's real-time progress.
4. Common functions:
   - Facilitate communication between teachers, students, and parents.
   - Enable collaboration through blogs, wikis, and discussion forums.

School Administration Systems

1. Register students and teachers.
2. Provide address and contact information for students (parents' phone and e-mail addresses).
3. Allocate classes with a grade and weekly class schedule.
4. Allocate students and teachers to classes.
5. Support extramural activities (sports, chess, debating, music, etc.).
6. Provide an events calendar.
7. Send notification messages to teachers, students, and families.
8. Track and manage disciplinary action.
9. Dropout tracking.
10. Design and generate student reports.
11. Keep track of student health records.
12. Provide student and teacher attendance register.

Management Information and Analytics System

1. Student history: schools attended, teachers, subjects, grades, achievements.
2. Teacher history: qualifications, schools, subjects, students taught, passes achieved.
3. Schools: students, teachers, pass rates and grade levels, facilities, and tools used.
4. Student data regarding access to learning resources, collaborative tools, etc.
5. Amount of investment per teacher in up-skilling.
6. Regional/country level—information, statistics, and analytics:
   a. Student information, grades, and comparison with peers in school and across schools.
   b. Grade comparison between classes at same grade level in same or across schools.
   c. Teacher: student grade levels and pass rate success for each subject taught.
   d. School: success rate.
7. Ratio of students/teacher, teachers/admin staff, students/teachers/admin/schools.
8. Percentage dropout rates/grade, student/teacher absenteeism per schools days.
9. Costs per student across different schools.
10. Comparison of all statistics from year to year to monitor trends.

Financial Management/Enterprise Resource Systems

1. Human resources (HR) and payroll management for teachers, admin, and other school staff.
2. Procurement and payment for contracted services.
3. Asset management and depreciation of facilities.
4. Financial management and reporting, budget versus expenses/operation costs.

Alternative Systems

If a robust infrastructure is not available, you can still reap the benefits of ICT on a smaller scale. Here are some things that can be achieved in a less robust technical environment that will help move you down the path to creating a 21st century education for students:

- Design student-centered learning environments.
- Create and deliver personalized learning experiences.
- Assess results.
- Increase productivity.
- Have students create and share knowledge within the classroom or school.
- If possible, use the available technology to do all of the above.

Turning Research Into Practice Recommendations: ICT

Moving a national education system to 1:1 is an immensely complicated mission. Depending on the current state of ICT in the country, the transition to 1:1 eLearning could be a very long process. If government leaders move strategically, however, and provide vision, leadership, and human and financial support, it can be achieved. Project RED recommends a few basic steps to begin moving toward universal access to technology.

ICT Recommendations for Centralized Education Systems

1. Assess what computer, storage, and network capacity is currently available in schools.
2. Assess what software solutions are currently available within the education system.
   - Cloud enablement (virtualization, automation, provisioning, single sign-on, metering etc.)
   - Digital content, instructional software, and other digital resources
   - Monitoring and management software for fault and performance monitoring, service management, and help desk
   - Security software
   - Data backup
3. Determine what is required to maximize the use of the existing ICT.
4. Develop a long-term strategic plan to move toward 1:1, with possible interim goals (10:1, 5:1, 2:1).
5. Build out the national technology infrastructure.
6. Stagger the implementation over several years. Start with a group of schools that are likely to be successful. Learn from them and build from their success. Carefully consider what students will be able to do, or not do, without the availability of the Internet or at least a closed network. Choose pilot schools that have the necessary electrical and ICT infrastructure to be successful.

Cloud computing will also drive many national policy discussions around cost, data security, functionality, and other important topics. Project RED recommends standardizing and integrating all the data systems describe in the section above. National policies and laws should be in place, however, before the implementation of these systems.

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ICT Recommendations for Decentralized Education Systems

It will be difficult to implement the Project RED Design and see the achievement gains and cost savings identified in the Project RED research without substantial involvement of the national government. Providing the appropriate infrastructure for a digital learning environment is too much for most individual schools to take on.

Regardless of the level of involvement of the government, there are still positive things that can happen within an independent or decentralized system:

1. Assess what computer, storage, and network capacity is currently available in your school.
2. Assess what software solutions are currently available in your school:
   - Cloud enablement (virtualization, automation, provisioning, single sign-on, metering, etc.)
   - Digital content, instructional software, and other digital resources
   - Monitoring and management software for fault and performance monitoring, service management and help desk
   - Security software
   - Data backup
3. Determine what is required to maximize the use of the existing ICT.
4. Create a long-term strategic plan to move to 1:1:
   - Investigate Internet access options available to the school
   - Investigate the feasibility of a school-run network with the cloud housed on the school server
5. Possibly partner with the central government or a consortium of schools to build out the infrastructure, and implement a larger area network with standardized platforms.

CASE STUDY

Panama

On the cusp of the 100-year anniversary of creation of the Panama Canal in 2014, Panama is transforming digital literacy and economic development through a nationwide rollout of ICT in 728 schools.

Panama has a dynamic Minister of Education who is changing the landscape of their national education plan. And most importantly, students are so excited and engaged with the technology that they are not only reading significantly more but becoming authors themselves.

Nationwide **ICT integration** in **728** schools

179,000 PCs distributed

162 early education centers equipped with ICT

Panama's Balboa Project began with the approval of the Technology Massification Program, an initiative led by the National Government through the Ministry of Education (MEDUCA), the Authority for Government Innovation (AIG), together with Intel. The program seeks to improve Panamanian education through the integration of ICT tools in the classrooms of Panamanian schools. The goals of the program include:

1. Contribute to greater educational equity among students.
2. Improve digital literacy.
3. Provide students with computers for daily use in the development of their schoolwork.
4. Give students the opportunity to access information and communication in different.
5. Contribute directly to local household economies.

Panama's Balboa Project, includes implementation of a technology infrastructure that supports the teaching and learning process. Technology supports 162 early education centers, which are equipped with ICT that will meet current and future educational requirements. In addition, educational services have been created to enhance teacher training in their use of ICT in the classroom to transform teaching and learning. The program has also improved educational centers and expanded services for supporting students.

The program began in 2012, with an initial purchase of 93,500 Intel® classmate PCs deployed across 162 schools nationwide. In 2013, the project forged ahead, bringing technology and services to an additional 566 schools for a total of 728 schools with never-before access to technology, and a total of 179,000 PCs distributed nationwide to date.

CASE STUDY

San Luis, Argentina

San Luis, Argentina, is one of the only ICT programs in the world with a 20-year plan to transform education from the most urban to the most rural corners of the province of San Luis. This program affects all aspects of society in San Luis and includes plans for all stakeholders—administrators, IT, teachers, students, parents, and the whole community. This transformation program is on a massive scale and is one that other countries across the world want to see and model themselves after.

Ambitious 20-year technology plan

Includes **goal of 1:1 eLearning** for all primary students

Improved math, language arts, and science **performance**

As part of the ambitious 20-year technology plan, the province's goals include exporting technology products, training more STEM (Science, Technology, Engineering and Math) students, and broadening its base of workers who have completed secondary education and have high-level skills in math, language arts, science, and ICT.

The plan included providing broadband access to every town, providing significant rebates for citizens to purchase computers, and an initiative called All Kids Online to bring 1:1 eLearning to all primary students.

The All Kids Online initiative provided teachers with a laptop and professional development through the Intel® Teach program. All students in primary grades received Intel classmate PCs with software to support the educational objectives. The program saw significant improvements in student achievement in math, language arts, and science. In addition the program helped level the playing field and created digital inclusion for students in rural area and with different abilities. Digital inclusion also grew beyond the students to their families as the students brought the PCs home and taught ICT skills to parents and grandparents.

Download this Case Study

To download this global toolkit, resources, and learn more about Intel's support of the Project RED work, please visit intel.com/projectred