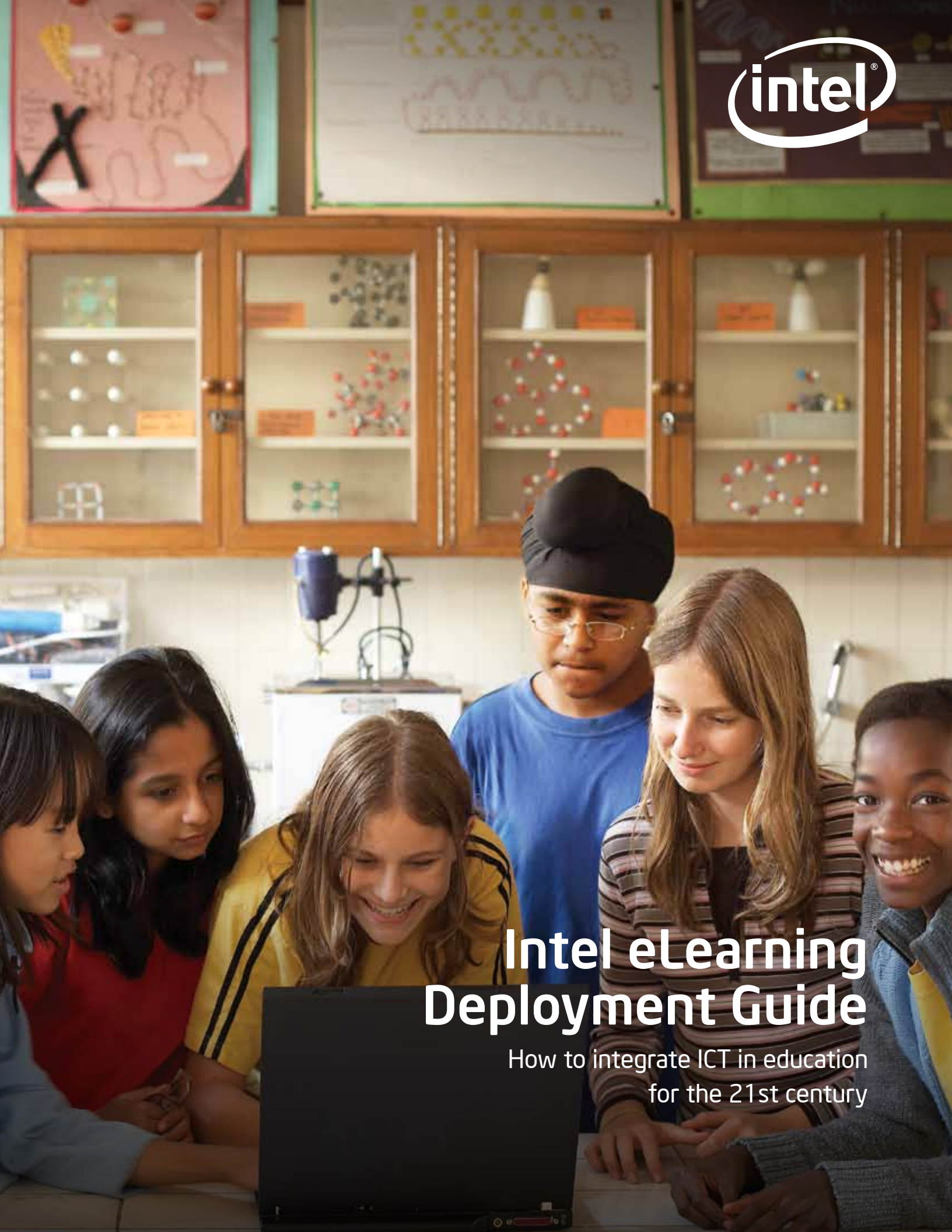
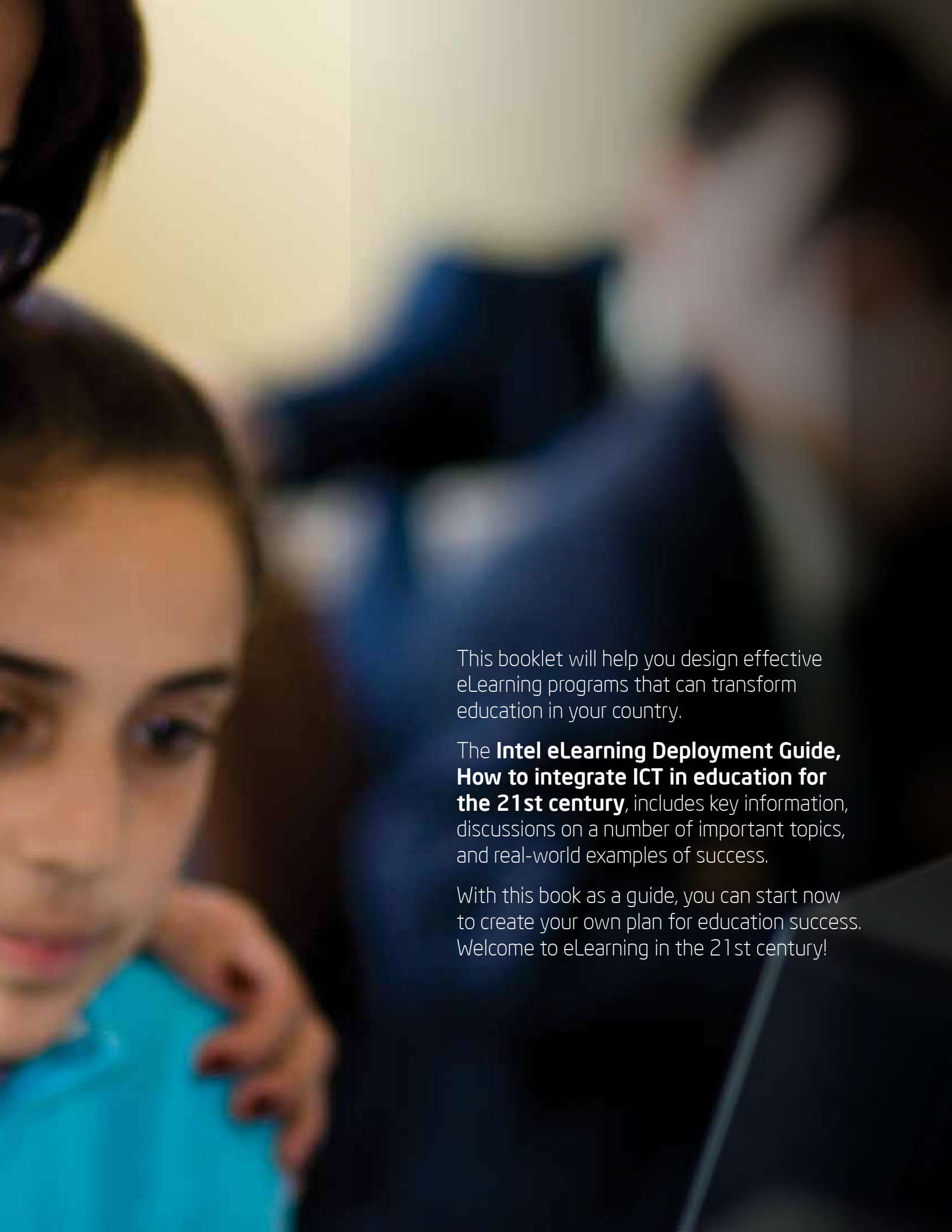


Intel eLearning Deployment Guide

How to integrate ICT in education for the 21st century



This booklet will help you design effective eLearning programs that can transform education in your country.

The **Intel eLearning Deployment Guide, How to integrate ICT in education for the 21st century**, includes key information, discussions on a number of important topics, and real-world examples of success.

With this book as a guide, you can start now to create your own plan for education success. Welcome to eLearning in the 21st century!

Contents

"...the Internet and education are the two great equalizers in life, leveling the playing field for people, companies, and countries worldwide."

President Nelson Mandela

Chapter 1

Successful eLearning Programs

You see it all around you—countries like yours are actively creating and using eLearning programs to accelerate the use of information and communications technology (ICT) in school classrooms. And the reason is clear: eLearning programs equip students with 21st century skills that enable them—and the countries they live in—to thrive and be successful in today's global economy.

This economy has already improved the lives of millions of people, and it will improve the lives of many millions more. These economic and educational changes are not on the horizon; they are occurring *now*.

This chapter gives an introduction to eLearning programs and their benefits. It should help you start to define objectives for your eLearning program.

1

21st Century Skills

21st century skills include technology and media literacy, effective communication, critical thinking, problem solving, and collaboration. These are the skills necessary for citizens to thrive and be successful in today's global economy.

eLearning Success: Turkey

Successful eLearning programs lay the foundation for a highly educated workforce. In Turkey, the Ministry of Education has worked with Intel, Microsoft, Turk Telecom, and others to provide over 100,000 teachers with affordable technology.

In addition, more than 200,000 teachers have learned how to effectively use technology in the classroom via Intel® Teach, and interactive math and science content is now available in the local language with the Intel skoool™ program.

Results:

- Greater access to technology, information, and content nationwide
- Increased student interest in their education, and development of 21st century skills
- Integration of teaching technology that supports improved learning

Transforming Education

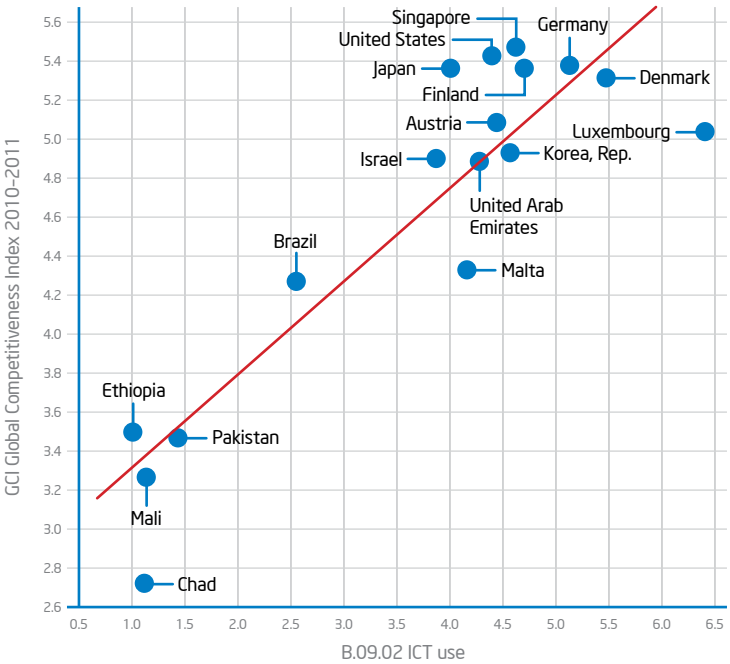
Countries today increasingly recognize that educated citizens are critical to their chances for success in the worldwide digital economy. Students need to develop 21st century skills to be best prepared for this reality, and to have the opportunity to succeed. These skills—technology and media literacy, effective communications, critical thinking, problem solving, and collaboration—are best developed in effective eLearning environments that include information and communications technology (ICT).

In order to bring 21st century skills to their students, governments around the world are using eLearning programs to implement the education environments that are best for their students. These programs bring together the solution elements—technology, connectivity, localized digital content, and improved teaching methods with professional development—and other considerations needed for success: policy, funding strategies, and metrics/assessment, and the commercial ecosystem to make it happen.

Intel works with government leaders, education and technology organizations, and commercial providers to put together successful eLearning programs to support education transformation in your country. Many countries have done this already, and are reaping the rewards. You can start on the same path, beginning today, by using this booklet and the workshops associated with it.

ICT Supports Global Competitiveness

The graph below shows how global competitiveness is greatly enhanced by the introduction or expansion of ICT. Note that all three groups of countries—fully industrialized, aggressively developing, and newly emerging—can benefit.



B.09.02 ICT Use vs. GCI Global Competitiveness Index 2010–2011

eLearning Programs

Successful eLearning programs include the essential elements for education transformation. These elements and supporting systems are outlined and described below.

Components of an eLearning Program

Solution elements

1. Technology
2. Connectivity
3. Localized digital content
4. Improved teaching methods and professional development

Support Systems

5. Policy
6. Funding strategies
7. Success metrics and assessments appropriate to eLearning programs
8. Working with vendors (the "commercial ecosystem")

We'll look at these elements briefly here, then examine them in detail in later chapters.

Technology. Affordable, rugged, energy-efficient, state-of-the-art computer technology designed for educational environments. This includes all hardware involved in the program: laptops (sometimes called "platforms"), desktop PCs, servers, peripherals, and all other aspects of the technical infrastructure. Chapter 3 provides information on all technical elements of an eLearning program.

Connectivity. Affordable, high-speed Internet connectivity to rural and remote areas, and intranet connectivity within schools and communities. This includes all connectivity modes—wired and wireless, WiFi, WiMAX, and others.

Localized digital content. Collaborative rich-media applications, content, and curriculum material localized for language and culture, and mapped to local curriculum standards.

Improved teaching methods and professional development. Interactive and collaborative teaching methods that help teachers deliver engaging lessons with the support of ICT. This must be coupled with readily available professional development to help teachers acquire the necessary ICT skills to assist students and to integrate technology into the education process.

Policy changes. Often administrative policies need to be created or revised to make eLearning changes possible. For example, some countries may need to modify public policy regarding the use of ICT in the classroom, or regarding emphasis on preparing children for higher education; others may need to examine educational policy regarding content or language requirements.

eLearning Success: Malaysia

In Malaysia, the Ministry of Education partnered with Intel on a plan to improve teaching and learning supported by technology. The program included increased access to PCs, teacher integration of technology, teacher professional development, and the deployment of wireless networks in schools throughout the nation.

Results:

- Greater access to technology, information, and content nationwide
- Integration of teaching technology that supports improved learning and achievement
- Increased student interest in their education, and development of 21st century skills
- Student-to-computer ratio reduced from 1:40 to 1:20
- Malaysia is now seen as a regional leader in education policies and programs—and as a choice-of-study destination for more than 50,000 international students from more than 100 countries.

1

eLearning Success: Colombia

Colombia's goal is to provide more of its citizens with ICT in order to create a highly skilled workforce. The government has worked with public and private organizations, including Intel, to find effective methods of bringing technology to even the poorest regions.

Programs include financing for first-time buyers and reduced taxes on ICT to make it more affordable. In addition, over 70,000 teachers have learned how to use technology effectively in the classroom via Intel® Teach, and interactive math and science content with the Intel skoool™ program is now available.

Results:

- National PC ownership has increased by 10 percent.
- The Columbian government has reduced taxes on technology, making it more affordable for many citizens.
- Colombia's lower-income population now has similar advantages to those with technology access, thereby lowering the digital divide between population groups.
- Colombia has influenced other governments to reduce or eliminate taxes that make it difficult for lower-income people to access technology.

There are a number of public policy areas that can potentially influence the success of an eLearning program. Chapter 4 discusses these policies.

Funding strategies. This means developing a coherent and practical set of methods to finance your eLearning program. A great many creative funding strategies have been used successfully. Chapter 4 offers a number of suggestions.

Success metrics and assessments. Success metrics refers to the way you measure the success of your eLearning program. It answers the question, "What do we need to measure to be sure an eLearning program is continuously improving?" Choosing appropriate success metrics allows you to know for sure that the program is successful. Choosing the wrong metrics gives a false picture of the program.

Assessment means specifically measuring student success according to national standards. Many forms of testing can be used to assess student success. What's different about eLearning is that traditional assessment methods don't typically measure what's special about eLearning, especially its emphasis on collaborative working skills. Traditional assessments are important, but they must be supplemented in order to assess the new desired student outcomes, such as collaboration and critical thinking.

Working with vendors (the "commercial ecosystem"). There are many kinds of technology and education vendors, each providing a different set of services. Many of these vendors offer overlapping services. Vendors must not only be well-chosen, but the *set* of vendors must be well-chosen, so that needed products or services are not accidentally neglected. Chapter 4 details these vendor types and offers some suggestions.

How Intel Can Help You

eLearning programs can take a number of forms. Programs can focus on some, many, or all of the solution elements, depending on country needs and resources to implement. For example: teacher PC programs (TPPs) focus on getting technology into the hands of teachers efficiently and affordably. Intel Teach and Intel skoool programs provide professional development and digital content (respectively). Some countries have more ambitious programs that combine multiple elements.

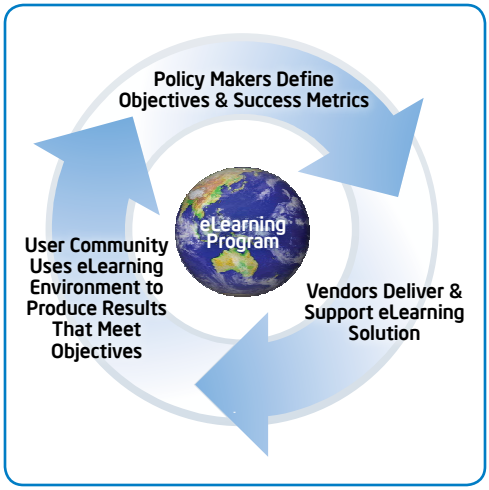
Intel can help you plan the best eLearning program for your needs, and also pull together the right organizations and people for success. Intel takes an active role with solution elements—helping choose PCs best suited to your teachers' and students' needs, making sure the infrastructure is best for your situation, and showing content options and sources, etc.

With the other non-technical program elements (policy, funding, etc.), Intel takes a facilitation role. We can show you which areas of policy may need examining, suggest funding methods, bring together the best team, and more.

Commercial Ecosystem

Commercial ecosystem *is a term often used to describe technology industry vendors and solution providers. Some of these companies are local, such as regional Internet service providers and value-added resellers (VARs) of computer equipment and services.*

Others are recognized global companies, such as Apple, Cisco, Intel, and Microsoft.



eLearning Program Cycle

"Since computers were introduced...students actually wanted to come to school even during summer vacation. It is clear this is benefiting the whole community, both students and teachers."

Dutu Nicolae, Mayor, Axintele, Romania

Chapter 2

Determining Program Requirements

In the previous chapter, you looked at the facets of eLearning programs that can help you define the education objectives that are important for your country (or region, state, province, district, or school). This chapter will help you determine program requirements to meet those objectives, based on the needs of key stakeholders: teachers, students, parents, and administrators.

2

Viewing eLearning Requirements from Several Perspectives

What capabilities must your own program have in order to meet the education objectives that you have chosen for yourself? The best way to determine that is to see that solution from a number of perspectives.

For example, if one of your objectives is to provide Internet access to schools that are isolated by geography, it's not enough to say, "The solution is laptops for students and teachers, and a network for the school." That's moving to the answer without first asking all of the questions.

Will the laptops be taken home or used by younger children? If so, how robust must those laptops be; how impervious to environmental conditions? Will the laptops be shared?

In addition, the way the eLearning will be integrated into the curriculum must be considered. Which subject areas will be enhanced with eLearning modules? Is local content, in the local language, important?

Finally, what about parents? Is it important that they participate in the new eLearning environment? (The answer to that is usually "yes.") If so, how will they participate? By communicating with teachers? By communicating with other parents?

As you can see, each perspective provides insight into the needs for your program. Let's look at the elements of an eLearning program from each perspective.

To define requirements successfully, we should ask these key questions:

a. What **activities** would each group perform in an eLearning environment?

b. What eLearning **requirements** are needed to perform the activities?

What Teachers Might Need

Teachers represent a critical element in the success of an eLearning environment since the teacher must guide, mentor, facilitate, and coach to improve education outcomes and help students develop 21st century skills.

Activities

- Prepare lessons
- Use applications such as word processors and spreadsheets to speed teacher tasks
- Map digital content to existing curriculum
- Share content with students
- Manage the classroom via instructor-based broadcast of content
- Design, integrate, and organize curriculum
- Manage class roster (for example, for recording attendance and grades)
- Manage content access by students (especially for students who are ill, disabled, or on long leave)
- Maintain degree of teacher-student interaction
- Assess student performance, perform testing, and create reports
- Build online communities and participate
- Create and share content
- Communicate effectively and frequently with students and parents

Requirements

- ☐ Mobility and "anytime-anywhere" use. Teacher platforms need to go wherever teachers go and be easily transported.
- ☐ Mainstream functionality, to take advantage of the world of applications and content, both licensed and public domain
- ☐ Internet access
- ☐ Connected or unconnected usage, so they can continue working even when not connected to the Internet or school network
- ☐ Flexibility. Platforms should provide operating system choice (Windows* or Linux*), a wide and affordable range of mainstream applications, and usage models that will support students as their skills mature.
- ☐ Capability. To ensure long-term success and viability of student 1-to-1 eLearning environments, select a computer with a robust feature set (including processing performance, disk capacity, memory, and the like), and establish a roadmap to continue improving the technology over time.

Starting with Teachers

One of the most effective ways to create near-term, high-impact results is by implementing a simple teacher PC program (TPP). This "starter program" can put technology quickly into the hands of teachers. A teacher PC program is most effective when it includes professional development to help teachers make the best use of technology in the classroom. For best results, always include professional development in an educational program that includes a TPP.

Many kinds of programs, in addition to TPPs, can be started, and this book will show them to you. But whichever choices you make, beginning with teachers offers the greatest early success. It grows the skills, capability, confidence, and expertise in the teacher community, and speeds the results of your educational transformation.

A TPP may be implemented by a government working with a public-private partnership. In addition, educational technology vendors may independently implement TPP solutions. (Funding strategies for TPPs and other eLearning programs is discussed in Chapter 4.)

What Students Might Need

When students are part of the eLearning environment, an entirely new dimension of ICT usage is added to the classroom.

Activities

- Perform simple homework tasks using Microsoft Word*, PowerPoint*, and other common applications
- Take form-based tests
- Access simple content
- Share student portfolios
- Access facts and concepts within subjects
- Do project-based activities
- Perform research on the Internet
- Access curriculum content localized for language and culture (especially important for students who are ill, disabled, on long leave)
- Publish research projects
- Acquire a deep understanding for interrelated concepts, misconceptions, and real-world systems, within and across subjects
- Be able to solve complex, real-world problems
- Create and participate in student groups (local, national, and worldwide)
- Participate in discussions and exchange experiences
- Consume and publish a wide range of media, including photos, videos, and podcasts
- Perform investigations and make reports, presentations, and demonstrations

Requirements

- ☐ Mobility and ease of use
- ☐ Ruggedness
- ☐ Age-appropriate content
- ☐ Anytime-anywhere usability
- ☐ Mainstream functionality
- ☐ Internet access
- ☐ Connected or unconnected usability, so they can continue working even when not connected to the Internet or school network
- ☐ Protection from viruses and inappropriate Internet content
- ☐ Physical security
- ☐ Ability to incorporate peripheral devices

What Parents Might Need

Parents may need to do one or more of the following.

Activities

- View student portfolios
- View student progress and up-to-date results
- Mentor and support student activities

Requirements

- ☐ Access to computer
- ☐ Parental content

What School Administrators Might Need

School administrators are primarily responsible for adhering to policy, applying governance on usage of the eLearning environment, and ensuring that the environment is operational.

Activities

- Set policy that facilitates early use of ICT in the classroom
- Reward teacher performance
- Set reporting and assessment standards that comprehend early development of 21st century skills
- Use results to measure return on investment (ROI) and effectiveness of eLearning environment
- Set up administrative management systems to unify state, province, or town processes
- Teachers create and participate in communities of practice
- Students join in subject matter user groups
- Parents communicate with teachers, students, other parents
- All communities support continuous improvement

Requirements

- ☐ Access to current policies that may affect program
- ☐ Measurement and assessment tools and plan
- ☐ Unified regional access (wireless/WiFi)
- ☐ Purchase plan

Using a Proof of Concept to Confirm Requirements and Test Solution Elements

A proof of concept (POC) is a useful tool for assessing requirements from the user community and determining the activities you want the user community to perform.

A POC can be done very early on. Typically, a POC is a close, but not exact representation of the eLearning environment that may be ultimately deployed. Nonetheless, a POC can be used to show what's possible and to begin to determine what works and what doesn't, so you know what should be deployed.

Constraints on an eLearning Program

In addition to capabilities and requirements, it is also important to consider constraints before specifying a solution that meets your objectives.

Constraints are limitations that an eLearning program must work within. These are the most common:

- ☐ Geography and terrain (for example, rural, remote, or rugged)
- ☐ Population density
- ☐ Electrical power (quality and existence)
- ☐ Availability of broadband Internet connectivity
- ☐ Weather, climate, and other environmental concerns
- ☐ Socio-economic factors
- ☐ Language and customs
- ☐ Cultural appropriateness of content
- ☐ Existing or legacy infrastructure

In addition to constraints on technology, there may also be constraints on other aspects of an eLearning program—the policy, funding, success metrics and assessments, or the commercial ecosystem. Be sure to consider any limitations on these elements as well.

Standards and Assessments

Determining success standards, metrics, and assessments is a critical part of your program. Users need to collect metrics via test scores and surveys; they need to analyze collected metrics; they need a means for providing feedback to teachers, students, administrators, and parents; and they need to receive feedback that would influence the setting of future education objectives and policy.

See Chapter 4 for a discussion of success standards and the implementation of metrics and assessments, in terms of what the program has to do in order to accommodate them.

"Math and science are now taught using Intel-powered PCs, with students searching for information on the Internet and then sharing with each other. This...enhances the learning process in an unprecedented manner."

Ladda Pukiat, Director, Chulalongkorn Univ. Elementary School

Chapter 3

Planning the eLearning Program

Once program requirements have been determined, you can start mapping those requirements to the program components that will work best for you.

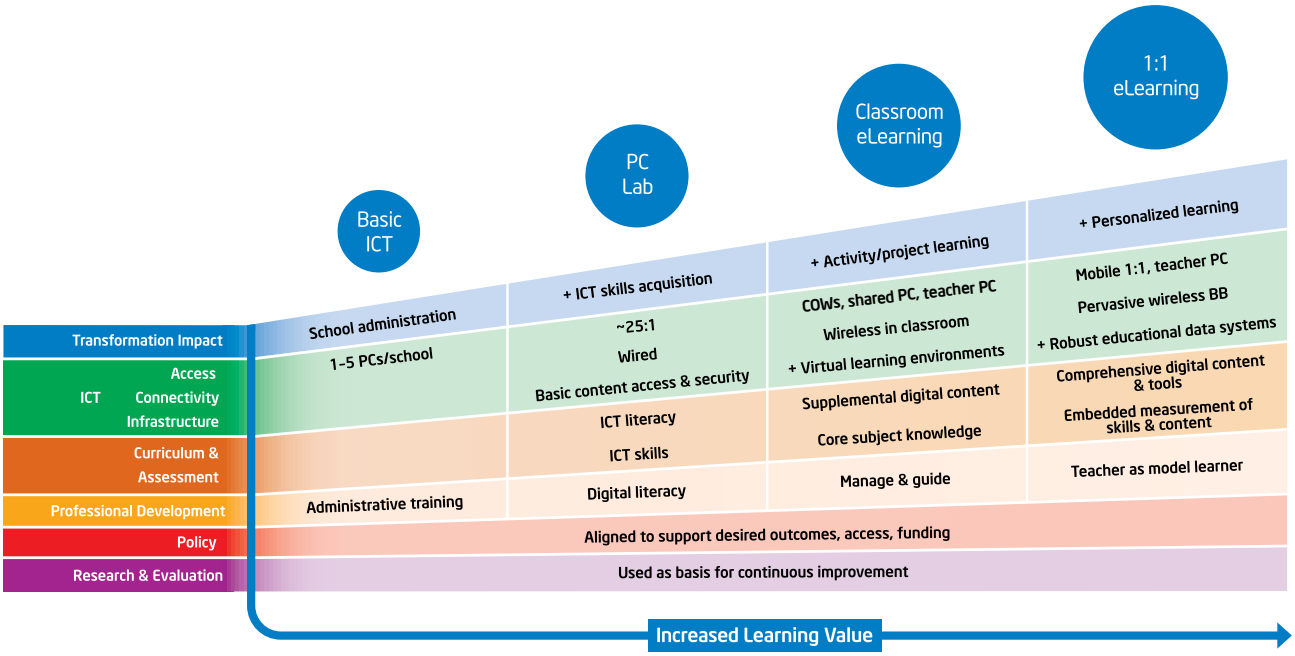
This chapter introduces the concept of effective eLearning environments, discusses key program components needed to build those environments, and then moves into the start of your eLearning program plan.

3

eLearning Environments

21st century skills are best developed in effective eLearning environments. These environments are learning facilities—typically classrooms—where several key components work together. Strong technology platforms, connectivity, professional development, improved teaching and learning methods, and digital curriculum all contribute to an environment where 21st century skills can develop and students can thrive.

The chart below characterizes the four typical eLearning environments, and how each is supported with increasing quantity and quality of key program components. Each environment represents increased learning capacity as you move from Basic ICT up to full 1-to-1 eLearning.



eLearning Environments

The 1-to-1 eLearning model, where each teacher and student has a dedicated laptop computer, is seen by many as the ideal way to integrate technology in the curriculum and maximize its benefits. Classroom eLearning is a good alternative for countries or schools not quite ready for 1-to-1, with many benefits at a lower cost-of-entry.

PC Labs

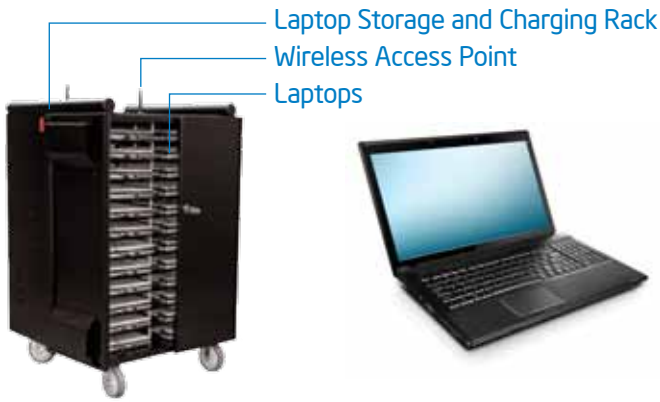
PC labs are a common starting point for ICT in education. They offer a low-cost way for students to get hands-on access to computers.

A PC lab is a classroom where students use secured computers to learn basic technology skills for a designated amount of time per session. Knowledge, whether ICT, social studies, or math, is acquired at a basic level, with a minimal amount of collaboration.

As a shared resource, student-computer ratios are commonly at 25:1 with PC labs.

Classroom eLearning

Classroom eLearning is often used as the beginning of project-based learning for some core subjects. Computers on Wheels (COWs) is a common implementation that works like a mobile computer lab.



Computers on Wheels (COWs)

In a COWs, one or more carts contain laptops that can be moved from classroom to classroom as needed or scheduled. The cart is used to both store and charge the laptops, and provides a wireless access point. Some carts provide intelligent charging—a rotating charging scheme in which only a certain number of laptops are charged at a time. This allows the cart to be plugged into a standard wall socket. The wireless access point creates an instant classroom wireless network for the teacher and all students. If the school does not already have a server available via a wireless network, the cart may include server functions such as file and information sharing.

A typical student-computer ratio for COWs is approximately 5:1 across the school, but when COWs are used in a classroom, students have a dedicated device for the duration of that class, heightening their 21st century learning.

Classroom eLearning can be deployed as a school program alone, or combined with other eLearning programs, such as a TPP, that can facilitate a change in pedagogical practice as well when the laptop PC is selected based on student age and usage needs.

3

More about 1-to-1 eLearning

1-to-1 eLearning refers to a specific kind of educational environment, one that uses technology to create a 1-to-1 relationship—not just between the student and a dedicated computer—but between the student and a broad set of learning resources.

These learning resources include, in addition to books, a variety of electronic materials—computer-based tutorials and online "laboratories," and Web-based collaborative resources, such as email, blogs, wikis, teamsites, virtual meeting spaces, Internet or intranet posting boards, and electronic discussion groups.

In a true 1-to-1 environment, students not only learn from their teachers, they become creators of knowledge. They not only benefit from curriculum content, they also increase their knowledge by self-discovery, and by exploring—and contributing to—the larger world of shared content, including community-created content.

From this description, you can see what 1-to-1 eLearning is, and also what it is not. *1-to-1 eLearning is not just one student and one computer.*

If the student isn't provided the technological resources depicted above and the ability to use that technology effectively, the computer is little more than a interesting toy or possibly even a distraction.

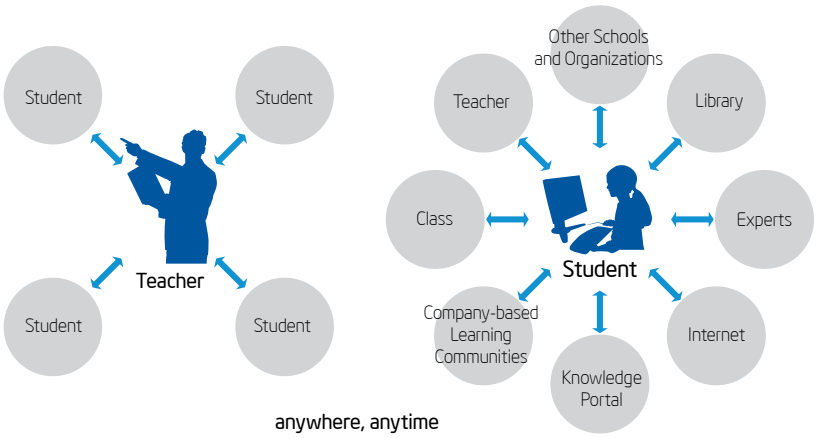
1-to-1 eLearning

The "1-to-1 school" is an example of one of the most effective eLearning environments. This deployment model is being implemented in many countries and is an aspiration or objective of many others.

In a 1-to-1 school, all participating teachers and students are provided with laptops, dedicated for their exclusive use. The laptops are not rotated among various groups of students during the day, but serve as personal teaching and learning tools. In a 1-to-1 school, students get the maximum value from access to technology and its integration into the education environment.

Main elements include a school wireless network (WiFi or WiMAX), school servers, teacher and student laptops, storage, and charging facilities for the student laptop—as well as curriculum and support software and professional development for teachers that specifically addresses how to take full advantage of a 1-to-1 environment.

In this environment, students are best able to practice and learn the collaborative working skills that are the hallmark of 21st century eLearning. A 1-to-1 school approach requires specialized professional development. This allows teachers to go beyond merely learning ICT skills as a subject, and allows them to learn how to use ICT as a tool to support teaching and learning.



An added benefit of the 1-to-1 school approach is that students can take their laptops home. This further extends the effectiveness of the eLearning environment. In one study, 50 percent of Internet access to Intel skoool eLearning content was after school hours, demonstrating the power of 1-to-1 eLearning in terms of extending learning beyond school hours and classroom walls.

eLearning Program Components

Building effective eLearning environments means implementing a robust eLearning program that includes some or all of the following Solution Elements and Supporting Systems:

Solution Elements

1. **Technology:** devices—cell phones, tablets, netbooks, laptops, PCs, servers and networks—communications and computing
2. **Connectivity**: broadband Internet access, wired or wireless
3. **Digital Content**: learning material from the Net, multimedia CD/DVDs, podcasts, or other digital media
4. **Improved teaching methods** include student-centric models, project-based learning, etc.; and **professional development** that helps teachers effectively integrate technology into their curriculum.

In putting together a program with these elements, you will also consider outside areas that will help to facilitate your implementation:

Support Systems

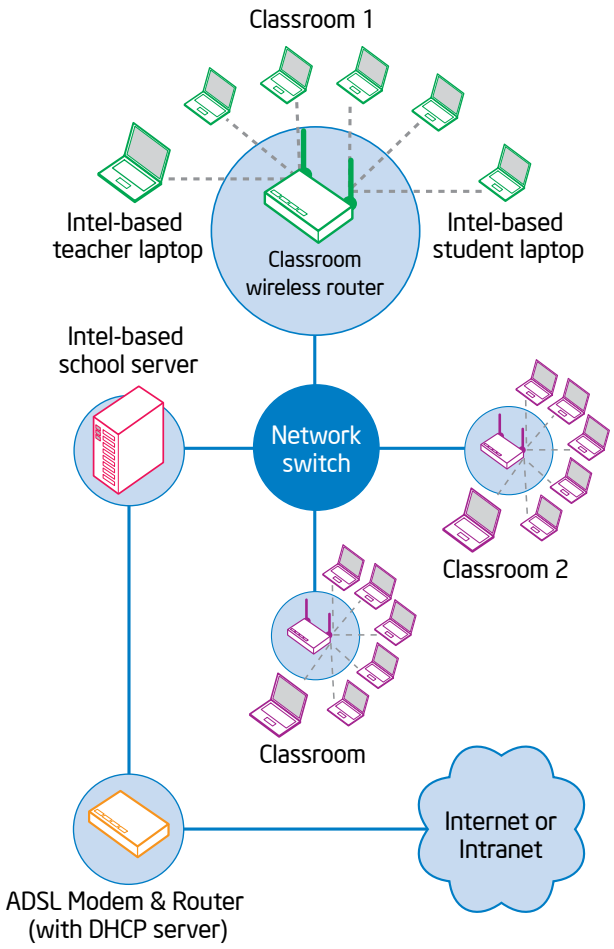
5. Policy
6. Funding
7. Metrics and assessment
8. Commercial industry partners

The next section provides more detail about Solution Elements, especially technology, in order to better understand which elements would be best for your program. The following chapter covers Support Systems in more detail.

3

Technology

A representative classroom solution is shown below, demonstrating how various technology elements are used in a robust 1-to-1 eLearning environment. Each part of this approach is discussed in some detail in the following sections.



1-to-1 School Solution

- **Teacher laptops**—these can be either moderately featured or full-featured. Most choose a more full-featured model, since teachers are likely to be a valuable source of content. Example: Intel® Core™–based laptops.
- **Student laptops**—these are more likely to be moderately featured, though full-featured models are also common for secondary and tertiary school students. Examples: Intel-based classmate PC, 2nd generation Intel® Core™-based laptops.
- **eLearning peripherals**—ask yourself what additional eLearning hardware should be made available to further enhance the learning experience. Example: interactive whiteboards, printers, scanners, thumb drives.
- **School server and services**—a school server is a key solution element for addressing content-sharing and collaboration requirements. Examples: content server, communications server.

Teacher Laptops

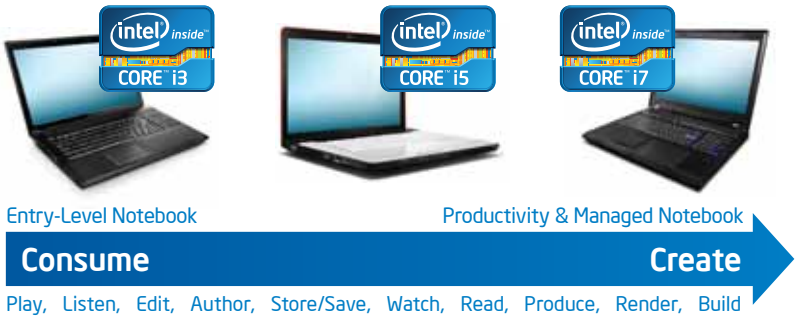
When teachers have laptops, they can use the technology for effective teaching in the classroom. In addition, they can take the system with them to conferences, the teachers' lounge, home, or other locations to continue working. Teachers often work at home to prepare lesson plans. Having a laptop with Internet access and learning content supports their planning and leads to more engaging lessons.

Selecting the Teacher Device

Quite a range of teacher devices is available. Simpler devices are acceptable for less-challenging situations. More fully featured devices are better suited for content creation, classroom management, and to run more advanced software. Also—if a teacher is in a school or classroom with a wireless network, the laptop must support wireless connections.

When considering what device to select, refer to "What Teachers Might Need" from Chapter 2.

Solution Map



Selecting the Teacher Laptop

The graphic above illustrates elements for a sample teacher laptop solution for both the Windows* and Linux* platforms.

PC Platforms for Teachers and Students

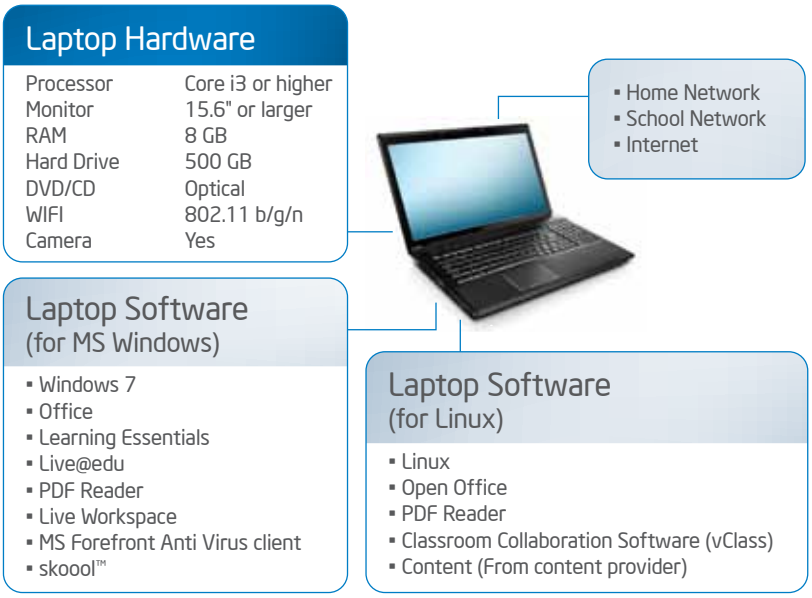
In general, Intel-based netbooks, notebooks, laptops, tablets, desktops, and servers are key components of successful learning environments worldwide.

- The latest Intel platforms are designed not only for performance, but also to improve security and manageability, and enable more connectivity options.
- Intel works with many other companies to enable a complete solution set, including hardware accessories, software applications, and locally relevant education content.

A full range of Intel-based notebooks and laptops provide excellent choices for education environments:

- Full-featured, powerful laptops are best for teachers to produce content, develop multimedia lesson plans, interact with online learning content, and more.
- Full-featured and midrange laptops are a great choice for older students who need to consume and produce content.
- Affordable netbooks, including Intel-powered classmate PCs, provide a more ruggedized alternative for younger students, including those in primary school.

Note that while notebooks and laptops are common choices, a full range of platforms for both teachers and students can be successfully used.



Teacher Laptop Recommended Specifications

Determining the Software

When looking at software for the teacher device, the primary elements to consider are the operating system, productivity applications, client management applications, and learning and content management applications. Each of these types is discussed briefly below.

The operating system (OS). This is the most fundamental software element. It is responsible for managing all aspects of the computer and allows the user to run and interact with all other software, including applications. There are three primary choices for an OS:

- **Windows* 7**. Closed source operating systems directly provided and supported by Microsoft. Windows operating systems make up the largest share of the overall client market.
- **Linux***. An open source Unix*-based operating system that can be obtained at no cost. (Support is not free, however.) Linux comes in several versions, such as SuSE*, Debian*, Ubuntu*, Mandriva*, Metasys*, and Fedora*. Versions of Linux are not identical; they vary in features such as performance, compatibility, ease of use, stability, quality, and security.
- **Mac OS* X**. Another closed source OS that runs only on computers manufactured by Apple Computer Inc. Examples of these include the Mac mini*, iMac*, Mac Pro*, MacBook*, and the MacBook Air*. Mac OS X is Unix-based and considered very stable and user-friendly. It is especially popular for education.

Keep overall cost in mind when choosing an operating system, not just the cost of the software itself. Additional costs can include user support, security, upgrade costs, localization fees, and other expenses related to efficiency and usefulness of the OS for the specific task at hand.

All other software elements are applications that run "on top" of the OS. In some cases these applications might be installed on the teacher's laptop; in other cases they might be rich Internet applications (RIAs) that run across a network connection.

Productivity applications. These programs are used for tasks such as creating and editing written documents, spreadsheets, and presentations. Productivity applications also include browsers, email clients, instant messaging programs, PDF readers, and so on. Keep in mind that productivity applications are OS-dependent.

Client management applications. These applications handle the maintenance, administration, and support of the teacher laptop. They include backup and restore programs, remote desktop applications, Internet filtering software, security and virus protection programs, and firewalls.

Learning and content management applications. These are responsible for managing the learning environment. They include class roster programs, electronic grade books, programs that "push" content to students, and applications with similar functions.

Student Laptops

The student laptop solution can be used in either a student PC program (SPP) or a school eLearning program. Like the teacher solution, the student laptop solution can also be used with or without connectivity. This solution also includes courseware or other digitized content.

Selecting the Student Device

As with the teacher platform, a range of devices is available for student use. Midrange and full-featured laptops are a great choice for **older students** who need to consume and produce content. Affordable notebooks, such as the ruggedized Intel-powered classmate PCs, can suit the specific needs of **younger students**, including those in primary school.

A student's age is probably one of the most important factors in determining the physical characteristics of the platform. Younger students may require ruggedness and ease of use, and may value these attributes more than other advanced features and performance. Older students have greater and more sophisticated requirements.

As with the teacher device, if students will use their laptops in a classroom or school environment equipped with a wireless network, consider a system that supports a wireless connection to the network. Especially for 1-to-1 eLearning environments, laptops with wireless capability are the best way by far to integrate computers into a student's highly mobile, anytime-anywhere learning activities.

Classroom Peripherals

Highly Recommended

- Video camera
- CD drive
- Interactive whiteboard

Recommended

- Printer
- Thumb drive
- Hard drive
- Scanner
- Projector
- TV/monitor
- USB memory

Nice to Have

- Digital pen
- Still camera
- Microscope
- Robotics
- MP3 player

3

Intel-powered classmate PC

The Intel-powered classmate PC (CMPC) is an excellent, ruggedized educational laptop specifically designed to meet the needs of students aged 5 to 14 years. Classmate PCs include practical, education-oriented features that improve the learning experience for students, parents, teachers, and schools. These features include:

- Lightweight, easy-to-carry design
- Rugged construction
- Education-specific software
- Compatibility with existing content, applications, and operating systems
- Theft deterrence

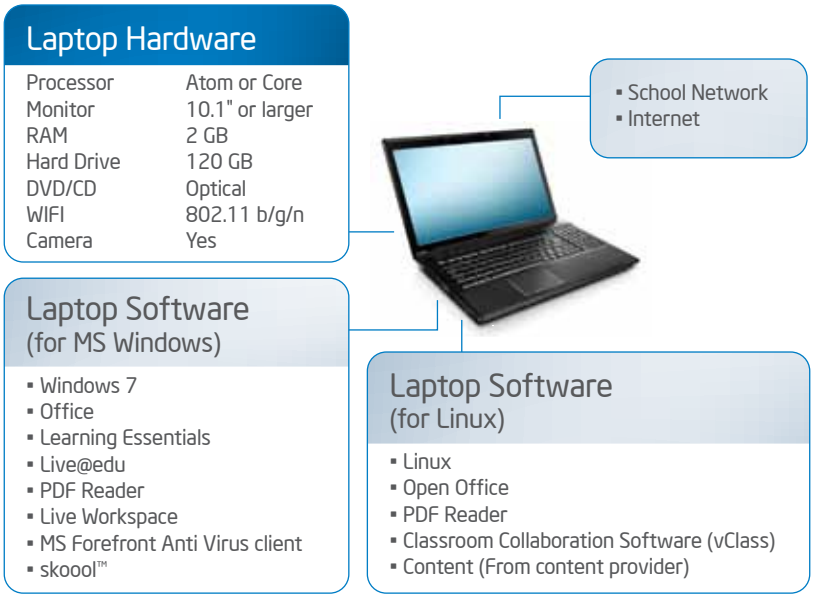
With the classmate PC, students can easily collaborate, exchange information, and review eLearning material. In addition, teachers can seamlessly monitor classroom activity and supplement lectures with interactive materials.

Finally, to ensure long-term success and viability of student 1-to-1 eLearning environments, select a computer with a robust feature set (including processing performance, disk capacity, memory, and similar features). In addition, be sure to establish a roadmap to continue improving the technology over time.

Selecting the Student Laptop

Solution Map

The graphic above illustrates elements for a sample student laptop solution for both the Windows and Linux platforms.



Student Laptop Solution Elements

Determining the Software Elements

The software needs of the student computer parallel those of the teacher computer with respect to operating system, productivity applications, and client management applications. In general, what is installed on one platform should be installed on the other. For more information, see the discussion of software for the teacher computer later in this chapter.

Securing the Student Computer

The greatest security concerns for student computers are protecting against theft, preventing infiltration by viruses, deterring information theft, and preventing student access to unwanted Web content.

Theft deterrence. Theft deterrence is generally the easiest kind of protection to implement. Theft deterrence includes identifying methods, such as locking cabinets, that physically secure desktop computers, laptop computers, and other technical equipment when not in use. Community involvement in eLearning can also help create a social stigma against theft and vandalism.

Virus protection. When student computers are connected to the Internet or to an external USB device, they become vulnerable to malicious software ("malware"), viruses, worms, and similar threats. Protecting computers against viruses usually involves the use of antivirus software (such as McAfee VirusScan*, Norton AntiVirus*, Cisco Security Agent*, and AVG Anti-Virus*) provided by commercial vendors or free and open source channels.

Student computers should also have a personal firewall, which protects the student by permitting only certain kinds of network traffic. A firewall controls the connection to and from "zones of trust," which in this case would be the school's internal networks or the student's laptop computer. Personal firewalls are available as standalone products from companies such as Symantec, McAfee, and AVG (www.grisoft.com).

Antivirus software also offers protection from Internet hackers and shields student identity and privacy. Additionally, antispyware products can act like a personal firewall, protecting against external threats and unwanted intrusions.

Securing information and privacy. Wireless access has additional security implications, since anyone within range of the wireless signal could potentially connect to the same network and access personal or confidential information. One of the more popular approaches to securing a wireless network is to use encryption, so that only those who know the access code can join the network and access its information.

Wireless access points (WAPs) typically provide Wired Equivalent Privacy (WEP), which offers confidentiality comparable to that of a traditional wired network. WEP, however, doesn't protect users from each other when they are on the same network. Hackers can also compromise WEP security. Two new protocols, WiFi Protected Access (WPA) and WPA2, are considered much more effective and require a password or pass-phrase to gain access to the network and information on the network.

Inappropriate Web content. Software that protects students from access to unwanted material can be implemented at a number of levels—the national infrastructure level, the network level, the server level, or at the level of the student computer. For protection software at the computer level, look for products by companies such as Symantec, Trend Micro, and Max Secure Software.

School Servers and Services

School servers optimize network performance and provide persistent, always-on access for students and teachers at school or when working from home. Depending on the number of students and the level of their needs, servers also can act as localized content repositories and support Internet caching and security.

School servers, with Windows or Linux-based operating systems, can provide:

- Shared file and print services
- Content sharing and publishing
- Web/Internet access and caching
- Security (firewall and access control)
- Web and Web application services
- Email service
- Dynamic host configuration protocol (DHCP) service
- Learning management system (LMS) service
- Calendar and meeting schedules
- Remote access and virtual private network (VPN) access
- Directory services
- Domain name system (DNS) service
- Streaming media

Connectivity

Connectivity—widespread and wireless access to the Internet—is an essential element for classroom success. Broadband Internet access enables greater access to information and communication capabilities. Use a Web browser and common applications to:

- Access and download research information
- Communicate with people around the world
- Collaborate on projects—locally, regionally, or globally
- Conduct self-paced learning

Options

Many connectivity technology options are available to meet the unique needs of classrooms and students. These options include:

- 3G, 4G, LTE
- ADSL or DSL
- Ethernet
- WiFi (802.11)
- WiMAX (802.16)

Most connectivity options require on-premise equipment to connect student and teacher PCs to the Internet. In addition, a wireless network is very useful.

Classroom Wireless Network

One of the most important elements in effective eLearning environments is the wireless network, used to create collaborative relationships between students, teachers, and school communities. Although hardwired connections are commonly used in PC lab environments, the freedom and mobility of wireless networking gives students the opportunity to take learning anywhere.

It is relatively easy to provide wireless access in a classroom with a commercial-grade wireless access point (WAP). Broad-scale wireless deployment requires more planning and technical skill. Work with your service provider to decide on the approach that works best for your situation.

Broadband Internet Connectivity: DSL and ADSL

Digital Subscriber Line (DSL) and Asymmetric DSL (ADSL) provide broadband Internet service using the same copper wires used for dial-up voice phone lines. Because upload speeds are typically lower than download speeds, ADSL may be a more cost-effective alternative. DSL and ADSL are usually limited to less than a five-kilometer distance from the telephone provider.

DSL speeds typically range from 256 kbps to 24,000 kbps, depending on the DSL equipment, line conditions, and service level. For optimal speed and service, a single DSL connection is not recommended for more than 100 connected laptops (students and teachers). A DSL modem is typically used to couple the DSL line to a computer or to a router that then connects to one or more computers.

WiMAX—Wireless Broadband Internet Connectivity

WiMAX (802.16a, d, e) is a wireless broadband solution designed to deliver ubiquitous, high-throughput broadband wireless services at low cost. Optimized for high-speed data, WiMAX networks provide new connectivity options to schools around the globe.

WiMAX represents an alternative to digital subscriber lines (DSL) and cable broadband access. Installation costs are lower for a WiMAX wireless infrastructure than for today's wired solutions.

While the more familiar WiFi (802.11a, b, and g) handles local areas, such as in schools or community "hotspots," WiMAX covers wider metropolitan or rural areas.

Go to **www.wimaxforum.org** to learn more about WiMAX Broadband Wireless Technology Access.

Digital Content

A fully integrated eLearning environment includes digital content, productivity applications, and management applications. Engaging digital content keeps students' interest while also providing the key concepts they need. Productivity tools let students learn using the same tools used in the real business world. And management applications allow teachers to share files with students, monitor student PCs, use school record-keeping systems, and more.

Digital content for students includes online learning material. For example, skoool is a free online learning system that helps develop math and science skills. Additional digital content is available from a variety of sources, often in local languages or customized for cultural needs.

Improved Learning Methods and

Intel skoool™—A New Concept in eLearning Content

The Intel skoool™ Interactive Learning and Teaching Technology is designed to exemplify the benefits of high-quality, multimedia, math-and-science content technology, and to stimulate wider use of these technologies to advance student education around the world.

Intel skoool is SCORM compliant, freely available, and has been localized for eight different languages and the education standards of 25 different countries. Languages include Arabic, English, European Spanish, Latin American Spanish, Portuguese, Thai, and Turkish—with new adaptations currently being completed in French, Chinese, and Russian.

More than 3 million students and teachers use this Web resource to explore key math and science concepts. More information is available at **www.skoool.com**

Professional Development

A new approach by classroom teachers can make a huge impact on student learning. In the student-centric approach, students work together in groups to share information, learn interaction skills, and create projects. This mimics the way that many business people work together in real life. In addition, it encourages useful 21st century skills such as problem solving, critical thinking, and collaboration. Students increasingly become independent, self-directed learners that build their knowledge and explore new topics.

Technology (PCs, peripherals), connectivity, and digital content provide the infrastructure that facilitates this transition from teacher-centric to student-centric classrooms. But many teachers are not yet comfortable using these tools, and need to learn how to effectively integrate technology into the classroom to support improved learning outcomes. Professional development helps teachers develop these skills in a meaningful way.

"Intel is the cornerstone we've held onto. They're so good about emphasizing that it's the student, the teacher, the parent, the community—not just the technology."

Joyce Morgan, Associate Superintendent,
Auburn City Schools, United States

Chapter 4

Understanding Support Systems

As discussed in Chapter 3, in order to put together a successful program, we need to include other essentials: policy, funding, metrics, and commercial partners.

In this chapter, we look at some strategies to integrate these support systems, and then look at a sample program to see them at work.

At What Grade Should 1-to-1 eLearning Be Started?

When should 1-to-1 eLearning be started? The best answer is: as early as a child can use a laptop, and as early as a 1-to-1 environment can be made available.

Research indicates that learning capacity and cognitive skills begin developing in the earliest stages of a child's life. In addition, a child's early learning environment is a strong determinate of future academic success.

Studies have shown a positive impact of ICT on the attainment of basic numeracy and literacy. Whether you're considering 1-to-1 for the attainment of 21st century skills or for basic literacy and numeracy, ICT can play a role in increasing effectiveness.

A limiting factor, of course, is the availability of content, and also the availability of teachers trained specifically in the use of ICT with younger children. These, however, are easily overcome with a well-designed eLearning program, such as those discussed in this guide book.

There is a natural concern about the responsibility of younger students and their ability to care for a laptop. However, the use of ICT at younger ages can create a culture of responsibility, in which children learn how to take care of the tools that they have. Also, in many cases this concern is alleviated by having younger students keep their laptops at school until they develop the necessary carefulness.

Support Systems

In order to put an effective program together, there are additional considerations that help facilitate implementation:

- Making any **policy** changes that may be needed
- Working to secure **funding** with governments and other sources
- Determining your success **metrics and assessments**
- Working with the **commercial ecosystem** (vendors)

Addressing these elements means working with the eLearning program stakeholders—the decision makers, vendors, funding entities, and the user community of teachers, students, parents and administrators—to start the process of developing an eLearning program.

Policy

When technology is deployed in schools, policy should be examined. Policy provides the foundation that enables technology planning and deployment to take place. The test of a successful policy is in the examination of the program accomplishments to determine whether the intended beneficiaries are truly profiting, and also to evaluate the fairness of the policy to all of the parties it affects.

An essential aspect of all policy is that it should be constantly evaluated and modified as needed. A systematic approach to policy formulation will establish realistic policies in reasonable time frames. Central to the process is the goal—in this case, the goal of education transformation that brings 21st century technology to schools, and 21st century skills to students. Regular evaluation enables the process to be checked for adherence to the stated goals and objectives of your eLearning program.

The importance of technology policy goes beyond initial development or initial changes. Strong leadership recognizes the need for policy that addresses in an ongoing way what to do and not do when using technology as a primary resource. This means creating an "Acceptable Use Policy" that is the foundation for all stakeholders involved in the propagation of the technology. Such a policy should define the following:

- Appropriate usage definitions
- Inappropriate usage definitions
- Consequences for misuse
- User liability expectations
- Security instructions
- Protocol for technical support needs

In addition to new technology policy, other existing policies need to be examined and perhaps modified. These include educational policy (how teaching is done), power usage policy, infrastructure policy, funding policies, and decision-making policies—whether decisions are made by policy makers alone, or by other stakeholders as well, such as teachers, parents, and students.

Funding Sources and Strategies

It's important to determine how your program will be funded. Funding can come from a plethora of sources—be it governments, public-private partnerships, local businesses, or participants themselves. The potential funding sources discussed in this section should give you funding ideas for your program.

Government and Agency Funding

Governments and government agencies are typically the primary sources of funding for large-scale national initiatives. Examples include teacher PC programs (TPPs) in Guatemala, student PC programs (SPPs) in Italy, and 1-to-1 eLearning programs in Portugal and Libya.

This funding can take many forms—from direct subsidies and low-interest loans, to VATs and duties whose proceeds are applied to an eLearning program, to reduction in VATs and duties on goods and services purchased by the eLearning program.

Depending on the hierarchy (in some cases, the national level makes policy and lower levels have the budgets), governments at all levels—national, state or province, and local—are candidates for providing funding support. In some cases where there might be an alliance of countries, such as the European Union, that alliance and its agencies can also act as a funding source. A successful project in Spain, for example, was funded with help from the EU.

Non-Government Agencies

There are many non-government organizations (NGOs), governmental agencies, and other private philanthropic organizations, such as USAID, Mercy Corps, the World Bank, and USTTI, that often fund programs and activities in countries worldwide.

These programs and activities often include a focus on education, healthcare, and economic development. In some cases, NGOs act as partners, offering direct funding; in other cases, they may provide human resources to perform training, or some element of the eLearning program, such as digital content.

Innovative Funding in Portugal

Portugal's e-Opportunidades program is a particularly good example of funding by an innovative model. The Portuguese government auctioned 3G licenses and set aside the auction proceeds to fund the country's information society programs, specifically bringing ICT to schools. The auction raised € 460M and is being used to bring PCs, Internet access, teacher training, local digital content, and more to Portugal's citizens.

Public-Private Partnership in Turkey

A coalition of public and private organizations worked together in Turkey on successful ICT programs. These programs have:

- Allowed 100,000 teachers to purchase laptop computers through a Teacher PC Program
- Offered low-interest financing through a government-backed bank
- Provided free installation for broadband connectivity from Türk Telekom

Public-Private Partnerships

Public-private partnerships (PPPs) are partnerships between a government (or a government organization or agency) and private sector companies. The private sector company may provide some form of capital investment, while the government provides matching funds, supportive government services, an in-kind contribution, or perhaps a contract to the private sector companies.

See the sidebar, "Public-Private Partnership in Turkey," for an example of this successful funding method.

Telecommunication Companies

A special type of public-private partnership involves leveraging business-funded incentives with telecommunication companies (telcos). Telcos, because many of the future eLearning technology users are already their customers, present special opportunities. For example, telcos might offer discounts to teacher PC programs as part of a connectivity contract. And telcos are often willing to apply the funds they would have spent on customer acquisition and marketing towards discounts to teachers.

Telcos could partner with the Ministry of Education to advertise and increase awareness through letters to teachers, teacher staff meetings, and so on. They could then make the bundle of products and services more attractive to teachers by providing discounts or free installation, such as in the example from Turkey mentioned above.

A unique opportunity might be to work with telecoms or Internet service providers (ISPs) to lease laptops to their subscribers, who are then billed as part of their regular monthly service payment. Another telco-related deal could include customer-leased laptops that could later be purchased at favorable prices. Many such arrangements are possible and should be explored.

Banks

Like telcos, banks are often willing to apply the funds they would have spent on customer acquisition towards favorable PC financing terms for teachers or students.

Furthermore, banks benefit by partnering with schools because schools are not only effective promotion vehicles, but also employers and community anchors. Because of a school's unique role with teachers and parents (for example, their ability to withhold paychecks or diplomas), banks can enjoy a dramatically lower risk of default in their dealings with schools.

Beyond the obvious services a local bank can provide (for example, low-interest loans), multilateral banking institutions like the World Bank can offer financial services for developing countries fully in line with their charter to spur development and reduce poverty. By tapping into such services, especially targeting funding directed toward civil development, education, and health, you can find additional assistance for your eLearning program.

Universal Service Funds and Other Mechanisms

Most countries have a Universal Service Fund (USF) established through an act of government. These funds frequently require telecommunications providers to contribute a percentage of their revenue into a national funding pool.

The fund then uses this revenue to provide equitable distribution of telecom services to rural and remote areas, services that would otherwise be prohibitively expensive for the subscribers served. The result is to create a baseline level of telecommunications services for every resident of a country.

Traditionally, USFs have been used for basic voice service (payphone service shared by many subscribers). However, governments have increasingly begun to apply these funds toward data-and-voice service, or even connected services, for a variety of applications—from telecenters to healthcare to education.

As a result, a community development–focused USF policy might be used to provide services such as shared ICT access, connected e-government, connected business, connected education, connected healthcare, connected homes, or connected farms.

In addition to USFs, there are many other mechanisms for funding eLearning programs. These range from bond measures dedicated to ICT, to tapping special funds for literacy intervention, ESL (English as a Second Language) programs, teacher quality and retention programs, and the like.

Universal Service Fund Examples

Three countries that have used universal service funds to support eLearning programs are Turkey, Colombia, and Morocco.

Universal service funds in Turkey enabled the creation of ICT classrooms in each of the country's 40,000 primary schools. In addition, USF supported the purchase of 150,000 PCs for the classrooms.

Colombia subsidized the installation of telecenters, which now reach 5.2 million people including 2.5 million schoolchildren.

Morocco supported the purchase of approximately 100,000 PCs and broadband Internet access to cover all schools.

Funding by Teachers, Students, and Parents

In many cases, financial appeals to end users—parents, students, and teachers—can finance school or district eLearning programs. Of course, the success of this funding strategy depends on the interest of these groups in your eLearning program, as well as their funding capacity.

But don't dismiss this option too quickly. There is a great deal of latent interest in eLearning programs among parents and teachers. Shared payment options, combining government and end-user contributions, are often successful. Easy payment plans for these users, such as low-payment payroll deductions, can make these options very workable.

Organizations such as parent-teacher associations (PTAs) and teachers unions should also not be neglected. Many of these groups are willing to provide subsidies to help you deploy your eLearning program. This option, funding by end users, does not work in every situation, but it's worth testing the level of interest before dismissing it.

Core 21st Century Skills

For the purposes of this guide book, we take the 21st century skills to be these:

- Creativity and innovation
- Critical thinking
- Problem solving
- Communication
- Collaboration
- Information fluency
- Technological literacy

Success Metrics, Standards, and Assessments

Where funding determines how a program is paid for, metrics determine how well a program works. Metrics, standards, and assessments work to provide feedback on success and areas within a program needing improvement. To start working with metrics, we need to look at how to implement assessments to truly evaluate the progress of your program.

Modern Standards and Assessments

Success metrics measure the success of your eLearning program, and demonstrate that it is working as you would like it to work. Success metrics also measure the return on investment (ROI) provided by the eLearning program. Success metrics are only valuable if the right things are measured. In order for metrics to be valuable, the right standards must be chosen.

Standards are defined by the education system and manifested in the curriculum. An increase in reading literacy, for example, is a standard; the program is successful if an increase in literacy is achieved.

Assessments are tests that try to determine if the program is meeting those standards, if it is achieving that success. Standardized competency testing in a given subject, administered to all students at a certain grade level, is one example of an assessment method. There are obviously many kinds of assessments.

Standards and assessments are important components of education improvement. Society uses these means to determine what students have learned. And they are also used to determine the effectiveness of teachers, schools, and entire educational systems.

For this reason, assessment, the application of success metrics, is a critical part of an effective eLearning program. You need to be able to determine if your program is successful or not, as measured against government standards for specific, expected learning outcomes.

Unfortunately, traditional assessment methods do not measure all of the skills needed by the 21st century workplace and society. There is a significant gap between the skills that traditional assessments measure, and the skills and resources that people use when working and interacting in the real world. Because eLearning teaches those skills, traditional assessment methods need to be augmented when assessing eLearning programs.

Which Standards to Use?

Many governments have learning standards already defined at the national, provincial, state, or district level. To be truly meaningful, it is important that these standards include the student attainment of 21st century skills and the successful use of technology, in addition to the other skills they measure.

True 21st century learning standards have these characteristics. They:

- Focus on 21st century skills, content knowledge, and expertise
- Build understanding across and among core subjects and 21st century interdisciplinary themes
- Emphasize deep understanding rather than just shallow, rote knowledge
- Engage students with the real-world data, tools, and experts they will encounter in college, on the job, and in life
- Allow for multiple measures of mastery

A number of reputable education organizations have developed standards that can be used as is, or as a reference for developing your own. These organizations include:

The Partnership for 21st Century Skills (www.21stcenturyskills.org)

Educational Testing Service (ETS) iSkills project (www.ets.org/iskills)

International Society for Technology in Education (ISTE) (www.iste.org)

The UNESCO ICT-CST Project (www.unesco.org/en/competency-standards-teacher)

See the Appendix on p. 58 for more information on these standards organizations.

Which Assessments to Use?

Having examined standards for 21st century skills, now let's look at assessments. Good eLearning assessments do the following:

- Gauge a student's prior knowledge and readiness
- Encourage the student's self-direction and collaboration
- Provide diagnostic feedback to both teachers and students
- Monitor student progress
- Check for understanding, and encourage the ability to think broadly about a subject, as well as within the subject content area
- Demonstrate a student's understanding and skill

When working out your own assessment plan, consider the following:

- Work on 21st century assessment methods is being done in many countries today.
- In these assessment methods, ICT proficiency standards and scoring rubrics were developed and validated.
- You can create your own assessment plan or adapt someone else's.

For more about assessments, please see the Appendix.

Working with the Commercial Industry

Working with commercial vendors is the final facilitator of an eLearning program. The commercial industry—sellers of technical equipment, software, and services—will actually deliver and support your eLearning program. They can also provide other key elements of the eLearning environment as well, such as professional development, IT training, and user and IT support.

While your vendors are likely comprised of both local and global partners, emphasis should be placed on using local suppliers wherever possible. This will help stimulate local economic growth—including job opportunities for the very students being educated.

Using local vendors can also ensure that localization and cultural sensitivity are accommodated, and that localization goals—a vital part of many eLearning programs—are realized. A local independent software vendor (ISV), for example, is more likely to know local education standards and be able to provide content localized for language and culture.

Providers of Commercial Products and Services

It is likely that a single vendor may not be able to provide all of your eLearning program needs. You will have to work with a combination of vendor types when building and maintaining your eLearning program.

The following kinds of companies are all able to help you with one part or another of your program. Some may be able to provide a more complete offering; others, while providing a smaller part, might have other advantages, such as lower cost or locality.

Education Service Providers (ESPs). ESPs are generally full-service providers of complete education-specific solutions, including both products and services. A good ESP can work with you to procure the equipment and software specified by your eLearning program. It can ensure all parts of the solution work well together. And it will order, deliver, install, and support your program. Many can provide professional development and IT training, and help with such activities as assessment, curriculum and content integration, and user and IT support as well.

One of the benefits of working with an ESP is that these companies are education specialists and have a deeper understanding of what is needed for a successful eLearning program. If you have an ESP available, this may be your best choice as a primary vendor.

Managed-Services Providers (MSPs). MSPs usually provide a subset of what an ESP provides. MSPs usually offer ongoing service, as opposed to products themselves or one-time setup and installation. Typical MSP services include helpdesk support, for example, or warranty and spares services.

System Integrators (SIs). System integrators are similar to ESPs, but with important exceptions. An SI can order and install all the pieces of the program and put them together, installing applications as needed, performing configuration, and often setting up classrooms. However, many SIs are not necessarily education experts and may not be able to provide training or ongoing support.

Value-Added Resellers (VARs). VARs are similar to SIs, only smaller. Many VARs specialize in IT—they deal primarily in computers, servers, networks, and systems software. VARs may or may not supply and install user applications. Most are not specialists in education-specific products.

Independent Software Vendors (ISVs). ISVs are companies that specialize in developing or selling software. There are many types of education ISVs, including application ISVs, content ISVs, and tool ISVs.

Many ISVs already have the experience of working with existing curriculum standards, or can take software that was developed for one curriculum standard and adapt it to another. (The Intel skoool program is a good example of content that has been developed once, then localized for many different countries and languages.)

Local OEMs (LOEMs). LOEMs offer smaller pieces of the solution, often just the client-server hardware, though LOEMs do vary in what they can provide. An LOEM may be able to "grow" into a larger SI, MSP, or ESP type of role. LOEMs are often the primary vendor in providing eLearning programs, especially where there are no established ESPs or education system integrators.

RFP (Request for Proposal)

An RFP is a document that tells your commercial suppliers exactly what you need from them, so they can submit bids and pricing. The response to an RFP specifies a technical solution that meets your requirements.

Other Considerations

There are other important things to consider when choosing and working with commercial suppliers.

1. Try using a pre-deployment testing plan or "pilot run" to qualify and select your vendors and make sure the program is ready for large-scale deployment.
2. You will probably deploy your program in phases—by first installing a smaller, manageable number of schools, and then adding more installations (more schools, for example). This first phase can be very informative; it can identify what worked and what didn't, and what the whole process looked like, including training. Don't rely on your second-phase vendors to remember what was done during the first phase. For one thing, they may not be the same vendors.
3. Part of the deployment process may involve writing an RFP (request for proposal). An RFP document captures your requirements and defines the products and services needed for the program. It is common to send the RFP to more than one vendor, or a group of vendors working together (a consortium). The vendor or consortium repesentative should respond with a program proposal that includes recommended approach with detail.
4. Commercial vendors sometimes develop their own eLearning programs that can then be offered to private schools, or to public schools with discretionary budgets. In this case, they attempt to anticipate what a useful eLearning program looks like. A vendor's standard solution may offer the benefit of cost savings and volume economics, as opposed to a custom solution that responds to an RFP. A vendor's standard solution may even be offered in response to an RFP as a way to reduce costs.

Timelines and Milestones

Rapid and successful deployment depends on setting a reasonable schedule, which in turn requires that the initial program be properly scaled and, usually, deployed in phases. When setting a schedule, it's important to determine which tasks can be performed in parallel (at the same time), and which ones must wait for other tasks to be performed first.

Phased Deployment

Generally speaking, eLearning programs follow this pattern: plan, pilot (trial), measure, amend, expand. It's usually better to start with a smaller eLearning program and make it larger over time than to attempt a large program all at once. This not only builds the program in a steady manner, but also builds the capability and expertise needed to create and administer the program.

You can deploy an initial program with your selected vendors, use your success metrics to validate the program's success, then easily expand the deployment—either by adding more schools or by adding enhancements to the initial program. This keeps the project from getting bogged down with too much initial complexity and provides faster results.

For example: you might start with a TPP for one or more schools, along with an SPP for students, and appropriate software and professional development. This would create the basic schools. In the next phase, you might introduce more advanced server capabilities, teacher and administrative support software, additional curriculum material, and greater networking capability. This would improve the environment to the knowledge-deepening type, providing a fuller 1-to-1 environment for students. The final phase could then expand the environment to a full collaborative one, the richest 1-to-1 environment, from which students will gain the most.

Or, using a different approach, you might expand a basic eLearning program from a small number of schools to a greater number, without changing the scope of the learning environment. The implementation might be a program that combines TPPs and SPPs, along with appropriate software, professional development, and some networking, in order to create basic eLearning environments in a large number of schools. Again, the benefit is more rapid deployment and greater simplicity in the initial phases.

Successful eLearning Programs in Portugal

Portugal's goal is to build a knowledge-based society that can compete economically with anyone in the world. Their comprehensive technology plan, Plano Tecnológico, is providing the technology, connectivity, content, and professional development needed to succeed.

Key programs include subsidizing PC purchases to students, teacher professional development, mobile broadband connectivity, local education content, and more. Local PC manufacturer JP Sá Couto has not only won the contract to provide Magellan PCs to Portugal schools, but has also won contracts to supply other countries with thousands of units, giving a huge boost to the economy.

Key success metrics are:

- Government targets for broadband penetration
- Internet usage
- PC ownership
- 21st century skills development

Additional metrics include local economic development, program participation, and selling units into other countries.

For more information, go to **www.planotecnologico.pt**.

Teacher PC Programs (TPP) Benefits

TPPs support learning and integration of ICT in the classroom through:

- Improved access to information and education resources
- Faster preparation of course material and lessons
- Improved instruction and teaching methods
- Increased motivation of students to learn

TPPs improve education administration and operation.

TPPs support career development and teacher retention by:

- Increasing skills and confidence in using ICTs
- Improving job flexibility, mobility, and work-life balance
- Enhancing career opportunities and professional development

TPPs are relatively fast and easy to roll out (often within 2–6 months).

Sample eLearning Program—TPP

Many countries have used PC purchase programs for their users—teachers, students, and parents—to great effect. These programs have been structured in a number of ways, depending on the circumstances and needs of the country or region, and depending on the needs and capabilities of the user community being served.

A PC program for teachers in one country, for example, wouldn't be identical to a teacher program in another; and neither would be identical to a PC program for parents. But all PC programs—TPPs, SPPs, programs for parents—share many common characteristics.

Below is a sample TPP. It includes all of the program elements—the four technical elements discussed in Chapter 3, plus the additional nontechnical elements (policy, funding, success metrics, and working with the commercial ecosystem) discussed here.

Sample TPP—Key Elements

The lists in this section illustrate basic suggestions for defining an eLearning program that deploys a TPP. These lists are organized around the eight program elements shown in Chapter 1:

Components of an eLearning Program

Solution Elements

1. Technology, such as laptops and servers
2. Connectivity
3. Localized digital content
4. Improved teaching methods and professional development

Support Systems

5. Policy
6. Funding strategies
7. Success metrics and assessments appropriate to eLearning programs
8. Working with vendors (the "commercial ecosystem")

For a sample TPP, the following represents a workable way to accommodate all of the program elements:

Technology

- Choice of basic, intermediate, and advanced computers

Connectivity

- Telecom company to provide DSL for teachers' homes, including free installation and 3 months' free subscription
- Telecom company to also act as ISP

Digital Content

- Intel PC Basics for Teachers
- Core curriculum content for math and science provided as eBook from local content ISV
- Supplemental curriculum content provided by Intel skoool
- Community-generated content available from TeacherTube
- Other content available from Web/Internet

Improved Learning Methods and Professional Development

- Guidebook provided to teachers on best practices for integrating Intel skoool content with national curriculum
- Guidebook provided to teachers on general ICT pedagogy and best practices
- Professional development provided by the One-to-One Institute. Focus on the initial use of ICT in education, plus use of ICT to actually teach in a 1-to-1 eLearning school
- ePals* account for teacher to set up virtual classroom
- Teachers to be encouraged to join the Intel online teacher community
- Teachers offered incentives to create content and post it on TeacherTube*
- Expected teacher activities for this program:
  - » Prepare lessons
  - » Integrate digital content with existing curriculum
  - » Share content with students

TPP Best Practices

The following are suggested best practices to follow when creating a TPP.

- Include these important key sponsors:
  - » Ministry of Education and local governments
  - » Teachers unions
- Explore creative financing options and guarantees:
  - » Government subsidies
  - » Teacher salary deduction or salary sacrifice
  - » Borrowing against retirement funds
  - » Foundations, unions, associations, credit unions, and aid and development organizations
- Include good-better-best platform options
- Use an integrated approach by:
  - » Combining connectivity ("unwiring" the campus), ICT skills, content, and services
  - » Working with local ISVs, telcos, and service providers
  - » Establishing organization, management, accountability, and reporting
  - » Considering a TPP with all SPPs

Policy

- Infrastructure development policy to be examined so that electrical grid can be more rapidly deployed to underserved areas
- Educational policy to be examined to allow eLearning-appropriate measures of school success
- Educational funding policy to be reviewed and revised as needed

Funding

- Government subsidy of $400 toward PC purchase
- Financing via government-backed bank
- Up to 3-year, low-interest leasing or loan terms
- Leasing option decreases VAT to 1 percent
- Teacher salaries issued by this bank, which simplifies salary deduction for teacher contribution to laptop purchases

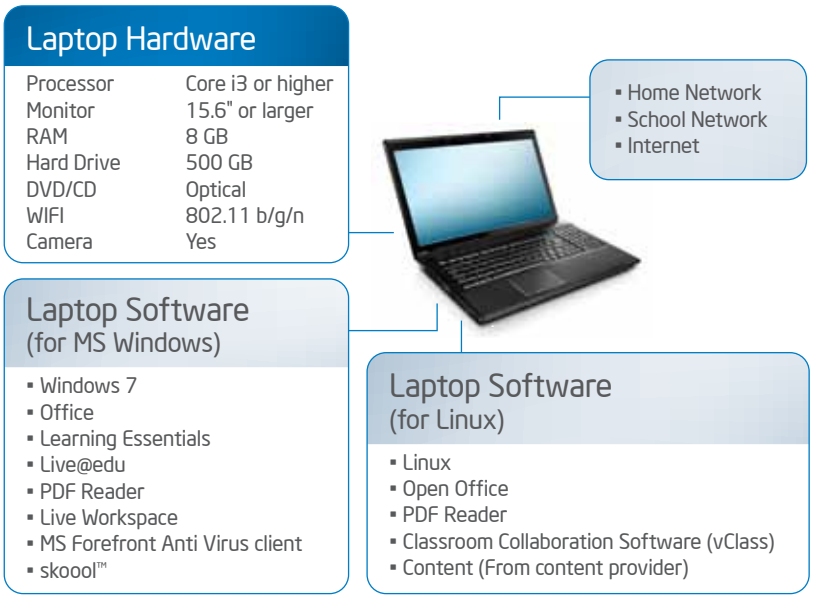
Metrics and Assessment

- Objectives (these goals will be measured):
  - Introduction of ICT in the classroom
  - Easy preparation of course material and lessons
  - Communication between teachers
  - Increased skills and confidence in using ICT in advance of more
  - Comprehensive school eLearning program
  - Target = number of teachers
- Assessment method:
  - Survey to be emailed by teachers at periodic intervals to report on key metrics in using ICT education. These emails to be sent to Ministry of Education or its designee for collection and analysis.
  - Other assessments as needed

Commercial Industry Partners

- Sponsors include Ministry of Education, local governments, teachers associations, and teachers unions
- Local OEM (LOEM) to provide platform and user support including 24-hour phone support for teachers and 2-year on-site warranty, including parts and labor
- One-to-One Institute to provide professional development for ICT in education and 1-to-1 eLearning
- Telecom company to offer TPP bundle to teachers through Ministry of Education portal
- Telecom company to provide DSL and Internet ISP
- Local content provider to supply core math and science curricula in eBook format

See the graphic below for an example TPP offering.



A Sample TPP Bundle

"We don't want children to only consume information. We want them to generate it, to produce ideas and knowledge."

Guadalupe González, Academic Advisor,
Malinalco Project, Mexico

Chapter 5

Ensuring Long-Term Success

Once your eLearning program is in place, its success will be determined by your user community—the teachers, students, administrators, and parents who use it. How well do they participate in the program? How well do they use the eLearning environment to produce the results originally identified by the objectives in Chapter 1? Your eLearning program is now in their hands.

Intel® Teach

The Intel® Teach program offers proven professional teacher development for 21st century skills. Intel Teach promotes standards-aligned and problem- and project-based approaches to learning.

Courses help teachers transform instruction to engage students in deeply relevant ways, including appropriate use of technology, Web 2.0, and social networking for learning, creativity, and communication.

Intel Teach is the largest, most successful program of its kind.

- By the end of 2011, Intel Teach will have provided professional development to over 10 million teachers worldwide.
- In an independent evaluation of Intel Teach, 91 percent of teachers said students were "motivated and involved in the lesson", and 81 percent said "student projects showed more in-depth understanding" than in other, comparable work.

As many have noted, the job facing educators today is to prepare students for new jobs, using new technologies, in order to solve new problems. These 21st century jobs require more than just single-discipline education and testing methods that rely on rote memory. Students need to be equipped with concepts that are common to all problems, all technologies, and all skills.

To do this, teachers must not only learn the new technology and content; they must also grow their pedagogical knowledge and skill as well.

This is no small undertaking. It is critical that teachers be given as much support as possible, and not be left simply to figure things out once the eLearning environment is installed and ready for use. They need as much support as can be provided.

This support will go a long way, not only toward benefiting the students that teachers help educate, but also toward benefiting the eLearning program itself, by helping it to grow and fulfill its larger social and national purpose.

Professional Development

Professional development needs to be ongoing to be successful. Teachers and administrators must keep up with the changing environment of technology to provide the best 21st century resources for the program. A good way to sustain professional development is to put together a teaching community, in which ideas can be shared. This way, teachers can mentor and learn from other teachers, and in fact, model the kind of self-tutoring community that they are working to create for students. You can find existing resources for long-term development within your program, or develop some as part of your long-term plan.

Curriculum and Content Integration

The resources used for ongoing professional development may also be used for ongoing curriculum and content integration. Teaching communities can allow teachers to share newly developed content, and collaborate on content creation.

Supporting Teachers with an Education Plan

A program must provide ongoing support of teachers beyond professional development and content integration. There are a number of ways to support teachers who will work with the new content and learning environment. The group of ways you plan to support your teachers is called your "education plan."

Finally, in most eLearning environments teachers are also responsible for student assessments, which measure the success of the eLearning program in terms of student performance relative to national standards.

In non-eLearning environments, assessments involve traditional, well-understood methods, such as tests, individually generated reports, essays, and examinations, both written and oral.

Assessment in your eLearning environment includes traditional methods, but added to these are other methods, such as evaluation of collaboratively produced student portfolios and electronic surveys (eForms). These are needed to assess the 21st century skills that the eLearning environment fosters and teaches.

For more on success metrics, standards, and assessments, see the discussion in Chapter 4.

Working with Master Teachers

One of the best methods of supporting teachers is to find and appeal to those who are the school's "master teachers" and those who are its visionaries.

In these groups, you will find your most interested eLearning champions. These are teachers who stand up first and embrace 21st century eLearning, who see the bigger picture for education in their country, and who are eager for the benefit to their students. Teachers in this group, despite their individual levels of readiness, are the least likely to feel threatened and the most likely to advocate for eLearning to other teachers.

Working first with these teachers builds a core of expertise and eagerness in the teaching community. This expertise can be then made available to other teachers in the school. In this way, a self-reinforcing and ever-widening circle of capability is started and maintained.

Working with master teachers and visionaries, and asking them to work with others, also encourages teachers to discuss pedagogical practice. It fosters an atmosphere in which teachers develop and communicate best practices among themselves.

One benefit of this activity is that teachers often feel a great sense of accomplishment when their working environment becomes more collaborative and creative.

Another benefit is that this kind of creative collaboration among teachers, especially when practiced using online communities, is a model for the kind of collaborative learning a true 1-to-1 eLearning environment brings to students. And as we've seen, the ability to work collaboratively in an electronic environment is an essential 21st century workplace skill as well. Teachers who practice these skills are more likely to bring them effectively to their students.

Ongoing Development

There are other sources of professional development and support for teachers.

One is to work with professional organizations, such as teachers unions and other professional societies. Many have already developed professional development material and programs for working in the new eLearning environment.

Another is to participate, as mentioned above, in online communities and user groups.

Yet another is to purchase professional development content designed specifically for this task. Several programs and packages like this are available.

Teacher Activities

All available ways of supporting teachers should be used. Their new job is not easy, and on their shoulders rests the success of your eLearning program.

The following represents a fairly complete list of activities for teachers relative to their students and to their own development as professionals. Use this list to guide you in developing your own education plan.

Prepare and embrace the change; evangelize; augment your value as a teacher:

- Find and participate in ongoing professional development.
- Mentor and learn from other teachers.
- Set up teacher training programs in your school (for example, Intel Teach).
- Participate in online communities and user groups (UGs).
- Publicize online communities and UGs to other teachers.
- Provide incentives and awards, and use competitions to address obstacles; affect change management.
- Identify champions and leaders among local educators and within education groups.

Evolve pedagogical practice (integrate eLearning; teach efficiently and effectively):

- Integrate curriculum with digital content:
  - Seek, access, and use digital content from many sources (for example, Intel skoool).
  - Create digital content for use in your school or district and publicize its availability.
- Integrate ICT into pedagogy
  - Develop and assign collaborative projects where students perform online research and analysis.
  - Use digital simulations to reinforce abstract concepts.
  - Use probeware to collect data then perform data analysis and finally have student visually represent their findings.
  - Assign students writing assignments to be published as blogs.
- Adapt standards and assessments for eLearning:
  - Adapt your own standards to the eLearning environment.
  - Adopt, modify, and apply standards from standards organizations.
- Develop and apply a list of success metrics for evaluating the process.
- Use eLearning to organize and manage courses, content, and assessment.

Collaborate (author and share); build and use a robust community of teachers:

- Create your own content and share it.
- Use social networking tools for collaborating with students, parents, and other teachers.
- Create a teacher community for sharing best practices.
- Participate in existing online education communities.

Take advantage of opportunities provided by government and vendors:

- Advocate or initiate a TPP or an SPP.

Conclusion

We hope you have found this guide useful.

- Visit the Intel IT Center for Education, for the latest resources and live support to help build your eLearning solution
- intel.com/go/ITforEd
- Contact your Intel representative to help put together a plan for your school or district

Appendix:
Additional Information

Education Sites

Explore these useful sites related to topics discussed in this guidebook.

Intel Education
www.intel.com/intel/education
An introduction to Intel's worldwide education programs, resources, and technology

Intel IT Center for Education
www.intel.com/go/ITforED

Intel® Learning Series
www.intellearningseries.com
Rugged laptops customized for young students

Intel World Ahead
www.intel.com/worldahead
Connecting people to a world of opportunity

Partnership for 21st Century Skills
www.21stcenturyskills.org
The leading advocacy organization infusing 21st century skills into education

skoool™
www.skoool.com
A new concept in e-learning solutions

Appendix:
eLearning Assessment Standards

Organizations

A number of organizations have developed education standards. They can be adopted, or used as a reference when developing your own standards.

Educational Testing Service (ETS) iSkills project

(www.ets.org/iskills)

Defines ICT skills as the ability to solve problems and think critically about information by using technology and communication tools and information skills that include defining, accessing, evaluating, managing, integrating, and communicating information and creating new knowledge.

International Society for Technology in Education (ISTE)

(www.iste.org)

Has defined a set of standards that include technology operations and concepts and they position technology skills in the context of school subjects and a broader set of skills that include creativity and innovation, communication and collaboration, research and information fluency, critical thinking, digital citizenship, and technology operations and concepts. These standards have been adopted by a number of countries and the United States. ISTE has developed a set of standards called National Educational Technology Standards (NETS). You may find these of interest

- NETS-A for Administrators
- NETS-T for Teachers
- NETS-S for Students

The ISTE NETS-T standards:

- Facilitate and inspire student learning and creativity
- Design and develop digital-age learning experiences and assessments
- Model digital-age work and learning
- Promote and model digital citizenship and responsibility
- Engage in professional growth and leadership

Partnership for 21st Century Skills

(www.21stcenturyskills.org)

Brought together the business community, education leaders, and policy makers to create a vision of 21st century learning and to identify a set of 21st century skills. Built around core subjects, those skills include learning and innovation; information, media, and technology; and life career. These skills have been adopted by a number of states in the United States, including Maine, North Carolina, West Virginia, and Wisconsin. The Partnership for 21st Century Skills:

- Focuses on 21st century skills, content knowledge, and expertise
- Builds understanding across and among core subjects as well as 21st century interdisciplinary themes
- Emphasizes deep understanding rather than shallow knowledge
- Engages students with the real-world data, tools, and experts they will encounter in college, on the job, and in life. Students learn best when actively engaged in solving meaningful problems.
- Allows for multiple measures of mastery

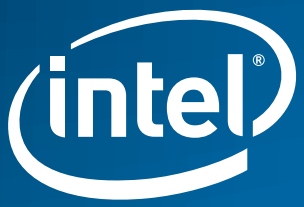
UNESCO ICT-Competency Standards for Teachers Project

(www.unesco.org/en/competency-standards-teacher)

Connects education reform to economic growth and social development that can improve the quality of education, reduce poverty and inequity, advance the standards of living, and prepare a country's citizens for the challenges of the 21st century. The Standards of the UNESCO ICT-CST project are based on three approaches to education reform that correspond to alternative, somewhat overlapping approaches to improve a country's workforce and fostering economic growth:

- Increasing the technological uptake of the workforce by incorporating technology skills in the curriculum—or the technology literacy approach
- Increasing the ability of the workforce to use knowledge to add value to economic output by applying it to solve complex, real-world problems—or the knowledge deepening approach
- Increasing the ability of the workforce to innovate and produce new knowledge and of citizens to benefit from this new knowledge—or the knowledge creation approach

ICT Competency Standards for Teachers also address six components of the educational system. It is important to note that the Standards do not merely focus on ICT skills. Rather, they include training on ICT skills as part of a comprehensive approach to education reform that includes policy, curriculum and assessment, pedagogy, the use of technology, school organization and administration, and teacher professional development.



For additional information about Intel, please visit **www.intel.com.**

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