Teaching and Learning in the Digital Age:

Lebanon's National Educational Technology Strategic Plan

The Ministry of Education and Higher Education Strategic Planning Development Team

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Foreword

A word from the Minister of Education and Higher Education (MEHE): Dr. Hassan Diab, Ph.D.

An essential component of Lebanon's Education Reform Strategy and Action Plan (LERSAP), announced in October 2011, is employing and harnessing information and communications technology (ICT) to support teaching and learning, as well as educational management and leadership. This component is an important contribution to the strategic goal of transforming education in the Lebanese schools so that the economic, social, and personal needs of our young people in the 21st century will be addressed.

This document, *Lebanon's National Educational Technology Strategic Plan*, aims to realize the above mentioned component in the LERSAP. Our vision is that Lebanon's young people will be able to adapt smoothly to the digital age and maximize the benefits from it. To achieve this, we intend to invest in ICT and human resources in schools and to provide enhanced learning experiences. As a result, graduated students will contribute to the economy and society by becoming better employees, employers, and citizens. On the personal level, they will also become more creative, better lifelong learners, and more competent applicants to higher-education institutions.

Lebanon's National Educational Technology Strategic Plan provides a roadmap and a set of recommended actions to ensure the integration of ICT within the Lebanese general education system. It is based on six pillars—infrastructure, curriculum, instruction, assessment, professional development, and management and leadership.

The initial draft of the strategic plan was developed by a task force supported by an international consultant. A consultation process followed, involving national experts and stakeholders. This process concluded with a workshop and led to this document.

Next, the strategic plan will be extended, with implementation plans that will provide detailed action steps with associated timelines, budgets, priorities, and key performance indicators. However, we recognize that these plans will be revised later as we make progress and learn from practical experience within a Lebanese context.

The Ministry of Education and Higher Education asserts its unwavering commitment to the implementation of *Lebanon's National Educational Technology Strategic Plan*. I am confident that this implementation will elevate the education experience of students to the next higher level of quality.

Finally, I wish to thank the task force that developed this strategic plan, led by Ms. Paulette Assaf; the external consultant, Ms. Mary Burns; the reviewers and advisors; and the national experts and the participants of the consultation workshop for their efforts in the production of this final version of the document.

A word from the President of the Center for Educational Research and Development (CERD): Dr. Leila Maliha Fayad, Ph.D.

In a digital age, schools need teachers and learners ready to meet the challenges of teaching, learning, and working in a hyper-connected, collaborative, creative, and information-rich world. Teachers and students need just-in-time and just-as-needed access to computers in their classrooms to support content-based instruction. They need access to experts and resources and the ability to use powerful and high-speed Internet tools such as video and multimedia. However, technical infrastructure, as important as it may be, is not enough. For the promise of educational technology to be fulfilled, as *Lebanon's National Educational Technology Strategic Plan* rightly notes, technology needs to be matched with digital-age curriculum, instruction, and assessment.

The Ministry of Education and Higher Education (MEHE) and the Center for Educational Research and Development (CERD) recognize that technology can equip learners with the necessary knowledge, aptitudes, competencies, and expertise to meet the demands of a digital world. But it can do so only when technology is embedded in a curriculum that focuses on promoting the skills and competencies necessary in the workforce of today and tomorrow—the ability to communicate using electronic tools, collaborate with online communities, organize data, evaluate information, and create new knowledge. To accomplish this, CERD has revised the national curriculum, developing competency-based outcomes that reflect the skills that students need to succeed in a world where problem-solving, entrepreneurship, intellectual risk-taking, and creativity are highly prized forms of human capital. Beginning in the next academic year, CERD will integrate technology outcomes into this revised curriculum so that technology and digital content are aligned with curriculum-based standards and competencies.

Simply revising the curriculum will not lead to high-quality outcomes if instruction remains static. As this strategic plan notes, teachers need ongoing opportunities to attain and refine the highly specialized skills needed to instruct in new ways demanded by technology and a competency-based curriculum. In concert with the revised curriculum, we will set high standards for teachers and teaching and help teachers attain these standards by equipping them with technology, curricular and instructional guidance, digital resources, and high-quality professional development and support. As a result, teachers—the linchpin to the success of the vision and goals outlined in this strategic plan—can successfully deliver high-quality, interactive, and outcome-based instruction that is responsive and adaptive to the changing needs of our students, our country, and our world.

A word from the Director-General of Education for the Ministry of Education and Higher Education: Mr. Fadi Yarak

Globalization is amplifying the importance of knowledge and information across all societies. Lebanon fully understands the role of information and communications technology (ICT) in addressing the implementation of educational reform for improved and equitable access to quality education for all learners. It is clearly our national responsibility to enable our children to benefit from and contribute to the *Teaching and Learning in the Digital Age: Lebanon's National Educational Technology Strategic Plan* to guide the integration of ICT into the general education system. This strategic plan includes a set of principles, goals, and objectives, serving as a series of decision points over a five-year period. If integrated into the curriculum, instruction, and assessment by skilled teachers supported by strong leaders, ICT can create new potential opportunities for students and teachers to acquire lifelong learning, information management, and analytical skills, while ensuring equitable access to education for all.

However, the benefits of ICT can be reaped only through the commitment and collaboration of all stakeholders. Our approach throughout the development of this strategic plan involved seeking input from a wide spectrum of stakeholders in academic and technology fields, from both the public and private sectors. Their contributions were invaluable, and we thank them for their reflections and recommendations. We also thank our hardworking Strategic Planning Development Team for their time and commitment.

The road ahead is an enormous challenge requiring tremendous and effective cooperative efforts. We call upon all stakeholders from both the public and the private sectors to continue joining forces toward reaching full implementation of the vision, goals, and objectives of *Teaching and Learning in the Digital Age: Lebanon's National Educational Technology Strategic Plan*.

Strategic Planning Development Team

Teaching and Learning in the Digital Age: Lebanon's National Educational Technology Strategic Plan was developed by representatives from the Ministry of Education and Higher Education (MEHE) and the Center for Educational Research and Development (CERD) with the support of the Education Development Center-administered Developing Rehabilitation Assistance to Schools and Teacher Improvement (D-RASATI) program. D-RASATI is funded by the United States Agency for International Development (USAID).

These representatives—the Strategic Planning Development Team nominated by ministerial decision reference 1506/2/2011, dated September 21, 2011—are listed below:

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Teaching and Learning in the Digital Age: Lebanon's National Educational Technology Strategic Plan

About This Strategic Plan

Lebanon's national educational technology strategic plan lays out a five-year roadmap to guide the implementation and integration of information and communications technology (ICT)[1] within all levels of the Lebanese general education system. *This strategic plan establishes a vision, set of goals and objectives, and recommendations that government, donors, private- and public-sector implementers, schools, principals, and teachers must address so that every stakeholder is working from and toward the same vision, goals, and outcomes.* The strategic plan covers the period of September 2012 to September 2017.

This strategic plan defines the mission and purpose of using ICT in schools; outlines the core beliefs of the Ministry of Education and Higher Education (MEHE) and its assumptions regarding how ICT can best improve teaching and learning; guides government, donors, and other funders on key areas for potential investment and funding; delineates critical activities needed to make the vision and goals for ICT for teaching and learning a reality for every Lebanese student; and defines key terms and practices to assure standardized, uniform, and high-quality implementation of technology for teaching and learning. (Figure 1 describes what is meant by the term, *quality*.) Though comprehensive, this plan marks a first step in Lebanon's journey toward technology integration in schools.

As Figure 2 displays, the goals and objectives outlined in this strategic plan will guide decision-making over the next five years, from 2012–2017, in the following areas:

- Procurement of school-related technology resources (hardware, software, connectivity, and digital content) and systems
- Placement and maintenance of technology resources in classrooms and schools
- Ongoing professional development, formation, and support for principals and teachers to manage, utilize, and integrate technology to strengthen teaching and learning
- Evaluation of technology-related initiatives in Lebanese schools

Figure 1: Definition of Quality

In this strategic plan, "quality" is a cumulative term involving: (1) adherence to a set of standards of content, design, instruction, assessment, and technology specifications that are grounded in excellence, meaningfulness, and relevance; (2) proof that interventions have resulted in demonstrable student learning and/or student learning gains; (3) development of useful and usable knowledge and skills by teachers, students, and principals as a result of technology initiatives; and (4) verification of all of these by external evaluations.

Quality involves planning, implementation fidelity, monitoring and ongoing assessment and revision.

1 This document uses ***ICT*** and ***educational technology*** interchangeably. These terms refer to all technologies and applications that involve information processing and/or exchange over communication networks, including the Internet.

- Implementation and support of school-based, technology-related initiatives
- Support for curriculum, content, instruction, and assessment through the introduction and integration of technology into the classroom

Figure 2: Areas Guided by the Strategic Plan
2012–2017 Strategic Plan Guide

Technology alone cannot improve an educational system. It cannot turn a bad teacher into a good one, transform a low-performing school to a high-performing one, or in and of itself improve student achievement. *Focusing on technology to the exclusion of the core components of teaching and learning (curriculum, content, instruction, and assessment) has been repeatedly tried across the globe—and it has repeatedly failed.*

Therefore, successful technology initiatives must focus on the core components of teaching and learning—*leadership* at the national, regional, and school levels; reforming the *curriculum* to align with what we know about how students learn and the types of skills necessary to succeed in a highly competitive global economy; improvements in *recruiting and hiring and paying qualified teachers* and then *continually improving their skills* and holding them accountable to standards of professional behavior; using *instructional practices* that have been shown to help students master content; and aligning the *assessment*

system with the instructional system.[2] A focused approach to using ICT can support these efforts, but it cannot substitute for them and it cannot in and of itself drive them. Therefore, if implemented, this strategic plan will help to drive reform in the Lebanese educational system; it will define success in core educational components at the national level; and it will introduce reform as a cohesive whole, rather than as a piecemeal endeavor.

The ultimate goal then of this strategic plan is to use technology to enhance, and support changes in *all components of the educational system as they affect teaching and learning* to prepare students in Lebanon to take their places as high-achieving, highly competent and highly skilled workers, learners, and citizens of a knowledge-based society that increasingly relies on and interacts with digital tools and information.

Organization of This Strategic Plan

The National Educational Technology Strategic Plan is organized into five sections:

Section 1	A national vision for educational technology
Section 2	Goals and objectives for providing schools and classrooms with technology; integrating technology into the curriculum, instruction, and assessment; and helping build the knowledge and skills of teachers and principals so that they can use and manage technology to improve teaching and learning
Section 3	Recommended actions to make the goals and objectives a reality
Section 4	Final thoughts
Section 5	"Concepts into Action"—our definitions of key concepts (such as "learner-centered instruction") that should be carried out in practice. This reference guide is designed, not as a *pro forma* glossary, but as an educational technology compendium to assure uniformity of practice and implementation by technology companies, university partners, organizations, and other implementers who will or may wish to assist the Lebanese government as it carries forward the goals and objectives of this strategic plan.

Note that the goals and objectives are both outcome oriented (describing results) and process oriented (describing inputs and actions). This variation is undertaken with a view of what is and is not feasible by 2017.

Opportunities on which the Strategic Plan Capitalizes

Lebanon's national educational technology strategic plan is school-based and complements other Lebanese initiatives to prepare schools and the teaching workforce for high-quality teaching and learning that meet the demands of successful participation in a knowledge society (see Figure 3) increasingly shaped by digital tools.

2 An *assessment system* is defined as a group of policies, structures, practices, and tools for generating and using information about student learning and achievement. Effective assessment systems provide information of sufficient quality and quantity to meet stakeholder informational and decision-making needs, such as determining progress, measuring achievement and providing accountability information, in support of improved education quality and student learning outcomes (Ravela, Arregui, Valverde, Wolfe, Ferrer, Rizo, Aylwin, and Wolff, 2008).

Figure 3: Definition of Knowledge Society (Arab Development Report, 2003: p. 2)

A *knowledge society* is one in which knowledge diffusion, production and application become the organizing principles in all aspects of human activity—culture, society, the economy, politics and private life. Knowledge can provide the means to expand the scope of human freedoms, enhance the capacity to guarantee those freedoms through good governance and achieve the higher moral human goals of justice and human dignity.

This strategic plan builds on a number of developments both inside and outside Lebanon. Taken together, these should inform the selection and placement of technology resources, decisions about the ways in which to use technology to support teaching and learning, and the design of programs, initiatives, and necessary supports to ensure the efficient, effective, and high-quality use of technology to support curriculum, instruction, and assessment. These developments are outlined here:

1. **The national educational technology strategic plan supports and echoes many of the principles and goals outlined at the highest levels of government to use ICT to support teaching and learning:** This strategic plan reflects the increased interest and commitment by the Prime Minister and National ICT Coordinator at the Prime Minister's Office, who included ICT in Education as a priority project in their action plan for 2010–2011. This strategic plan is also aligned with many of the key outcomes of the *National Education Strategy Framework Education Sector Development Plan* (some of the relevant key points of which are listed in Figure 4), which itself is grounded in the fundamental principles outlined in the Lebanese Constitution and the National Accord Convention.

   The national educational technology strategic plan also has its foundation in the laws and regulations governing educational matters, which emphasize a right to education as well as accessibility to and equality of opportunity and the requirement of education for all. Those principles have also been emphasized in several international conventions that Lebanon abides by, including the *Declaration of Human Rights;* the *International Convention of Economic, Social, and Cultural Rights;* and the *International Agreement on the Rights of the Child* (MEHE, 2010: p. 12).

2. **The national educational technology strategic plan builds on and will help to further shape several major Lebanese government educational initiatives:**

   These include:

   - MEHE's Digital Devices in Classrooms' proof of concept scheduled for 2012–2013.
   - The Ministry of Telecommunications (MOT) and MEHE's *3G Tablets for Youth* outside-of-classroom program, which began in early 2012.
   - Revision of the national curriculum by the CERD to adopt a competency-based curriculum and agreement by CERD to integrate ICT into the curriculum to support intended learning outcomes.
   - Agreement by the MOT and MEHE to begin connecting schools via a wide area network; the release by MOT and l'Organisme de Gestion et d'Exploitation de l'ex Radio Orient (OGERO) of bandwidth in the mobile, wireless, and broadband Internet markets; and the introduction of third-generation (3G) mobile networks in late 2011 portend an improvement in Internet access, availability, and hopefully, cost.

- » Expansion of the Departement d'Orientation Pedagogique Scolaire (DOPS), a unit within MEHE tasked with teacher support and increased attention to augmenting the qualifications of DOPS staff.
- » Adoption of the *Professional Growth and Reforms Support System: Standards-based Classroom Observation for Lebanon (ProGReSS SCaLe)* teacher observation tool by MEHE, which assesses teachers in part on their use of ICT and learner-centered instructional practices in the classroom.

3. **The national educational technology strategic plan capitalizes on current and future global market trends in computing:** Computing is increasingly becoming miniaturized, portable, cheap, and ubiquitous. A fairly robust laptop can be purchased for well below $300 (U.S.). Since 2008, the sale of laptops has exceeded that of desktops, and now, in a further trend toward miniaturization and portability, global sales of tablets are growing rapidly and may soon exceed those of laptops.

   MEHE and MOT have embraced these trends in portable computing, in particular through their Digital Devices in Classrooms' proof of concept, which will be tested for use both outside and inside classrooms. Plans by MOT to configure schools for wireless Internet access will further enhance the benefits of laptops and (where possible) tablets. Adding a few access points to schools will eliminate the need for extensive cabling of schools as a mobile router can accommodate machines with no wireless features at all—like desktop computers—thanks to standard Ethernet network jacks on the back. Adding access points to schools will further build upon mobile computing trends. Additionally, given the uneven electricity supply in many parts of Lebanon, mobile routers can serve as a backup connection when the power goes out, since they can draw their power from cars or battery packs.

4. **The national educational technology strategic plan builds on over 25 years of cumulative research about teaching and learning with technology:** This strategic plan is grounded in extensive research on the effective uses of technology for teaching and learning. Prior to its development, MEHE commissioned a literature review, *Technology, Teaching, and Learning: Research, Experience, and Global Lessons Learned* (http://www.mehe.gov.lb/Uploads/file/TTLA.pdf) from which this strategic plan draws a number of its lessons. Additionally, as the extensive "References" section of this strategic plan attests, research on the effective use of technology to support curriculum, instruction, assessment, and classroom management is woven throughout this strategic plan. This research and accumulated knowledge is built into every goal, objective, and recommendation. If followed, this document serves as a guide for what to do—and what *not* to do—to assure a greater likelihood that educational technology can support reforms in teaching and learning. This does not mean that mistakes will not occur nor false starts be taken—such is the nature of any endeavor—rather, it means that program designers and implementers can draw upon, and contribute to, a reservoir of usable

Figure 4: The National Education Strategy Framework Education Sector Development Plan (2010–2015) (MEHE, 2010: pp. 15-16)

Education (must) develop the general (formation) of individuals and provide them with critical thinking skills and moral reasoning, enabling them to live and work in a modern, changing society and to become lifelong learners. This includes:

- **Preparing students for lifelong learning**
- **Developing general education curricula and personnel to enhance the development of thinking and moral reasoning abilities**
- **Developing general education curricula and personnel to enhance the development of the individual's general education**

Education (must be) oriented toward the development of knowledge, skills, and attitudes needed for handling information and the intensive use of ICT. This includes:

- **Orienting education toward building a knowledge society**
- **Developing the curricula, personnel, and structures needed for the intensive use of ICT in teaching and learning in pre-university education**

knowledge about how to use technology to improve teaching and learning and design programs for the Lebanese educational system that build on best practice.

Challenges Faced by the Lebanese Educational System and Ways This Strategic Plan May Begin to Address Those Challenges

The Lebanese educational system faces a number of challenges (which are discussed in greater detail on pages 21–25 of *Technology, Teaching, and Learning: Research, Experience, and Global Lessons Learned.*[3]) In isolation, a national educational technology strategic plan cannot correct all, or even many, of the challenges listed below. Nor can technology alone reform what ails an educational system. However, as Figure 5 shows, an educational technology strategic plan *can* begin to address these challenges by using technology as a vehicle to focus attention and efforts on the critical factors that affect the quality of teaching and learning.

Figure 5: Challenges Faced by Lebanese Educational System and Ways This Strategic Plan May Begin to Address These Challenges

Challenges to the Lebanese Educational System	How the National Educational Technology Strategic Plan Can Help to Address Such Challenges
A perceived lack of high-quality instruction in government schools, particularly at the pre-secondary level	• Complement and support reform in key areas within the educational landscape that are associated with high-quality teaching and learning and student achievement—curriculum, instruction, assessment, and leadership—and propose ways in which technology can promote and support reform efforts within these areas • Focus attention on selection and recruitment of new teachers; and ongoing professional development, support, and evaluation of existing teachers; and offer new models of pre-service and in-service teacher professional development • Identify and begin to address critical inputs within the system (school leadership, teacher professional development and support, and a teacher evaluation system that includes the use of technology as an indicator of effective teaching) that must be addressed for technology to be deployed and integrated in ways that promote improved student learning
A shortage of teachers in specific subject areas and in certain regions of the country (Ministry of Education and Higher Education, 2010)	• Initiate the use of online or e-learning to provide students with high-quality content and instruction, particularly in areas where teachers are in short supply and/or where face-to-face teaching is of low quality

3 See http://www.mehe.gov.lb/Uploads/file/TTLA.pdf

Challenges to the Lebanese Educational System	How the National Educational Technology Strategic Plan Can Help to Address Such Challenges
Comparatively low achievement levels of students in Lebanon vis-à-vis their international peers	• Coordinate technology implementation efforts with targeted improvements in key areas of student learning, such as improving students' math, science, and English-language abilities • Focus national efforts on providing modern, well-functioning technology and technical expertise to Lebanese schools so that teachers use data to quickly identify and address areas of difficulty for students in general, identify at-risk learners in particular, and use data to differentiate instruction and support for these learners • Use technology to collect and examine data on how students are/are not meeting learning targets, identify areas of weakness within content areas, provide formative feedback to students, and help teachers identify new instructional strategies to improve student performance
A national curriculum that does not integrate technology	• Identify and integrate ICT skills and competencies to support student knowledge and skills • Use the depth and reach of multimedia, online learning, simulations, and computer-based learning so that students can learn at their own pace, move beyond text to more visual and conceptual understandings of information, and apply knowledge in real-world situations, particularly in key content areas, such as math, science, and English • Use high-quality digital content to support content-focused competencies
Poor to uneven technology infrastructure and Internet connectivity in Lebanese schools, particularly in certain regions	• Focus national efforts, and multi-ministry initiatives, to provide digital equipment, digital content, and high-speed Internet access to all schools, particularly in traditionally underserved regions
A focus on high-stakes examinations—the Brevet and Baccalauréat—that do not reflect the types of skills necessary for a digital age, such as critical thinking and information literacy skills	• Prompt reflection, discussion, and revision of the national examination system to integrate digital-age literacies and digital-age thinking skills • Move toward making examinations more efficient through computer-based and computer-adaptive testing
Uneven teacher professional development and the lack of a functioning teacher support system	• Drive university faculties of education, relevant ministries, and educational providers to furnish teachers and school leaders with access to high-quality e-learning content related to their professional responsibilities, and access to professional development and ongoing support to enhance their professional qualifications and competencies
A lack of data at the national level	• Implement a national Educational Management Information System to support the goals of the national educational technology strategic plan • Automate data collection, analysis, reporting and dissemination by, within, and across schools, *mohafazas*, and MEHE • Support systemwide changes by providing policymakers, principals, teacher support staff (DOPS), teachers, and students with a variety of digital tools and skills for project planning, data management, activity planning, and information analysis, fostering deep understanding of content, and communication and collaboration to support, extend, deepen, and transfer educational reforms

To support the educational system in addressing these challenges, the goals, objectives, and recommendations of this strategic plan take into consideration all schools, grade levels, and curricular areas and emphasize the following themes throughout this document:

- Aligning all components of the educational system—curriculum, instruction, and assessment—to guarantee meaningful use of technology
- Improving the human capacity of the entire educational system—educational officials, professional development providers, principals, and teachers, through high-quality professional development and support
- Establishing quality-assurance measures, including standards for teaching, professional development, use of technology by students, teachers, and principals, and standards for acceptable use of technology and procurement guidelines
- Increasing access to technology and digital learning resources for all students in the place where learning occurs—the classroom
- Improving access to and quality of information for decision-makers to make evidence-based decisions
- Cross-institutional responsibility to provide resources and support for schools, teachers, and principals

Immediate Steps Following Adoption of This Strategic Plan

This national educational technology strategic plan outlines a broad vision for how and why technology should be integrated within Lebanese classrooms to support teaching and learning. The adoption of this strategic plan provides evidence of the Lebanese government's support of the vision, goals, objectives, and recommendations described in this document. But this strategic plan is not the culmination of the thinking and planning about educational technology. Rather, it represents the *beginning* of Lebanon's educational technology efforts and will be immediately followed in the remainder of 2012 and 2013 with activities and products that will define and detail how this vision becomes actualized. Figure 6 outlines these immediate next steps.

Figure 6: Steps to Implement the National Educational Technology Strategic Plan

Activities and Products	Purpose(s)	Timeline
1. Operational plan (implementation plan)	• Create a detailed plan for ICT integration • Execute reform components outlined in this strategic plan • Outline roles and responsibilities with disaggregated timelines for activity completion • Detail a dedicated budget, timeline, and resources for ICT-related activities • This should be developed in tandem with national performance indicators and a performance monitoring plan to assure the alignment between implementation and evaluation activities	August 2012–January 2013

Activities and Products	Purpose(s)	Timeline
2. Development and administration of readiness protocols to assess schools' ability to support and use ICT	• Assess infrastructural, structural, and human readiness for placement of "tiered" suites of ICT • Gather baseline data from which decisions about future placement of technology can be made and progress monitored	August–October 2012
3. Development of national ICT standards for teachers, principals, professional development providers, technology coaches/ support staff, and students	• Provide frameworks, targets, benchmarks, and rules that guide "best practices" in using technology for teaching and learning • Guide the recruiting and selection of teachers, principals, and professional development providers • Determine levels of ICT-related, performance-based proficiency for students, teachers, principals, and professional development providers	September–December 2012
4. National acceptable use policies	• Make clear acceptable and unacceptable uses of technology in educational settings and for educational purposes • Explain to parents and communities the benefits and responsibilities associated with using educational technology	January–March 2013
5. Teacher professional development and support plan	• Outline types, formats, and activities related to teacher professional development and support • Establish mission, roles, and responsibilities around teacher professional development and support	January–March 2013
6. National procurement policy/ guidelines and technology support plan	• Assist MEHE, vendors, and donors in making procurements more efficient and effective by providing a source of basic, systematic guidance about procurement policies and practices • Ensure open competition, fairness, and transparency in all procurement activities • Protect interests of citizens and taxpayers by promoting fairness in contracting with the business community and minimizing fraud, waste, and extravagant purchases • Establish sets of technical guidelines that govern selection and placement of technology • Outline roles and responsibilities for maintenance and support by vendors	August–September 2012
7. National communications strategy	• Provide information and inspiration to parents, the education community, community members, business, and government • Solicit input and feedback from parents, educational, business, civic, and community leaders, and communities themselves	January–March 2013

Activities and Products	Purpose(s)	Timeline
8. National performance indicators (access, leadership, teaching, and assessment around ICT)	• Establish metrics for purposes of quality assurance, compliance monitoring and accountability, continuous improvement, and formative and summative evaluations • These should be developed in tandem with the operational plan and performance monitoring plan to guide implementation activities	August 2012–January 2013
9. Performance monitoring plan	• Demonstrate how educational technology initiatives have/have not met goals and objectives • Describe necessary data, data collection procedures and analysis, and reporting • This should be developed in tandem with the operational plan and national performance indicators to guide implementation activities	August 2012–January 2013
10. Progress reports	• Update all stakeholders on progress of educational technology initiatives	Quarterly, 2012–2017

Implementation Cycle: From Now to 2017

Plans and strategies, though important, are not in and of themselves sufficient to actualize the lofty vision and goals of a strategic plan and ensure adoption and uptake by principals, teachers, students, and parents. Though the ambition and scope of this strategic plan is *large*, initial implementation activities will start *small*—with well-designed pilots that are grounded in quality implementation, transfer of learning, and systemic change. The design of these pilots will follow the cycle outlined below:

- **Creating readiness**—Increasing the climate and culture for change through enhancing the motivation and capacity of a critical mass of stakeholders, and preparing principals, teachers, students, and parents for change
- **Phase wise implementation**—Implementing changes in phases and stages, using well-designed infrastructure, training, and support, and resources to build guidance, support, buy-in, and capacity
- **Assessment and revision**—Critically, honestly, and openly assessing all pieces of all implementation activities, and using this evidence to expand what works, fix what needs fixing, and abandon what does not work
- **Institutionalization**—Ensuring that there is a technical, human, and institutional infrastructure to maintain productive and real change and that this infrastructure is supported nationally, regionally, and locally
- **Evolution and renewal**—Using mechanisms to improve quality continuously and provide continuous support in ways that enable stakeholders to become a community of practitioners who are committed to, and constantly strive for, excellence (Adelman and Taylor, 2008).

Section 1:
A National Vision for Teaching and Learning with Technology in Lebanese Schools

Many nations have inserted ICT into their existing educational system *without* a view toward reforming all parts of the existing system.[4] The result is that technology use is merely procedural, versus transformational, and techno-centric versus focused on qualitatively improving teaching or learning. Lebanon's national educational technology strategic plan emphasizes and advocates that *ICT must be a central component of overall reform of all components of the educational system to improve the quality of education for students in order to assure their continuous improved academic achievement.* (Figures 7 and 8 outline some ways that technology can improve the quality of education.) In such an improved learning environment, this strategic plan envisions the following:

- **Students** are actively engaged with content and with one another in the process of learning. They work individually and collaboratively in a variety of challenging, stimulating, and higher-order activities using the most appropriate types of classroom technology—to inquire and access information based on their inquiry; to wonder, explore, and hypothesize; to generate new ideas, solve problems, and create new paradigms and understandings; and to share, communicate, and collaborate with colleagues across the globe as they do so.
- In these classrooms, the **teacher's** role is transformed from a dispenser of information to a facilitator of student learning—he or she designs activities and units of study that promote higher-order thinking, probes student thinking and guides and supports students as needed, plans learning experiences that capitalize on the features of technology, and employs technology as appropriate to engage students with content, to promote student sharing and communication of ideas, and to assess whether and how students have learned.
- **Principals and school leaders** establish a school-based vision for how technology supports instruction and assessment based on information, best practices, and research. They set guidelines, provide models, and identify and procure resources and support to help teachers adopt and integrate technology to improve achievement for all learners. They understand how technology can support and streamline data collection and management, and how technology can deepen understanding of content and modernize assessment. They exhibit appreciation for appropriate instructional strategies supported by technology. They provide supportive and facilitative leadership and foster a climate of innovation and risk-taking with technology. Principals and leaders make careful budgetary and resource decisions about the school's technology "infrastructure" to provide teachers and learners with continuous access to well-functioning and up-to-date technology.
- **Within this classroom ecosystem,** technology is used for formal classroom learning and after-school programs to address students' various learning styles, academic needs, and academic, vocational, and personal interests. It is used to find, enrich, and furnish content; as a research, writing,

Figure 7: Educational Benefits of Technology

Research has demonstrated numerous benefits of technology on teaching and learning. These include:

1. **Enhanced access to content**
2. **The ability to organize content in multimodal ways that support various student learning styles**
3. **Support for competency-based curricula**
4. **Facilitation of communication and collaboration with local and global peers**
5. **Promoting and making more efficient multiple types of assessment**
6. **Providing additional learning opportunities via e-learning**
7. **Opportunities for personalization**

Indeed, even in the absence of such benefits, the ability to use technology for productive purposes in a digital world has become as basic a vocational imperative as literacy and numeracy.

4 Within this strategic plan, those components include content, curriculum, pedagogical practices, assessment, teacher professional development, and leadership

problem-solving and creativity tool; as a medium for communicating and collaborating with colleagues in the same *mohafaza* or across the globe; as a means to formatively and summatively assess student learning; and as a vehicle for gathering, managing, and disseminating information that helps to improve the overall efficiency of teaching and learning.

Figure 8: How Can Technology Improve Learning? Answers from Andree Nahas High School

For the students at Andree Nahas High School in Tripoli, technology not only engages them in learning, but is indispensable to their learning. Below, students share some of the ways they use technology as part of learning:

Facebook: "We do our homework together, we teach each other difficult topics…We learn from each other…and this motivates us to do well."

YouTube: "When we don't understand the concept in class, we find videos that help us understand better to supplement the teacher's lecture on a particular topic. It's better because we can read the text, listen, and watch."

Language websites: "We can hear the words in French and English and practice our pronunciation."

Word processing: "It automatically corrects our grammar and spelling so we can focus on writing…on the content."

E-mail and chat: "We share ideas and solutions together."

All technologies: "It helps students who are weak in the concepts because it presents information in many different ways….and it helps the shy students who won't speak in class but will communicate their ideas online."

Attaining This Vision

The remainder of this strategic plan will lay out exactly how to attain this vision. As Figure 9 displays, doing so depends upon careful attention to three sets of discrete though intersecting and mutually reinforcing factors.

First, attainment of this vision (see orange circle) depends upon qualitatively improving the *core functions of "schooling"—curriculum, instruction, and assessment* (see green circle). An educational technology strategic plan is not about boxes or bandwidth—it is about using technology to qualitatively improve how teachers teach and children learn. Classroom technology "works" when it supports instructional outcomes and when it is used to deepen content knowledge, instruction, and assessment. Successful use of technology—helping students learn in ways that are measurably better or that would otherwise be impossible—hinges upon the most fundamental of classroom transactions—*interaction around content, developing students' abilities to think deeply about content, and assessing student learning of content*. This strategic plan pays careful attention to this priority.

To support these core functions, schools and classrooms (in particular) must have sufficient and reliable energy, hardware and software, high-speed Internet connectivity, digital content, and technical support. Students, teachers and principals must know how to use technology for a variety of educationally related purposes; and schools and classrooms must have appropriate spaces, layouts and furniture to physically accommodate new ways of working and collaborating with technology.

These core functions must be driven and sustained by *strong teachers and strong school leaders* (see blue-green circle). Therefore, the second set of factors pertains to the importance of building overall human capacity within the educational system. No education system can exceed the capacity of the individuals within the system, and teachers and principals cannot succeed unless those who manage, supervise, assess and support them also exhibit high degrees of excellence. As such, this strategic plan advocates continuously improving the individual capacity and quality of all personnel in all levels of the educational system—ministry officials, teacher professional development providers, support personnel, inspectors—so they can in turn help principals and teachers ensure that technology is used to support curriculum, instruction, and assessment with the eventual goal of improving student learning.

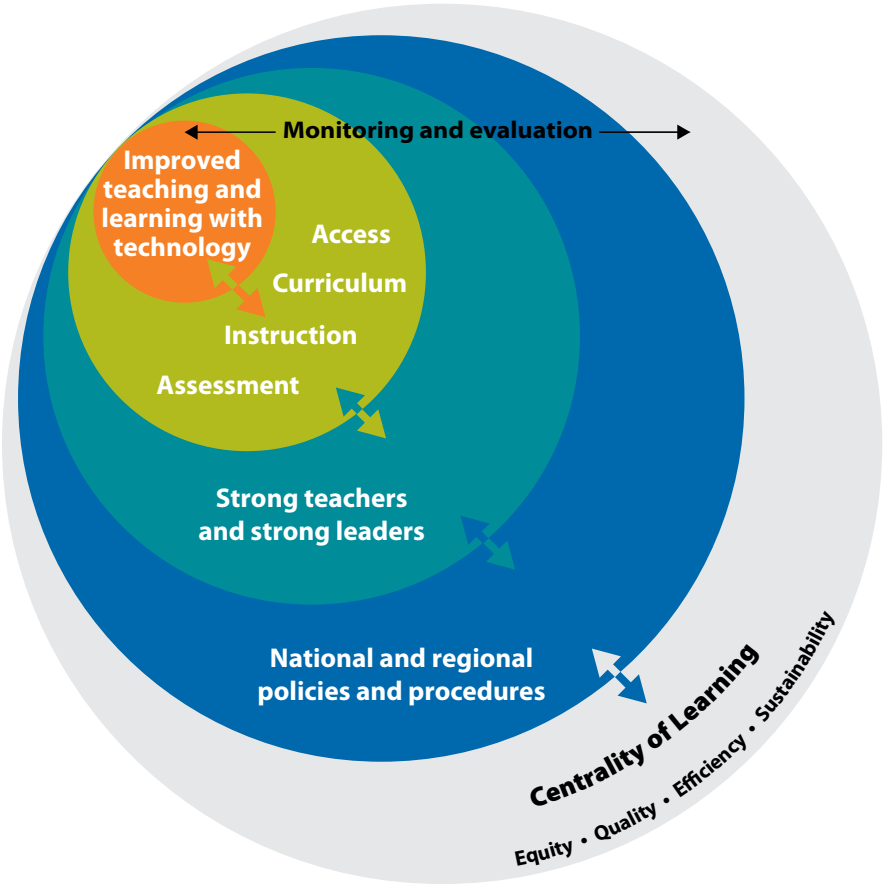
Third, successful attainment of this national vision for educational technology is also *contextually* dependent (see blue circle). Classrooms reside and operate within a nested environment of communities, schools, regional authorities, and

national ministries. All of these entities, beginning with MEHE, must develop and communicate a clear set of policies and practices and ensure that these are articulated, understood, and adopted with the highest degree of fidelity and quality by all "levels" of the educational system—from the national to the regional to the school and classroom level. These levels must operate in unison united by a common vision and purpose and working toward shared goals and outcomes, as this strategic plan advocates.

As shown in Figure 9, all of these factors—the core functions of "schooling:" building qualified and capable personnel at all levels of the educational system; and policies and procedures that support and facilitate such efforts—must be continuously and rigorously monitored and evaluated to ensure that all are being designed, implemented, and carried out with the highest degrees of fidelity, quality, and transparency.

Thus, Figure 9 provides a visual framework for understanding the goals, objectives, and recommendations of this *document*. More important, it visually encapsulates the *theory of action* that drives this strategic plan—the pathway that stakeholders must follow, and the inputs and components to which they must attend, in order to attain and sustain the vision for educational technology that is at the heart of this strategic plan.

Figure 9: ICT for Teaching and Learning: Attaining the Vision



Principles Underlying This Vision

As seen in Figure 9, this strategic plan's vision for the use of educational technology is grounded in five principles, which underlie the vision, goals, objectives and recommendations of this strategic plan. These five principles are:

1. **Equity:** All students in all regions of Lebanon, of both genders, all abilities, and all backgrounds, must have ready access to technology that enables creative and collaborative work; communication and self-expression; complex problem solving; choices about approaches toward and demonstration of learning; access to multiple sources and formats of information; and abundant opportunities to integrate and demonstrate knowledge and skills across disciplines.

2. **Quality:** The client and the beneficiary of this national strategic plan is every student across Lebanon. Every action that is carried out under the aegis of this strategic plan must be done so with regard to attaining the highest standards of quality. This depends on the development and implementation of standards that govern digital content, curriculum, instruction, assessment, professional development, coaching, and leadership, as well as systems for monitoring adherence to quality standards, and support and accountability to ensure that the highest levels of educational quality are attained. When it comes to educating our young people, nothing short of the highest quality design and implementation should be the norm.

3. **Efficiency:** Stakeholders must use available resources wisely to maximize the good that these resources can do for the educational system.

4. **Sustainability:** For the reforms mentioned here to succeed, they must be embraced by all stakeholders within the educational system and adopted and implemented with commitment, fidelity, and skill. Sustainability thus deals with *knowledge formation* (building the skills and knowledge of all stakeholders regarding the ways in which technology can add value to teaching and learning), *management of resources* (assuring provision of well-functioning and adequate resources), and *consumption of resources* (wise and purposeful use of resources).

5. **The centrality of learning:** Above all, this strategy and the vision toward which it aims are grounded in a belief in the centrality of learning. Learning, as Figure 10 suggests, is a complex, dynamic, developmental, and multifaceted process. If used in ways that adhere to research-based understanding of learning, technology can qualitatively improve students' learning experiences. Thus, every decision made, and every action undertaken by every actor within the educational system, must be focused on the same overarching goal—*improving the quality of learning for all students.*

Figure 10: What Do We Know About Learning? (Gardner, 1983; Bransford and Cocking, 2000; Dimock, et al. 2000; Vygotsky, 1978; Dewey, 1916; Schon, 1987)

Thanks to developments in cognitive science, social psychology, and emerging technologies, our understanding of how people learn has been transformed. We know more now about how people learn and, by extension, how to design environments and experiences that maximize learning. Some, though by no means all, of these key characteristics of learning include the following:

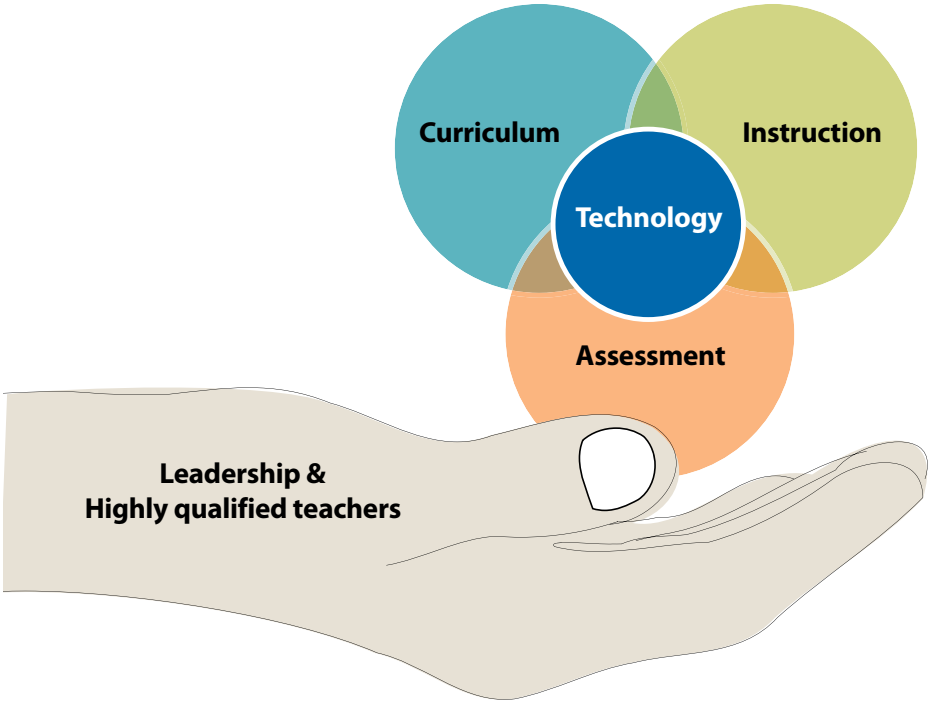
- **Learning is a highly personal event that builds on prior knowledge and beliefs and is predicated upon an individual's learning interests, strengths, or styles.**
- **Learners construct knowledge in a variety of ways, using multiple tools and resources and by interacting with subject matter that is meaningful and relevant to their own experiences.**
- **Learning is a dynamic, developmental, and cumulative process in which learners assimilate, accommodate, or reject new information into existing frameworks.**
- **Learning has a social dimension: We learn with and from one another.**
- **Learning has affective, behavioral, and cognitive dimensions. The most effective forms of instruction use and impact all three.**
- **Learning is a developmental process. Learners need commensurate amounts of scaffolding, support, practice, feedback, and motivation.**
- **Cognitive and behavioral changes that result from learning are long-term, non-linear, and complex processes.**
- **Metacognition is critical to learning. It allows learners to monitor and assess their progress; reflect upon actions to make informed, reason-based decisions; act with foresight and planning rather than basing actions on tradition, authority, or impulse; and make sense of and extract meaning from experiences.**

Every area of human enterprise—business, commerce, leisure, and health—has been reshaped and redefined by technology. Education is no different. *Teaching* no longer exclusively involves face-to-face interaction; it can occur across the Internet between teachers and learners in two different countries or in some combination of face-to-face and online learning. *Technology* is no longer confined to desktop consoles but includes laptops, tablets, and smart phones. With portable digital technologies and wireless connectivity, the concept of *school* is being radically transformed from a defined physical space, within a set time frame, employing a certain set of protocols to an experience that can take place in a student's home, an Internet café, or whatever place (and time) a student chooses to learn. And *learning* itself no longer involves interacting with content via paper-based text, chalkboard-based notes, and mediation by a teacher, but rather involves engaging with content via multimedia, video, and immersive environments, alone, with or without a "teacher," and with varying groups of colleagues, both national and international.

These changes are inexorable. Education systems that fail to plan for and capitalize on such changes risk being left further behind.

Section 2:
Goals and Objectives

Figure 11: Key Components of the Strategic Plan



Section 2 of this national educational technology strategic plan outlines the goals and objectives of the *six key components* of this strategy:

1. Providing access to technology
2. Aligning technology with curricular competencies
3. Blending technology and instruction
4. Integrating technology with assessment
5. Designing professional development that helps teachers integrate technology into content areas
6. Building leadership around technology

This section represents the very heart of Lebanon's national educational technology strategic plan and makes clear our belief that technology alone will not promote improvements in educational quality or student achievement. Rather, as Figure 11 illustrates, technology should intersect reforms in curriculum, instruction, and assessment, all of which together must be supported and sustained by strong administrative leadership and highly qualified teachers. Thus, technology must be integrated into in an overall system of educational reform as outlined by MEHE's National Education Strategy Framework Education Sector Development Plan (2010–2015), shown previously in Figure 4 (p. 9).

This strategic plan begins by discussing the provision of technology to schools, moves next to a discussion of the core elements of teaching and learning—curriculum, instruction, and assessment—and then outlines instruction and supports for the critical frontline agents in schools—teachers and principals.

Each component contains three elements—an overarching goal, a related set of goals, and specific objectives for each goal. In many cases, the objectives are measurable and may be adapted into performance indicators and metrics for follow-up implementation and evaluation plans. In other cases, objectives are non-quantifiable, serving as standards and norms describing what should occur as a consequence of their enactment. The reader will note that some of the goals and objectives appear in more than one place—a deliberate editorial decision designed to emphasize the interconnectedness and importance of many of these components.[5] Whether discrete and measurable or broad and non-quantifiable, these objectives, if followed, can serve as a pathway for implementers of this national strategic plan, and as outcomes for performance monitoring and for evaluation.

5 This strategic plan further notes here that the same or similar objectives may be found across multiple goals because many goals require the same sets of inputs and activities.

Chapter 1: Access to Technology

Overview

Across the globe, technology has given principals, teachers, and students more powerful and increasingly cost-efficient tools to create, innovate, and collaborate. Portable digital devices, robust and fast Internet connectivity, social networks and the cloud, rich and engaging educational software and digital content, and users (teachers, students, and principals) who are comfortable with technology and understand how it supports student interaction with content are not simply the foundation of a successful educational technology strategic plan. Indeed, they are its oxygen.

As Figure 12 notes, *access* to a sufficient amount of technology has been shown to positively influence student learning in certain content areas. Thus, this educational technology strategic plan begins with access to technology tools. The term "access" is broadly defined in this document. First, it means that students will be able to use technology in schools as they need it, even if they have to share the technology. Next, access is not simply proximity to and ubiquity of digital devices and Internet connectivity. Rather, "access" also includes the teacher's, student's and principal's ability to use technology for purposeful and meaningful work.

Figure 12: Computers in the Classroom

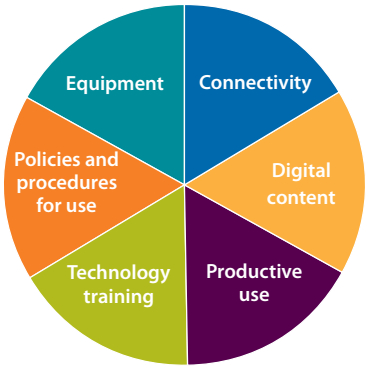
For technology to positively affect teaching and learning, teachers and students need a sufficient number of computers in their classrooms.

Research and experience clearly demonstrate that technology programs rarely have a positive impact on students when schools are limited to one computer for every 30 students or when available computers are only in computer labs, not in the classrooms. In such situations, teachers revert to "traditional" instructional styles—standing at the computer and lecturing, focusing on information technology (IT) skills in lab situations, or having students follow a task in lockstep (Stratham and Torell, 1999a; Rivero, 2006). Data from the United States and United Kingdom show that students are more likely to gain proficiency in ICT skills as a result of using computers as part of normal content coursework rather than from stand-alone IT classes.

Further studies have found that an increase in the amount of instructional technology, combined with teacher training, is strongly related to students' mathematics passing rates on state examinations. For instance, studies of students' passing rates on the New York State Regents' Exam found that 42 percent of variation in math scores and 12 percent of variation in English scores could be explained by the addition of technology in schools (Mann and Shafer, 1997: p. 1). Analysis of PISA data shows that in terms of educational performance, computer use amplifies a student's academic skills and competences (OECD, 2010: p. 3).

Overarching Goal

Students and teachers must have access to high-quality and high-capacity technology infrastructure and high-quality educational content, as well as the skills to use both. Such access allows teachers and students to participate in learning experiences so that they can become independent, competent, and confident users of information technology (IT). This overarching goal



is supported by the following six related goals focused on equipment, connectivity, training, use, and policies to assure access to and use of educational technology.

Access to Technology: Individual Goals and Objectives

To establish a strong foundation for ICT in education, this strategic plan proposes that by 2017:

Goal 1.1: 100 percent of students and teachers in Lebanon will have ready access to appropriate classroom technologies that support the fulfillment of curricular and instructional objectives in all subject areas.

Attaining this goal will involve meeting the following objectives:

- **Objective 1.1.1 Individual access to technology:** 100 percent of students will have access to a shared digital device (tablet, laptop, etc.) as part of classroom learning activities.
- **Objective 1.1.2 School/classroom access to technology:** 100 percent of schools will be provided with sustainable and affordable instructional technology of various configurations (See Figure 13).
- **Objective 1.1.3 Minimum 1:4 student-to-computer ratio, with a future target of 1:1:** At least 40 percent of schools (Tier 3 and 4 schools) will *meet the minimum recommended standards* of having one digital device for every four students (President's Committee of Advisors on Science and Technology, 1997; OECD, 2000; Ministry of Education of Singapore, 2008), but with the eventual goal of achieving a 1:1 ratio (See Figure 13).
- **Objective 1.1.4 Access for special populations:** Students will have access to appropriate assistive technologies to accommodate differences in their physical and cognitive abilities and maximize their opportunities of benefiting from the general education curriculum.
- **Objective 1.1.5 Mobile computer labs:** In schools without fixed computer labs, introduce mobile technology labs through the provision of digital device carts (See Figure 13).
- **Objective 1.1.6 Secure technology access:** Develop partnerships with public institutions (such as ministries and councils), private companies and industries, local community partners, universities, and research institutions to explore emerging technologies that could be potentially useful in teaching and learning.

Figure 13: Technology Configurations for Various Types of Schools

Tier 1 Schools (130 schools)	Tier 2 Schools (640 schools)	Tier 3 Schools (385 schools)	Tier 4 Schools (126 schools)
1. Access to Internet is planned but not yet available	1. Dial-up Internet access	1. Nonstop, low-speed Internet access	1. Nonstop, high-speed Internet access
2. Selected offline e-support content	2. Limited downloading bandwidth for accessing resources	2. Limited uploading and downloading bandwidth for accessing resources	2. Unlimited uploading and downloading bandwidth for accessing resources
3. ICT devices: • 1 shared projection device (Interactive Whiteboard (IWB), LCD projector, etc.) per school • 1 shared laptop/ notebook for all the teachers on a floor	3. Selected online e-support content	3. 1 caching server per school	3. Wireless, cable, Bluetooth, infrared setups for the school
4. Upgrade the existing ICT lab in school, if applicable, or 1 mobile laptop cart (mapping to 1 shared device per 4 students ratio)	4. 1 caching server per school (optional)	4. Wireless setup for school	4. Web-services, direct access
5. 1 printer per school	5. ICT devices: • 1 shared projection device IWB, LCD projector, etc.) per floor • 1 PC/laptop/notebook for teachers per classroom	5. Rich online e-support and interactive content	5. Full online e-support and interactive content
6. 1 scanner per school	6. Upgrade the existing ICT lab in school if applicable	6. ICT devices: • 1 projection device (IWB, LCD projector, etc.) per classroom • 1 laptop/notebook for each teacher • 1 laptop/tablet for each group of 4 students per classroom (minimum) • 1 mobile laptop/ tablet cart (30 laptops) per floor—for 1:1 applications	6. ICT devices: • 1 projection device (IWB, LCD projector, etc.) per classroom • 1 laptop/notebook for each teacher • 1:1 environment for all students
	7. 1 mobile laptop cart (30 computers) per school (mapping to 1:1 device per student ratio)	7. Upgrade the existing ICT lab in school if applicable to accommodate advanced educational applications (virtual science labs)	7. Upgrade the existing ICT lab in school, if applicable, to accommodate advanced educational applications (virtual science labs)

Tier 1 Schools (130 schools)	Tier 2 Schools (640 schools)	Tier 3 Schools (385 schools)	Tier 4 Schools (126 schools)
	8. 1 printer per school	8. 1 printer per school	8. 1 digital interactive table per classroom
	9. 1 scanner per school	9. 1 scanner per floor	9. 1 printer per classroom
			10. 1 scanner per classroom

Criteria for technology placement will include, but not be limited to, the following:

- Structural conditions of schools
- Existing technology equipment, size, and condition
- Internet connectivity (type and availability)
- Electricity capacity and supply
- Budget provisioning
- School cabling infrastructure and school building infrastructure (distance between buildings, floors, and classrooms)
- Human capacity, such as ICT readiness and skills (principal, teachers, and administration at large)
- E-content availability locally developed by teachers and centrally supported by MEHE

Figure 14: Using One Laptop to Promote Rich Learning

Successful use of technology still comes down to, not *how much* technology a classroom has, but how *it is used* for instruction. Consider the example of Sahar Abdallah, a biology teacher at Dr. Nazih El Bizri Public High School in Saida, who used her one laptop and LCD projector to help students discover the physical characteristics of healthy human hearts versus unhealthy ones.

Using two videos of angiograms, Ms. Abdallah asked students to identify traits of each heart. Through a series of questions, she prompted students to begin analyzing their observations and developing hypotheses about which angiogram showed a healthy human heart and why. Students were encouraged to test their hypotheses through reference to their text, discussion and reflection, and by reviewing videos in small groups. The teacher recorded students' observations and hypotheses on the board, asked probing questions to help students clarify their thinking, and prompted them to come up with general behaviors of healthy and unhealthy hearts.

This use of technology in this lesson was quite simple. The videos of angiograms allowed students to see the heart as a living muscle and provided students with a micro-level visualization of arteries.

But the learning was profound. First, the use of digital video made concrete and visual concepts that might otherwise have remained abstract. Indeed, detailed visualization of the heart would have been impossible without technology. Second, and more important, the teacher's use of inductive learning combined with visual imagery, prompted students to share observations, generate hypotheses, test and revise hypotheses to come up with generalizations about healthy and unhealthy hearts.

Goal 1.2: Approximately 90 percent of Lebanese schools will have affordable Internet connectivity and access to networks, including wide area networks (WANs) and local area networks (LANs), to support flexible learning options to allow students and teachers to interact with video, online learning opportunities, and digital media that deepen and broaden students' grasp of a particular content topic (See Figure 14 for one such example).

Attaining this goal will involve meeting the following objectives:

- **Objective 1.2.1 Establish Internet connectivity:** Guarantee constant, cost-effective broadband Internet access to 90 percent of schools to connect students and teachers to outside sources of information (See Figure 13).
- **Objective 1.2.2 Address the digital divide:** Prioritize networking for all schools in regions of the country that suffer from poor access to technology and networking.
- **Objective 1.2.3 Set up Internet access in schools and/or classrooms:** Provide an enabling environment for the introduction of new communications technologies (two broadband wireless access points, two network points, and two electrical outlets in each classroom to run multiple digital devices).[6]
- **Objective 1.2.4 Use the Internet for communication:** Ensure through policies, procedures, and practices that classroom technology offers online interaction among students and educators, within each school, each region across the country, and throughout the globe.
- **Objective 1.2.5 Upgrade existing facilities:** At schools where fixed computer labs exist, upgrade networking and hardware in each lab.
- **Objective 1.2.6 Install Internet security:** Develop tools for safe and secure online knowledge sharing and collaboration including social networking (Web 2.0) systems.

Goal 1.3: 100 percent of schools will have access to high-quality digital learning resources and software that are linked to the national curriculum and student learning outcomes.

Attaining this goal will involve meeting the following objectives:

- **Objective 1.3.1 Secure digital content:** Employ both domestically and internationally produced content in Arabic, English, and French, as well as open educational content and open courseware, to enrich students' learning in the classroom, at home, and wherever they choose to work or study.
- **Objective 1.3.2 Higher-level digital content:** Select, develop, or adapt digital content that stimulates inquiry, higher-level thinking, creativity, and problem solving by students and educators.
- **Objective 1.3.3 Standards for assessing content:** Develop or adapt standards for assessing the quality of digital content.
- **Objective 1.3.4 Guidelines for digital content:** Develop a national model for content supply—with guidelines, standardized metadata, interoperability frameworks and systems—that is adopted by jurisdictions, cultural organizations, and commercial providers, among others.[7]

6 This will depend on the conditions of schools.

7 Several nations (Singapore, for example) have designed educational software procurement schemes that help schools obtain software easily at discounted prices. Digital resources for subjects that are not commercially available can be developed locally with an annual software budget provided by MEHE. MEHE can collaborate with local industries to encourage the development of a wide range of educational software that meets specific curricular outcomes.

- **Objective 1.3.5 Centralized access to digital content:** Develop an online portal that provides easy access to relevant, approved, high-quality digital content that is linked to national curricular topics and student learning outcomes.
- **Objective 1.3.6 Centralized access to information:** Provide access to "learning portals," supporting curriculum planning and delivery, progress monitoring, and communication between students, teachers, and parents.

Goal 1.4: 100 percent of teachers and administrators in Lebanon will have access to technology tools for administrative and productivity purposes: to manage data, keep electronic records and grades, plan lessons, assess student learning, and communicate with parents, other teachers, students, and administrators.

Attaining this goal will involve meeting the following objectives:

- **Objective 1.4.1 Technology training:** Provide all administrators and teachers with professional development and support in using ICT for job-related purposes.
- **Objective 1.4.2 Data management:** Provide for the collection of, access to, and exchange of data by administrators and teachers to use for informed educational decision-making.
- **Objective 1.4.3 Technology and productivity:** Enable educators to manage content standards and performance indicators, and link them to locally developed curriculum, instruction, and assessment.
- **Objective 1.4.4 Parent involvement:** Enable parents to be able to view online student programs and progress and communicate with teachers and school leaders at all times.

Goal 1.5: 100 percent of students, teachers, and principals in Lebanon will be able to use digital technology effectively to learn and work successfully in an increasingly complex, technology-based society.[8]

Attaining this goal will involve meeting the following objectives:

- **Objective 1.5.1 General use of technology:** Students, teachers, and principals will be able to conduct research, organize data and solve problems, create original works, and communicate information and ideas.
- **Objective 1.5.2 Acceptable and ethical uses of technology:** Students, teachers, and principals will demonstrate the responsible, legal, and ethical use of information and technology (e.g., respecting copyright rules and fair use and using technology only for legal academic purposes).
- **Objective 1.5.3 Find information:** Students, teachers, and principals will use effective and efficient strategies to explore and use a wide range of information and technology resources to gain knowledge, deepen understanding, make informed decisions, and solve problems for educational, career, and personal pursuits.

8 This does not include the use of technology for teaching and learning, which will be discussed in Chapter 3.

- **Objective 1.5.4 Manage information:** Students, teachers, and principals will be able to locate, evaluate, interpret, and synthesize information from print and nonprint sources.
- **Objective 1.5.5 Technical support for technology:** Students, teachers, and principals will be supported in these pursuits by technical assistants who understand the learning goals of the students, the school, and the teachers.

Goal 1.6: Government agencies, such as MEHE and MOT, will provide an enabling environment for widespread, national educational technology use through continued development of ICT in education-related policies and procedures.

Attaining this goal will involve meeting the following objectives:

- **Objective 1.6.1 Standards for technology use:** Adopt competency-based standards for technology use that students, teachers, and principals must attain and to which all entities must adhere.
- **Objective 1.6.2 Policies for technology use:** Establish privacy safeguards, Acceptable Use Policies (AUPs), protection of intellectual property rights through legislation and digital rights management infrastructure, and policies to cultivate a legal software download culture in the education community.
- **Objective 1.6.3 Frameworks for technology use:** Develop interoperability frameworks that enable the sharing of systems and information between sectors and jurisdictions, and industry-specific data and technology standards to facilitate the provision or exchange of data, educational content, and/or learning objects.
- **Objective 1.6.4 Data sharing:** Make public, through digital repositories, the publication of documents, data, and educational materials, complete with metadata, so that educational objectives and activities are transparent and available to teachers, students, parents, principals, and community members.
- **Objective 1.6.5 Cybersecurity:** Put in place all procedures, mechanisms, and protections to protect digital identities and digital property from theft or corruption, and protect the privacy and safety of all users, especially students.

A national educational technology strategic plan obviously begins with ensuring that access to high-quality equipment, connectivity and digital content—and the skills to use each—are in place. More important, a national educational technology strategic plan is—or should be— about how technology improves teaching and learning. These next three chapters discuss how technology can support the core components of teaching and learning—curriculum, instruction, and assessment.

How Does Learning Occur?

Learning is not an isolated or static process. As children interact with the world around them, and the infinite variety of images, ideas, information, and other stimuli that comprise their world, they are constantly constructing, revising, and reconstructing their impressions, knowledge, and beliefs to create a new framework of understanding. Knowledge, then, is constantly under construction—a dynamic, evolutionary, and developmental process.

Learning is influenced by a child's level of biological and psychological development. As the writings of Jean Piaget assert, children think and reason differently at various periods in their lives, passing through a series of stages in their cognitive formation—from the *sensorimotor stage,* during which the child gains motor control, to the *formal operational stage,* where the child begins to reason logically and systematically.

We know that learning is often fraught with tension and conflict, for both children and adults. If new information matches our existing understanding, we can easily assimilate it. However, if it does not—or if it threatens our existing corpus of knowledge—we must accommodate it—either by forming new understandings or reevaluating and reconstructing our prior theories—or reject it. This continuous struggle between varying and often conflicting information and concepts—this *dialectic* of learning—occurs constantly, sometimes consciously but more often unconsciously, and contributes to our overall construction of knowledge. Without this disequilibrium, the student's belief system remains unchallenged, and the potential for greater intellectual growth is stifled. Learning, therefore, is rarely a final product. More often, it is a constant, evolutionary, and sometimes revolutionary process.

The idea of learning as a developmental process has been firmly established in educational systems across the globe through learning "taxonomies," such as that of Benjamin Bloom. Bloom (1956) identified six levels within the cognitive domain, from simple recall or recognition of facts and comprehension of these facts at the lowest level, through increasingly more complex and abstract mental levels—what we term "higher-order thinking"—such as the application, analysis, synthesis, and evaluation of information. It is this last set of cognitive domains—higher-order or critical thinking—that results in deeper, more permanent learning.

These three conditions for knowledge construction (and these are by no means the only three)—*learning as a product of interaction with rich stimuli; learning as a continual, developmental, evolutionary process;* and the *dialectic of learning*—have spawned a new understanding of how information should be presented, organized, and known; how instruction should unfold; and how learning should be monitored, assessed, and supported. Curricula have shifted from a narrow focus on what learners *know* to a broader focus on the results of that learning—what learners should *know* and be able to *do* as defined by multiple definitions of knowledge and a set of criteria and measurable behaviors. The traditional transmission model (e.g., lecture/short answer format), with its emphasis on quantity, coverage, and product creation, has yielded to learner-centered approaches with a focus on learning as a *process* that must be examined and understood.

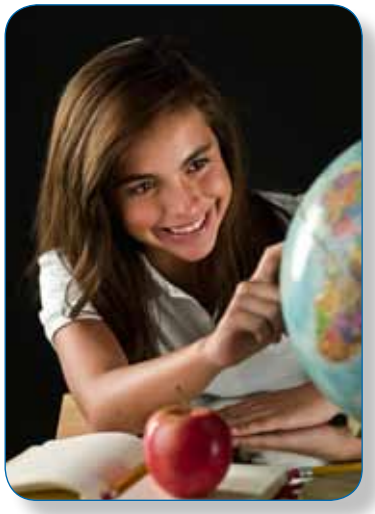
Thus, over the last several decades, in many classrooms across the globe, we have witnessed increased attention to new conceptual structures and understanding of complex, often conflicting, information. Mindful of this new body of knowledge on learning, we notice greater efforts to purposefully use *learner-centered* pedagogy—an instructional approach in which students explore, manipulate, question, and discover answers for themselves. We observe attempts to create activities that are developmentally appropriate, yet challenging enough to allow for a certain level of frustration on the part of the learner.

In short, to use Bloom's taxonomy once again, we see attempted convergence between instruction, curriculum, and tools in the promotion of higher-order learning.

The Role of Technology

Computer technology is a natural complement to this paradigm shift. When effectively integrated into the curriculum, technology can enrich, expand, and deepen students' understanding of content, rendering it more engaging and relevant, and support students in acquiring digital-age or "21st-century" competencies. Technology can provide interaction with rich, visual, multimodal, and immersive stimuli, which, particularly when situated within authentic learning experiences and anchored by a skilled teacher's open-ended and probing questions, can deepen and enrich learning and indeed, make possible learning experiences that would otherwise be impossible. Thus, when used in ways that allow students to explore, question, predict, analyze, compare, and create, technology can become a "mind tool" (Jonassen, 1996) functioning as an intellectual partner and guide with the learner to engage and facilitate critical thinking and higher-order thinking. This combination of technology and learner-centered pedagogies deepens and extends opportunities for assessment that are ongoing and plays a central role in student learning. It also enables teachers to assess a spectrum of student skills from multiple angles, thus providing a fuller picture of what students know and can do.

Chapter 2: Technology and Curriculum



Overview

Technology works best, not when treated as a separate subject or an occasional project, but when teachers select equipment, applications, or digital resources that support the curriculum and use them on a daily basis to address, reinforce, and enhance learning objectives and curricular outcomes (Harris, Mishra and Koehler, 2008).

Effective technology integration is achieved when decisions to use technology are based on students' learning needs relative to curriculum-based content standards; when technology, pedagogy, and content interact with one another to produce effective discipline-based instruction and assessment; and when the use of technology as part of teaching and learning is routine and transparent. Effective technology integration must happen across the curriculum in ways that research shows will deepen and enhance it—active engagement with content, students interacting with the content in groups, teacher feedback about students' degree of mastery of the content, and connections to experts and authentic activities.

The Center for Educational Research and Development (CERD) is currently revising Lebanon's national curriculum, moving it from a knowledge-based curriculum to a competency-based one. This revision, underway in cycles, will be completed in 2017.

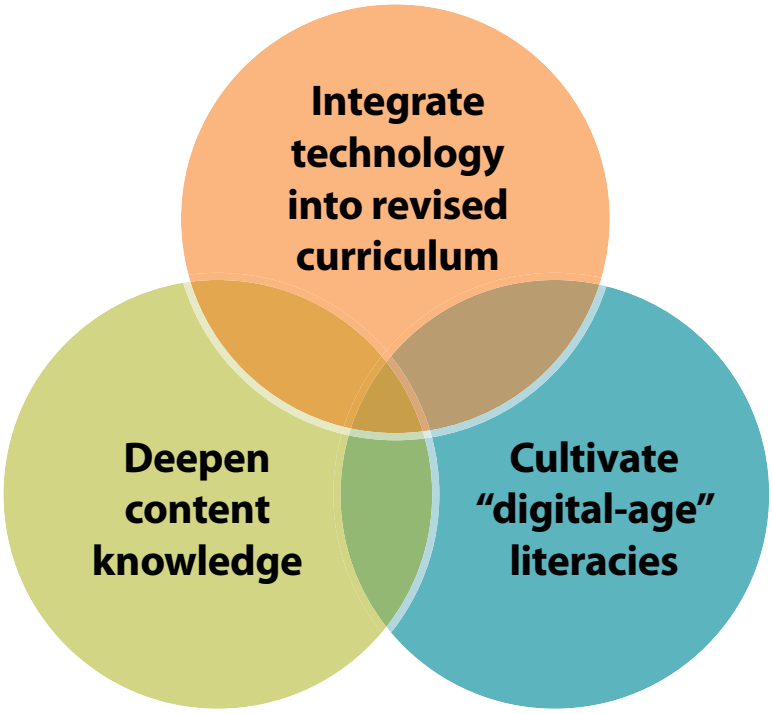


Figure 15: Digital-Age/21st-Century Skills (Partnership for 21st-Century Skills)

21st-century or digital-age competencies include the following:

Information, media, and technology competencies:

- Information literacy
- Media literacy
- ICT literacy
- Digital literacies

Learning and innovation competencies:

- Creativity and innovation
- Critical thinking and problem solving
- Communication and collaboration

Life and career competencies:

- Flexibility and adaptability
- Initiative and self-direction
- Social and cross-cultural skills
- Productivity and accountability
- Leadership and responsibility

Explanations of many of these competencies can be found in the "Concepts into Action" section of this strategy.

Overarching Goal

The overarching goal for this curriculum component is that technology be integrated into a new, competency-based curriculum to help students achieve content mastery. *Content mastery* in this strategic plan means the ability to (1) organize knowledge around core concepts or "big ideas" within a particular content topic; (2) recognize meaningful patterns of information within a topic or domain and be able to communicate these clearly; (3) retrieve relevant knowledge of a particular concept or skill and apply it to new situations; and (4) solve problems within a particular domain (Bransford, et al. 2000). Thus, mastery in this sense encompasses both propositional and procedural knowledge.

To attain this overarching goal, this strategic plan proposes three related goals—integration of technology to support Lebanon's new competency-based curriculum; the use of technology to deepen content learning; and the infusion of digital-age "literacies" to support and strengthen technology integration and competency-based outcomes.

Technology and Curriculum: Individual Goals and Objectives

To help students master the skills, knowledge, and aptitudes associated with each content domain, this strategic plan proposes that by 2017:

Goal 2.1: CERD will integrate appropriate and relevant technologies to promote key competencies outlined in Lebanon's newly revised curriculum.[9]

Attaining this goal will involve using technology as part of a strategy to meet the following objectives:

- **Objective 2.1.1 Support key content-related competencies:** Identify the types and uses of technology and specific applications to support content-related key competencies.
- **Objective 2.1.2 Identify key *digital* competencies:** Identify key student digital competencies necessary to thrive in a digital world in which fluency with technology and various forms of literacy are essential for academic and vocational success. (These skills, sometimes referred to as "21st-century skills," are outlined in Figure 15.)
- **Objective 2.1.3 Authentic learning:** In all content areas, teachers and students will use a variety of content-related technology resources, such as multimedia, online applications, and simulation sites, to carry out and complete authentic tasks required by core subject areas. (The concept of authentic learning tasks is defined in Figure 16.)
- **Objective 2.1.4 Hard-to-teach areas:** Identify and begin to integrate into specific content areas and curriculum frameworks those technologies that have proven to be most effective in helping students grasp difficult content topics or concepts.

9 Technology will be introduced in Cycle 1 in 2012–2013 and in Cycle 2 in 2014–2015.

- **Objective 2.1.5 Standards for digital content:** Adopt clear standards evaluating "high-quality" digital content, as well as guidelines for integrating digital content into high-priority content areas such as math, science, and English.
- **Objective 2.1.6 Develop digital content:** Procure, adapt, and/or develop high-quality digital content aligned with competencies outlined in the revised curriculum.
- **Objective 2.1.7 Develop models:** Prepare model activities that demonstrate how to use digital content and tools (e.g., electronic games, learning objects, digital media, and educational software) to support content and curricular objectives.
- **Objective 2.1.8 Instructional design:** Help teachers develop learner-centered activities supported by technology to address curriculum standards.
- **Objective 2.1.9 Extend learning opportunities:** Identify appropriate online courses, e-learning opportunities, online universities, and education portals so that advanced learners, homebound learners, learners with special needs, and/or learners in regions lacking access to such courses can benefit from learning opportunities as needed.
- **Objective 2.1.10 Assistive technologies and special needs:** Address learning diversity through identifying assistive technology tools and materials that respond to learners with a variety of cognitive and physical needs and abilities.
- **Objective 2.1.11 Assistive technologies to support curriculum:** Help teachers use assistive technologies to build tools and materials that will improve students' understanding of content and support their mastery of identified learning outcomes.

Figure 16: The Definition of Authentic Learning (Lombardi, 2007: pp. 3-4).

This chapter refers repeatedly to a curriculum grounded in "authentic learning," a curricular approach that shares the following attributes:

1. ***Real-world relevance:*** **Authentic activities match the real-world tasks of professionals in practice as nearly as possible. Learning rises to the level of authenticity when it asks students to work actively with abstract concepts, facts, and formulas inside a realistic—and highly social—context mimicking "the ordinary practices of the [disciplinary] culture."**
2. ***Ill-defined problem:*** **Challenges cannot be solved easily by the application of an existing algorithm. Instead, authentic activities are relatively undefined and open to multiple interpretations, requiring students to identify for themselves the subtasks needed to complete the major task.**
3. ***Sustained investigation:*** **Problems cannot be solved in a matter of minutes, or even hours. Instead, authentic activities comprise complex tasks to be investigated by students over a sustained period of time, requiring significant investment of time and intellectual resources.**
4. ***Multiple sources and perspectives:*** **Authentic activities provide the opportunity for students to examine tasks from a variety of theoretical and practical perspectives, using a variety of resources, and requires students to distinguish relevant from irrelevant information in the process.**
5. ***Collaboration:*** **Success is not achievable by an individual learner working alone. Authentic activities make collaboration integral to each task, within the course and in the real world.**
6. ***Reflection (metacognition):*** **Authentic activities enable learners to make choices and reflect on their learning, individually or as a team.**
7. ***Interdisciplinary perspective:*** **Relevance is not confined to a single domain or subject matter specialization. Instead, authentic activities have consequences that extend beyond a particular discipline, encouraging students to adopt diverse roles and think in interdisciplinary terms.**
8. ***Integrated assessment:*** **Assessment is not merely summative in authentic activities but is woven seamlessly into major tasks that reflect a real-world evaluation process.**
9. ***Polished products:*** **Conclusions are not merely exercises or sub-steps in preparation for something else. Authentic activities culminate in the creation of products that display results, issues that could not be solved, and the processes of arriving at such conclusions.**
10. ***Multiple interpretations and outcomes:*** **Rather than yielding a single correct answer obtained by the application of rules and procedures, authentic activities allow for diverse interpretations and competing solutions.**

Goal 2.2: CERD will integrate technology into the revised curriculum to deepen the learner's *content mastery.*

Attaining this goal will involve using digital reading (see Figure 17) and technology tools to meet the following objectives:

- **Objective 2.2.1 Technology for content mastery:** Beginning at the primary level and continuing until the end of secondary school, students will learn how to use a variety of technology tools and applications to develop mastery of the most important topics.
  - » **Objective 2.2.1.1 Support mathematical literacy:** Students will use appropriate digital tools and content to enhance mathematical literacy.[10]
  - » **Objective 2.2.1.2 Support science literacy:** In math and science classes, students will use appropriate digital tools and content to enhance scientific literacy.

10 For instance, this could include the use of spreadsheets, databases, and modeling applications to explore and gain new insight into particular topics; classify, organize, and analyze data; perform arithmetic and statistical queries; and display and interpret data results in visually appropriate charts and graphs.

  - » **Objective 2.2.1.3 Technology and writing:** In language and social science classes, teachers and students will use word processing software and online writing applications as part of the formal writing process[11] to improve students' written communication abilities.
- **Objective 2.2.2 Technology for authentic learning:** In all content areas, students will use technology as part of authentic learning, in complex, content-related tasks that require them to collaborate with use higher-order thinking skills (see Figure 16).
- **Objective 2.2.3 Technology for knowledge formation:** In all content areas, students will be able to use various Web-based applications and functions, multimedia applications, and various forms of digital media to organize and classify data, produce meaningful reports and presentations, and discuss particular content topics.
- **Objective 2.2.4 Technology and higher-order thinking:** In all content areas, students will be able to use digital tools, such as concept/mind maps to break down or analyze "big ideas" of the content or topic into their constituent parts/concepts and display visual relationships among these concepts.
- **Objective 2.2.5 Universal Design for Learning (UDL):** The curriculum will be universally designed to provide all students with multiple means of representation, expression, and engagement, with and without technology.

Goal 2.3: Technology is embedded within the curriculum to cultivate in learners the essential "literacies" required to be successful workers and learners in a digital age (See Figure 18 for a definition of digital-age "literacies.")

Attaining this goal will involve using technology to meet the following objectives:

- **Objective 2.3.1 Research:** Students will be able to demonstrate a command of information retrieval skills and strategies to search for, identify, locate, evaluate, and use digital and nondigital resources to conduct research, solve problems, answer questions, or address an issue.
- **Objective 2.3.2 Information management:** Students will be able to apply information from a variety of sources and formats using evaluative criteria to interpret, analyze, organize, and synthesize information from digital and nondigital sources.
- **Objective 2.3.3 Knowledge creation:** Students will know how to use computers and other technology devices as tools for productivity, problem solving, and learning across content areas.
- **Objective 2.3.4 Communicate information:** Students will be able to use appropriate digital devices, software, and applications to create written, visual, oral, and multimedia products to communicate ideas and information.

Figure 17: The Relationship Between Navigation and Digital Reading (OECD, 2009: p. 90).

One of the major distinctive features of digital text (specifically, hypertext) is that it consists of several pieces or "nodes" of text that are interconnected via hyperlinks. The reader must effectively "navigate" these nodes of text—selecting and ordering text to make meaning.

A considerable number of studies have found that navigation is closely linked to understanding digital texts. This is because in digital reading, a reader "constructs" his or her text through navigation. Thus, the reader's navigational choices directly influence what kind of text is eventually processed. This affects both the text's content and structure.

Navigation choices determine which pieces of information will be accessible to the reader, whether that information is appropriate to the task at hand, whether the pieces of information accessed will be in a semantically coherent order, and the degree to which they require more or less cognitive effort to be understood.

11 The formal writing process includes brainstorming, prewriting, drafting, revising and editing, and rewriting.

Figure 18: Literacy in a Digital Age

The notion of literacy has been dramatically transformed in our digital age. Learners must not simply know how to read and write (functional literacy) using print-based materials, but consume and produce information using a variety of digital tools, in a variety of formats, and in non-linear and often non-text-based ways. Indeed, literacy in a digital age is no longer a simple definition, but a taxonomy that involves functional literacy, technical literacy, media literacy, civil literacy, discourse literacy, personal literacy, community literacy, visual literacy, evaluative literacy, and pedagogical literacy (Burniske, 2002). These 10 literacies are interactive, build off of one another, and illustrate the challenge and the responsibility schools face in developing "digitally literate" students.

- **Objective 2.3.5 Collaboration:** Students will be able to use digital networks and Web 2.0 tools (such as social media and collaboration ware) to collaborate with other students in class or online for information gathering and processing.
- **Objective 2.3.6 Evaluate information:** Students will be able to assess digital information for credibility, logic, veracity, and bias through analysis of visual, text-based, numeric, tabular, graphic, and oral information.
- **Objective 2.3.7 Ethical uses of technology:** Students will demonstrate the responsible, legal, and ethical use of information resources, digital communication tools, computers, and other technologies.

Chapter 3: Technology and Instruction

Overview

Instruction is the process by which curricular goals and competencies are carried out. At its core lies interaction with content by the teacher and student. Thus, these two chapters—curriculum (Chapter 2) and instruction (Chapter 3) are highly interconnected.

When technology is used in ways that support curricular competencies—finding and evaluating information, solving problems, observing and analyzing real-world phenomena, and developing and expressing ideas in writing or through images, multimedia, mashups, or video—it can deepen and enrich teaching and learning around content.

Successful implementation of the national educational technology strategic plan ultimately depends on the teacher's ability to integrate technology into his or her content areas, using proven pedagogical practices[12] that qualitatively improve student learning.

Figure 19: Learner-Centered Instruction

Learner-centered instruction (also known as "active learning") is a teaching and learning method in which activities are organized so the *student* is engaged with a group of classmates in a real-world ("authentic") project or task involving a high degree of cognition. Thus, the student may work in teams outside the classroom taking soil samples as part of a science project, cowriting a report with classmates, or presenting findings to the whole class. The teacher in such a context sets up the activity as a case or project and physically moves throughout the learning space (both inside and outside), among groups of students, checking on their progress, facilitating their learning, and providing assistance as needed.

In contrast, in "direct" or "traditional" instruction, the teacher lectures, demonstrates a concept, writes on the chalk or Interactive White Board, or reads from a text. (Note that this also occurs as part of learner-centered instruction, but is a much smaller overall proportion of instructional time.) This is often followed by small-group, individual, or choral questioning and responses and individually based seat work.

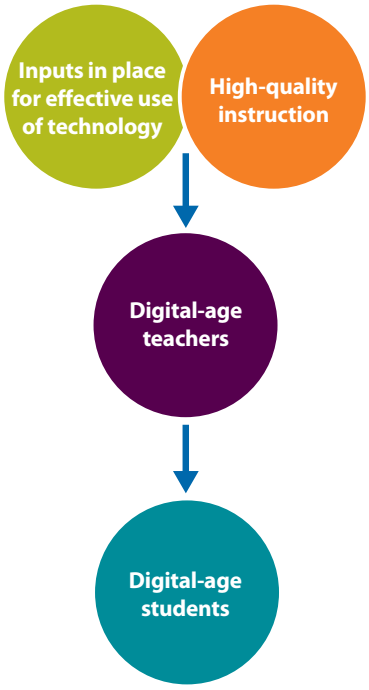
Both approaches, when used appropriately, are helpful to learning. But engagement, motivation, and mastery over many real-world competencies are better attained through structured, learner-centered instructional approaches.

Teachers may adopt any number of learner-centered approaches (project-based, problem-based, case-based, and inquiry-based methodologies, for example) but all learner-centered methodologies are governed by five common features:

12 Examinations of meta-studies on instruction (Marzano, 2010; Rosenshine, 2012; Hattie, 2009) identify numerous "high-quality" or "high-yield" instructional practices. These include, but are not limited to: setting and communicating learning goals; beginning a lesson with a short review of previous learning; direct instruction for novices; reciprocal teaching; problem-based learning; assessing for learning to improve instruction; providing meaningful feedback; scaffolding students' task engagement and performance; collaborative learning; using graphic organizers; note taking; teaching students self-verbalization skills; guided and independent practice; engaging students in weekly and monthly reviews; and summarizing learning. Most, if not all of these practices, can be carried out via varying degrees of technology. More information on learner-centered instruction can be found on pages 110–113 of this strategic plan.

Figure 19: Learner-Centered Instruction *(continued)*

1. Collaboration: Students work together in groups, teaching and learning from one another, negotiating differing points of view, and arriving at a consensus.
2. Critical thinking: Learning focuses on the cultivation of *higher-order thinking skills*—transferring information to new situations, analyzing information, gathering information from a variety of sources, and synthesizing it to create a cogent argument, and evaluating the veracity, worth, and merit of such statements. This focus on critical thinking may require objects of study, instruments by which to examine and record phenomena, hypothesis testing, dialectical exchanges, and discourse and debate.
3. Authentic learning: Learning is based on real-world issues versus artificial, academic constructs. For instance, students may be given real-world problems to solve (balancing population growth and available land supply in a community—*problem-based instruction*); a project to create (conducting a predesign of a school—*project-based instruction*); a case to analyze (common in law and medical school—*case-based instruction*); or an overarching question, which they must answer through inquiry and research (*inquiry-based learning*)
4. Interaction with a variety of materials: Learner-centered instruction recognizes that students learn through a variety of tools, resources, and experiences. This demands a variety of cognitively rich learning tools, both technological (such as computers, software, applications, content-specific Internet sites) and non-technological (microscopes, text-based and visual data, natural elements, people, books, manipulatives, etc.).
5. Authentic assessment: This is assessment that mimics a real-world task, such as developing a business plan, making a presentation to a local government official, or teaching a lesson to younger students.



Overarching Goal

The overarching goal for integrating technology into classrooms is to improve the overall quality of instruction in all classrooms in Lebanon.

The individual goals and objectives supporting this overarching goal demonstrate a belief that technology works best when all educational inputs are learner-centered—when the pervasive teacher sentiment is one of sensitivity and accommodation toward a learner's emotional, developmental, and social needs, especially those deemed to have special needs; when teachers modify instruction and curricula to address the various learning styles of their students; when they physically reconfigure their classrooms to allow students to work together collaboratively; and when they refashion themselves from micromanagers to "conductors" of student learning who guide students toward concepts, skills, attitudes, and behaviors.

Though actual practice may vary in such environments, teachers understand that they must often personalize instruction, focus on each student as a whole person, and provide sustained scaffolding and support for deep learning to occur (see Figure 20).

Technology and Instruction: Individual Goals and Objectives

To improve the quality of teaching and learning in all classrooms in Lebanon, this strategic plan proposes that by 2017:

Goal 3.1: At the system level, MEHE and CERD will ensure that major inputs are in place to ensure that technology is used effectively to improve the overall quality of teaching and learning in all schools.

Attaining this goal will involve meeting the following objectives:

- **Objective 3.1.1 Develop guidelines for technology use:** Develop, adopt, or adapt guidelines, standards, and competencies for content-specific innovative instructional practices using ICT.
- **Objective 3.1.2 Research-based technology use:** Using research and best practices as guides, integrate technology into all content areas and all grade levels to enable students to learn in ways that are unavailable without these technology resources.
- **Objective 3.1.3 Technology aligned with curriculum, instruction, and assessment:** In all content areas and in all grade levels, align technology with curricular objectives, instructional activities, and assessment to support deep learning. (See Figure 21 to see how computers can support "deep learning.")
- **Objective 3.1.4 Digital repository:** Develop a national portal/digital platform for teachers and students containing models and lesson plans of content-based, learner-centered activities that use technology; archived video lectures for student reference and self-learning; and e-learning courses for teachers and students.
- **Objective 3.1.5 Ongoing professional development for teachers:** Develop a system of ongoing professional development and continuous school-based support for teachers to help them integrate ICT into instruction and assessment.[13]
- **Objective 3.1.6 Evaluate technology use:** Design and implement ongoing outcome and impact evaluations of the efforts described in this chapter and revise programs, inputs, and resources based on results from these evaluations.
- **Objective 3.1.7 Assess teachers' use of technology:** For purposes of support and evaluation, ensure ongoing assessment of teachers' use of technology.[14]
- **Objective 3.1.8 Community outreach regarding technology:** Develop a dissemination strategy that involves communities, families, and businesses as partners in student learning who can furnish physical, emotional, and technical supports for schools.
- **Objective 3.1.9 Block scheduling:** Investigate or experiment with block scheduling to organize the school day into fewer, but longer, class periods to allow flexibility for learner-centered instructional activities.

Goal 3.2: In concert with the introduction of technology in schools, create and promote a national system of "high-quality" instruction (see footnote 12, p. 43).

Figure 20: What Is "Deep Learning"? (Sawyer, 2006: p. 4)

Deep learning requires that learners:

- Relate new ideas and concepts to previous knowledge and experience
- Integrate their knowledge into interrelated conceptual systems
- Look for patterns and underlying principles
- Evaluate new ideas and relate them to conclusions
- Understand the process of dialogue through which knowledge is created
- Critically examine the logic of an argument
- Reflect on their own understanding and their own process of learning

For more information on deep learning, see page 107 of this document.

13 The reader will note that teacher professional development is deliberately repeated in many places throughout this strategic plan because well-trained and highly qualified teachers are the fulcrum around which the goals and objectives of this plan pivot. Thus, where germane, this document mentions teacher professional development.

14 This will require a combination of low- and high-instrument subject-specific assessments and general pedagogical instruments, highly trained observers who work closely with (or are) teacher support staff and/or professional development providers, and multiple types of measures.

Figure 21: How Do Computers Support Deep Learning? (Sawyer, 2006: p.9)

- Computers can represent abstract knowledge in concrete forms.
- Computer tools can allow learners to articulate their developing knowledge in visual and verbal ways.
- Computers can allow learners to manipulate and revise their developing knowledge via the user interface, in a complex process of design that supports simultaneous articulation, reflection, and learning.
- Computers support reflection in a combination of verbal and visual modes.
- Internet-based networks of learners can share and combine their developing understandings and benefit from the power of collaborative learning.

To attain this goal, instruction in all schools will focus on meeting the instructional practices outlined by the following objectives:

- **Objective 3.2.1 Targeted and differentiated instruction:** Teachers will use technology to differentiate instruction for students based on their particular level of expertise and skill, learning styles, and needs.
- **Objective 3.2.2 Learner-centered instruction:** Teachers will use a variety of learner-centered methods, such as project-based, problem-based, inquiry-based, case-based, and collaborative learning (See pages 110-113).
- **Objective 3.2.3 Higher-order thinking:** Teachers will advance students' higher-order thinking skills by using a wide range of technologies, instructional practices, and assessment activities.
- **Objective 3.2.4 Inductive and deductive reasoning:** Teachers will advance students' inductive and deductive reasoning skills and higher-order thinking skills by using a wide range of technologies, instructional practices, and assessment activities.
- **Objective 3.2.5 Balance collaborative and independent learning:** Based on the intended learning outcome and complexity of the task, teachers will demonstrate an ability to balance the use of collaborative learning (to support understanding of concepts, skills, and procedures that are part of more complex units of study) and individual learning (to support independent practice for mastery of skills).
- **Objective 3.2.6 Learning beyond the classroom:** The teacher will move beyond 2 x 4 learning[15] to integrate resources, experiences, and issues from the community at large and, where possible, to connect student learning to real-life, community issues.
- **Objective 3.2.7 Online and face-to-face collaboration:** The teacher will design well-structured face-to-face and online collaborative learning activities with clearly defined learning goals, roles, and responsibilities for each member, characterized by positive interdependence, individual accountability, and group interaction so that students can learn from each other's scholarship, skills, and experiences.

Goal 3.3: The teacher will exhibit the knowledge, skills, and dispositions necessary for teaching in a digital age.

To attain this goal, the teacher will exhibit the skills, behaviors, and habits of mind listed in the following objectives:

- **Objective 3.3.1 Orchestrate student learning:** Through the use of technology and learner-centered instruction, the teacher will shift from being the sole provider of knowledge to a "conductor" of student learning, thereby allowing students to become active participants in setting their own educational goals, managing their own learning, and assessing their own progress (see Figure 23 for an explanation of the teacher as a conductor).

15 The two covers of the book and the four walls of the classroom.

- **Objective 3.3.2 Technology for productivity:** The teacher will use technology for a variety of productive purposes (for instructional design, instruction, assessment, and data management).
- **Objective 3.3.3 Model attitudes toward learning:** Through technology and instructional practices, the teacher will model curiosity, intellectual flexibility, open-mindedness, a willingness to listen to different points of view, and a desire for continuous learning.
- **Objective 3.3.4 Achieve technology competencies:** Teachers will attain the technology proficiencies defined by the National Education Technology Standards for Teachers (NETS-T) and UNESCO's ICT Competency Framework for Teachers,[16] both of which will be adapted to the Lebanese context.
- **Objective 3.3.5 Represent learning in multiple formats:** The teacher will help students use a variety of media to produce linguistic (text) and nonlinguistic representations (for example, drawings, videos, or audio) that demonstrate their learning and help them better understand content-related topics and concepts.
- **Objective 3.3.6 Promote student choice:** The teacher will provide opportunities for students to self-select resources and arrange content in personally meaningful ways to produce higher levels of intrinsic motivation and higher levels of student engagement with content.
- **Objective 3.3.7 Capitalize on student interest in technology:** The teacher will capitalize on students' uses of computers, mobile devices, and the Internet outside of school to cultivate engaging learning experiences inside of school.

Goal 3.4: Through the integration of technology and high-quality instruction, students will become digital-age learners.

Attaining this goal will involve using technology to meet the following objectives:

- **Objective 3.4.1 Independent learners:** Teachers will allow and encourage students to independently, autonomously, and routinely use technology to complete required academic assignments.
- **Objective 3.4.2 Attain digital-age skills:** Students will engage in learning activities that foster creativity and innovation, communication and collaboration, and critical thinking, problem solving, and decision-making.
- **Objective 3.4.3 Pursue their own interests:** Students will use technology to pursue particular interests, formulate their own beliefs and opinions, draw their own inferences supported by facts, and choose how to present information (e.g., through the creation of a video or Web-based slide show) as appropriate to the learning assignment.
- **Objective 3.4.4 Higher-level thinking:** Students will be able to use technology and non-technology resources to generate, test, and revise

Figure 22: Students and Teachers in a Technology-Integrated Classroom (Vision Statement, p. 17)

Students are actively engaged with content and with one another in the process of learning. They work individually and collaboratively in a variety of challenging, stimulating, and higher-order activities using the most appropriate types of classroom technology—to inquire and access information based on such inquiry; to wonder, explore, and hypothesize; to generate new ideas, solve problems, and create new paradigms and understandings; and to share, communicate, and collaborate with colleagues across the globe.

The teacher's role is transformed from a dispenser of information to a facilitator of student learning—he or she designs activities and units of study that promote higher-order thinking; probes student thinking and guides and supports students as needed; plans learning experiences that capitalize on the features of technology and employs technology as appropriate to engage students with content, to promote student sharing and communication of ideas, and to assess whether and how students have learned.

16 ISTE's NETS-T: http://www.iste.org/standards/nets-for-teachers.aspx and UNESCO's ICT Teacher Competency Framework: http://unesdoc.unesco.org/images/0015/001562/156207e.pdf

Figure 23: The Teacher as a Conductor

This strategic plan likens the teacher in a learner-centered classroom to the conductor of an orchestra. A classroom, like an orchestra, is an ensemble of a large number of individuals, each with a unique but collective responsibility to play in support of an overall melody, or *harmony*. Like an orchestra, organized by instrument groups (strings, woodwinds, percussion, and brass), a classroom may be composed of different teams each with its own "lead" (team captain or manager), instrument, and its own particular role, purpose, and contribution to the overall learning "composition" or activity.

As does the teacher with a learning unit, an orchestra conductor prepares the musical score; sets the pace of the composition; coaxes performers via signs and gestures to play the music as the composer intended; recognizes, diagnoses, and corrects mistakes in interpretation of the score; leads the orchestra to certain points in the symphony; and balances whole orchestra, small groups, and individual solos to highlight the key movements and the composer's intended musical outcomes. Neither the teacher nor conductor typically "plays" an instrument—music and harmony are created by musicians/students. But in both cases—the orchestra and the classroom—harmonized output and the intended outcomes by musicians/students depend on the design, organization, and leadership of the conductor/teacher.

hypotheses via deductive and inductive reasoning skills; apply, analyze, synthesize, and evaluate information; and create, not simply consume, information.

- **Objective 3.4.5 Attain technology competencies:** Through the authentic use of technology as part of the actual learning process, students will develop skills and competencies in a variety of technologies defined by the National Education Technology Standards for Students (NETS-S).[17]
- **Objective 3.4.6 Online collaboration:** Through the use of structured and collaborative face-to-face and online activities that use communication technologies, students will learn how to collaborate with other learners, where they must work together on a common task with defined roles, responsibilities, and deadlines, and work with people whose ideas, personalities, and working styles may be different from theirs—all of which are essential skills for a 21st-century workplace.
- **Objective 3.4.7 Express knowledge in multiple formats:** Through the use of all types of assistive technologies, all students, regardless of their abilities, will be able to complete their work, achieve learning goals, and express what they have learned.

17 The NETS-S standards identify several higher-order thinking and digital citizenship skills as critical for students to learn effectively for a lifetime and live productively in a global society. Such skills include using technology for demonstrating creativity and innovation, communicating and collaborating, conducting research and using information, thinking critically, and problem solving. See http://www.iste.org/standards/nets-for-students.aspx

Chapter 4: Technology and Assessment

Overview

Technology can improve the experience, breadth and depth, and efficiency of assessment. For example, computer-based assessments (CBAs) offer numerous advantages that paper-and-pencil assessments do not in terms of personalizing and differentiating assessment, and efficiency in measuring, grading, reporting, and feedback. Some of the advantages of CBAs are outlined in Figure 24.

Yet technology linked to assessment is not simply about taking an online test. Technology offers a wealth of authentic assessment opportunities for students—synchronous and asynchronous, Web-based and non-Web-based, using established technologies (laptops) and emerging technologies (cell phones and tablets). For instance, extensive writing via word processing software or a digital writing tool—in which learners put forth a thesis statement, support their thesis with evidence, and arrive at a conclusion—serves to assess students' thinking and communication abilities. Student Response Systems (SRSs), or "clickers," can be used as a diagnostic and formative assessment tool for question-driven instruction and to promote student reflection and metacognition. Online discussions and social media conversations can also serve as a rich source of assessment data. These

Figure 24: Advantages of Computer-Based Assessments (CBAs)

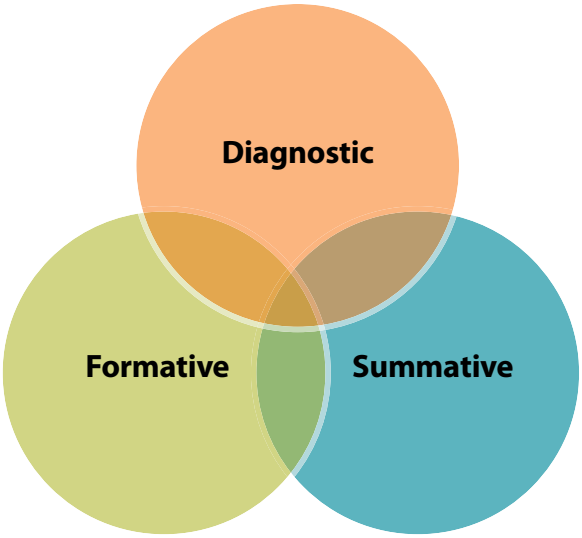
Computer-based Assessments offer numerous "testing" advantages, including the ability to:

- **Mix different types of assessment (traditional multiple-choice questions with simulations, applets, short-answer questions, and essays) that address all content standards (not just ones that are easy to measure).**
- **Allow for multiple types of assessments (norm- and criterion-referenced and ipsative assessments) and multiple types of questions (open-ended, closed-response and technology-enhanced), such as the use of video.**
- **Provide a clearer image of student performance because they are tailored to individual students' abilities.**
- **Enable teachers to design more rigorous assessments that include measures of complex thinking, authentic tasks, and computer-based tasks.**
- **Use screen readers, magnification tools and text-to-voice or voice-to-text, thereby making test-taking easier for learners with visual, auditory, and motor impairments.**
- **Quickly score assessments and relay results to students; thus, several examinations can be administered over the course of a school year, serving as a form of formative and interim assessment.**
- **Lower the cost of assessment because they take less time to score.**
- **Quickly turn around assessment data to the teacher and students, allowing teachers to assess performance at a much more granular, detailed level and making possible more reliable scoring and valid data interpretation.**
- **Provide students and teachers with feedback that informs instruction and performance, respectively.**

The immediacy of such feedback is an especially salient feature of successful learning technologies.

examples may appear to be instructional rather than assessment activities. But in fact they are both because in a learner-centered environment, assessment and instruction are inextricable.

Figure 25: Balanced Assessment: Assessment has a triple function—assessing student readiness (diagnostic); informing instruction and providing data on student progress (formative); and certifying competence (summative).

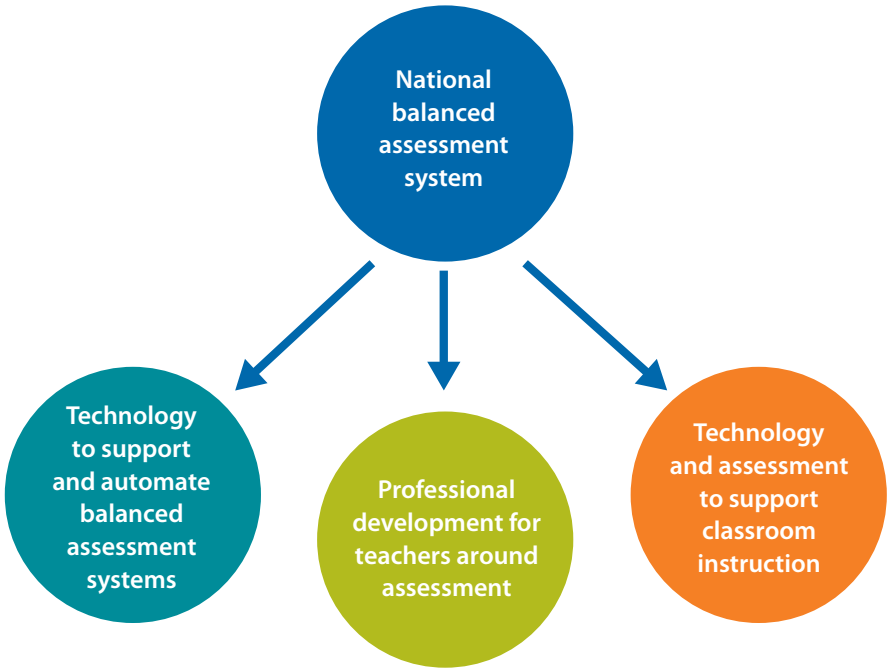


Learner-centered assessment supported by technology allows students to learn in multiple ways and thus provides teachers with more types of *knowledge*—declarative, procedural, and conceptual—to assess. It provides teachers with *multiple points* for assessment—at the beginning, middle, and end of lessons; it allows for multiple *types of assessment* (performance-based tasks, written and oral reports, or projects); it offers students a *variety of assessment products* by which to showcase their knowledge and skills (technology-based products, multimedia, Web pages, reports). In short, learner-centered assessment supported by technology can allow for *balanced assessment* that measures not just *that* students learn, but *what, how, why, and under what conditions* they best learn and their progress as learners.

Review and reform of the Lebanese assessment system are currently planned once the national curriculum has been revised. Any reform of the Brevet and Baccalauréat that occurs will take place well after this strategy is complete. Yet, assessment drives how curricular outcomes are transacted with students. Assessment drives instruction, and assessment drives technology use.

Therefore, efforts to revise Lebanon's national and school-based assessment system—to align assessment with a competency-based curriculum, innovative models of instruction, and the use of technology to promote higher-order thinking—must begin upon adoption of this national educational technology strategic plan. Without such revision, curriculum, instruction, and technology use will produce little in terms of meaningful change.

Overarching Goal



The overarching goal for this component is to build upon the momentum resulting from the infusion of technology in schools, a newly revised curriculum, and a push toward more diversified instruction to begin the process of reforming the present assessment system. In so doing, Lebanon can begin to develop a *balanced assessment system* (See Figure 25) aligned with technology, curriculum and instruction.

To support this overarching goal, the following goals advocate a national-level review of the current national assessment system; where possible, the use of technology to administer and score current national assessments; and intensive professional development that helps teachers use technology to integrate and align learner-centered assessment with learner-centered instruction.

Technology and Assessment: Individual Goals and Objectives

To assist with this reform of the assessment system, this strategic plan proposes that by 2017:

Goal 4.1: MEHE and CERD will begin to develop a national, balanced, learner-centered, and school-based assessment system that blends multiple *types* of assessment (diagnostic, formative, and summative); that conforms to *standards* of good assessment (fairness, reliability, validity, and transparency); and that builds on known *best practices* in assessment, with and without technology.

Attaining this goal will involve meeting the following objectives:

- **Objective 4.1.1 Review current assessment system:** Undertake a national evaluation of the current assessment system, developing a framework for new models of assessment to be aligned with (1) a newly revised,

Figure 26: Why Assess?

Within schools, we assess for a variety of reasons:

- **Administrative purposes**
- **Certification and promotion to the next level**
- **Feedback about student achievement**
- **Guidance**
- **Instructional planning**
- **Motivation**

Since these purposes for assessment vary, so too must the:

- **types of assessments that we use (oral exams, written exams, informal questioning, portfolios, performance-based tasks, etc.)**
- **standards for assessment (norm-referenced; criterion-referenced, or ipsative)**
- **use of this information (assessment for learning vs. assessment of learning).**

In all cases, assessments must be valid, fair, reliable, and transparent.

competency-based curriculum; (2) new models of instruction; and (3) the integration of ICT into all content areas.

- **Objective 4.1.2 Expand current understanding of assessment:** Help all educators understand the multiple purposes of assessment, multiple types of assessment, multiple methods of assessment, and the variety of strategies that can be employed to measure student learning (see Figure 26).
- **Objective 4.1.3 Assessment of learning progress:** Move beyond the current system of simply certifying student learning to create new policies, mechanisms, criteria, and indicators that promote the use of diagnostic and formative assessments to measure students' progress within a given domain.
- **Objective 4.1.4 Competency-based assessment:** Move away from the current assessment system to a competency-based assessment system that is tightly aligned with curriculum standards/competencies/benchmarks and instruction.
- **Objective 4.1.5 Professional development:** Provide mechanisms, professional development, support, and outreach to help parents, principals, and teachers understand the rationale for and new mechanisms for assessment.[18]
- **Objective 4.1.6 Align grading with new modes of assessment:** Review all procedures for grading and reporting and align these with new modes and models of assessment.
- **Objective 4.1.7 Analyze and use assessment data:** Continuously collect and analyze student assessment results to guide national, regional, school, and classroom decisions about curriculum and instruction.

Goal 4.2: MEHE and CERD will implement the use of technology to support, automate, and increase the efficiency of this balanced assessment system.

Attaining this goal will involve meeting the following objectives:

- **Objective 4.2.1 Digital item bank:** Develop a digital repository of test items, as well as metadata about the test items, extensive information regarding test development, and psychometric characteristics of the items.
- **Objective 4.2.2 Public assessment data:** Make all summative student assessment data available to parents, students, teachers, and principals via a secure and searchable Internet-based Student Information System (SIS).
- **Objective 4.2.3 Technology and assessment:** Integrate into content areas technologies such as computer-aided instruction, simulations, digital learning games, and virtual worlds to provide students with a developmental sequence of increasingly difficult challenges; and embedded, just-in-time feedback so that learners are working at their highest ability.

18 Teacher professional development in assessment is also mentioned in Chapters 3 and 5.

- **Objective 4.2.4 Computer-based testing:** Shift summative and high-stakes assessments to the online or digital realm so that students can receive immediate results and feedback on their performance.
- **Objective 4.2.5 Computer Adaptive Testing (CAT):** In particular, for summative and high stakes assessment, use CAT (see Figure 27) to maximize the precision of the exam, provide more precise and reliable scores for test-takers, and generate immediate feedback for test-takers.

Goal 4.3: MEHE and CERD will develop teachers' abilities to measure and assess student knowledge and skills—with or without technology.[19]

Attaining this goal will involve ongoing professional development and support to meet the following objectives:

- **Objective 4.3.1 Expand teacher understandings of assessment:** Expand teacher understanding of the characteristics of good assessment, types of assessment (formative and summative), and the purposes of assessment (e.g., determining readiness/baseline understanding of a topic, providing valuable information about their understanding of topics to modify instruction, and certifying mastery).
- **Objective 4.3.2 Assess digital-age skills:** Provide teachers with the knowledge and skills to design and develop authentic assessments that measure digital-age skills in real-world settings, such as critical thinking, collaboration, drawing inferences, justifying positions, and managing information.
- **Objective 4.3.3 Use assessment data for instruction:** Provide teachers with the knowledge and skills to use assessment information, not for judgment of student performance at the end of a unit, but to tailor instruction, provide remediation or enrichment, make available individual or peer tutoring, and modify units of study to help students successfully grasp the key concepts of the unit of study.
- **Objective 4.3.4 Common assessments:** Provide teachers with the knowledge and skills to develop and administer common assessments[20] for similar courses or grade levels.
- **Objective 4.3.5 Assess different types of knowledge:** Provide teachers with the knowledge and skills to assess declarative, procedural, and conceptual knowledge in the core concepts and main ideas in a particular topic (see Figure 28) using multiple forms of assessment (e.g., performance-based assessments, portfolios, essays, etc.).
- **Objective 4.3.6 Questioning techniques:** Provide teachers with the knowledge and skills to assess and promote deep learning via deep questioning, such as inferential, analytical, and hypothetical questioning techniques.

Figure 27: Computer Adaptive Testing (CAT)

Computer Adaptive Testing (CAT) can collect sufficient data for highly reliable results in a relatively short time by using the power of technology to select the items presented as the test progresses, based on students' answers. CAT measures the difficulty of each test item, as well as the probability that the learner will get it right. The computer then matches the difficulty of questions to a student's previous performance, so that the scores are always comparable to the previous administration of the test. This means that no two students, even if seated next to one another and being assessed on the same content, would take the exact same test, although they would be assessed on the same constructs. Thus, CATs can eliminate redundant questions and questions that are too easy or too difficult and zero in on a student's performance range, reaching reliable conclusions in a very short time.

19 Although this is considered professional development, it is included in this chapter rather than the next because it is so highly focused on assessment.

20 Common assessments are diagnostic, formative, or summative assessments created collaboratively by a team of teachers responsible for the same grade level, course, or content area. They include all students taking the same course or grade-level assessment across classes/teachers and are administered and graded systemically.

Figure 28: Types of Knowledge and How to Assess Them

Declarative knowledge includes knowledge about information and facts. Declarative knowledge is best measured by closed-response, selected-response questions, and short-answer tests.

Procedural knowledge includes knowledge of how to do something—perform a task, solve a problem, etc. Because it focuses on skills and procedures and requires some degree of fluency and automaticity, procedural knowledge is best assessed via performance-based tasks (e.g., building a model, giving a demonstration, etc.).

Conceptual knowledge is knowledge based on reflection and metacognition around a domain. It involves seeing patterns in domains and understanding why something is significant, how it relates to other issues, or how it can be assimilated into larger understanding. Conceptual knowledge is harder to assess than declarative or procedural knowledge, but it is the level of knowledge that indicates expertise in a domain. It is best assessed through open-ended writing, projects, performances, debates, or discussions.

- **Objective 4.3.7 Design scoring guides:** Provide teachers with the knowledge and skills to design and use holistic and analytical rubrics, checklists, and scoring guides that reliably and consistently measure student performance.
- **Objective 4.3.8 Grading and feedback:** Provide teachers with the knowledge and skills to use appropriate grading; immediate, corrective, and informative feedback; and reporting strategies that are aligned with new technology-based modes and balanced, learner-centered models of assessment.

Goal 4.4: Based on the professional development provided as part of Goal 4.3, teachers will use technology to support balanced assessments that inform teaching and learning.

Attaining this goal will involve meeting certain classroom behaviors, outlined in the following objectives:

- **Objective 4.4.1 Technology as part of assessment:** Ensure that, as part of learning, students use various and appropriate technologies to produce products and projects that demonstrate their mastery of particular content-related concepts or competencies.
- **Objective 4.4.2 Authentic assessment tasks:** As part of instruction, integrate technologies to develop authentic learning tasks that, by their nature, blend assessment with instruction.[21]
- **Objective 4.4.3 Focus on content, not technology use:** Ensure that technology-rich products can be evaluated directly and accurately in relation to the intended learning outcomes of the curricular topic (not according to levels of technology use).
- **Objective 4.4.4 Assess digital-age competencies:** Use various technologies as appropriate to assess student digital-age competencies.[22]
- **Objective 4.4.5 Assess hard-to-measure skills:** Use technology to allow for the creation of more learner-centered, digital-based products, such as digital portfolios, that can easily assess harder-to-measure competencies, such as student creativity, and which can be more easily updated and archived and shared.
- **Objective 4.4.6 Self- and peer-assessments:** Integrate technology into learning activities to allow for teacher assessment, peer-based assessments, and self-assessment of learning[23] and help students reflect on what and how they have learned, and articulate their thinking and progress on a range of topics.

21 An example of this could include blogs, wikis, and social bookmarking sites to demonstrate learners' understanding of a topic and their ability to identify additional resources and issues associated with that topic.

22 For instance, archives of student discussions to assess students' ability to communicate in online environments; online simulations to assess student understanding of content; or the development of a website that articulates both viewpoints of a current political issue.

23 This could involve the use of audio- and Web-conferencing tools to allow learners to present information to one another and the instructor, and to engage in debates about a particular content-based issue.

- **Objective 4.4.7 Assistive technologies for students with special needs:** Use assistive technologies to monitor students' responses, provide immediate feedback, and increase accessibility using particular exam software for students with particular physical and cognitive needs.

Figure 29: The Interplay of Assessment, Instruction, and Technology in Student Learning

The teacher begins science class by showing a video clip of an earthquake on the classroom's Interactive White Board (IWB). She then poses a multiple-choice question about why earthquakes occur, with four possible answers. Students use their response systems ("clickers") to select the correct answer. These selections appear instantly as a bar graph on the IWB, displaying the percentage of students who voted for answers A–D. In providing their answers, students reveal their preconceptions about and baseline understanding of earthquakes. The teacher then organizes students into heterogeneous groups based on these responses. Within the group, each student must discuss his or her response to the original question and defend his or her position. Armed with an Internet-connected laptop, students use Google Earth to look at the pattern of fault lines across the globe and the "Make a Quake" simulation at the Discovery Learning Channel to examine how factors such as construction, slope, and soil type can worsen or mitigate damage from an earthquake.

The teacher gathers students together again, posing the same question and asking students to answer again using their clickers. In contrast to the first set of responses, all students now arrive at the correct answer. The teacher asks students to explain the changes to their thinking—what information or evidence made them change their minds? What have they learned about earthquakes that they did not know before? Based on this information, could they make predictions about other global locations where earthquakes might occur? Based on what they've learned, can they predict the types of soils, building materials, structures, and terrain that are most vulnerable to and from seismic activity? The teacher concludes by replaying the original video and asking students to summarize what they learned about earthquakes from it.

In this lesson, we see how a combination of technology and formative assessment strategies (teacher questions and peer- and self-assessment) serve as the instructional focus to help students deepen their content knowledge. The clickers and IWB provide instant visual information that display differences in the students' original answers. This visual information allows the teacher to diagnose student understanding of earthquakes instantly and use this information as a starting point for instruction.

Through a process of *peer-assessment,* students question one another about their understanding of earthquakes. Based on their answers, the questions of their teammates, and access to immediate information from the Internet, the student goes through a rapid *self-assessment*—new information confirms, adds to, supplants, or contravenes the student's original beliefs—and students must revise original assumptions based on this information. Through the process of exploring additional information, students are able to gain a *greater depth of knowledge* about content from which they can make predictions, generalizations, and inferences. The teacher provides students with the freedom and motivation to discover and generate information about earthquakes independently, framing the activity with key formative assessment questions to ascertain the level of their understanding. Finally, as part of this assessment, students develop *meta-cognitive abilities*—the habits of mind necessary to assess their own progress and reflect on what and how they have learned.

Curriculum, instruction, and assessment are the foundations on which educational technology rests, and the core teaching and learning components into which it must be woven. This cannot occur without professionals who understand the synergy between technology, curriculum, instruction, and assessment—high-quality teachers and principals.

Chapter 5: Technology and Professional Development

Overview

High-quality teachers are key to a successful ICT for education initiative, and one of the best investments that any educational technology strategic plan can make is to invest in improving teacher quality. Unfortunately, high-quality professional development that is ongoing, school-based, and augmented by in-school support is far less common than professional development that is episodic, held away from teachers' schools, and lacks ongoing support. In cases where high-quality professional development is not systemwide, innovative teaching with technology is also not systemwide—instead, it becomes a teacher phenomenon, not a schoolwide one.

To be successful, technology-related initiatives must be systemic. To be systemic, technology-related professional development must provide teachers with ways to apply new learning directly to their teaching and support teachers as they do so. Professional development leads to better instruction and improved student learning when it connects to the curriculum and materials that teachers use; to the national academic standards that guide their work; and to the assessment and accountability measures that evaluate their success—and when it is collaborative, coherent, and continuous (Holland, 2005). To be effective, professional development needs to become a focus of attention and responsibility, not just of teachers, but of pre-service and in-service institutions, policymakers, education officials, and principals.

One of the real weaknesses of technology-based professional development is that it often "leads" with technology instead of content. As counterintuitive as it may seem, this strategic plan proposes *phasing out* this type of professional development in favor of professional development that "leads" with improving teachers' content, instructional, and assessment skills. *Where and when* technology fits, it should be integrated into content, instruction, and assessment—not by focusing on operational skills, but rather by developing the conceptual and instructional skills teachers need to use a particular technology to promote learning in a particular domain.

The above point is illustrated in Figure 30, which outlines three classroom technologies—concept mapping software, word processing software, and SRSs. To use these technologies effectively to improve student learning, the teacher must possess a range of knowledge and skills, including the following:

- Deep knowledge of the particular topic
- Knowledge of the best strategies to help students learn a particular topic
- An ability to organize learners (individually or in groups based on certain criteria) around a content-related task

- The ability to assess student learning, on multiple levels—that they have learned, how they have learned, and why, in certain cases, they have *not* learned

The teacher should certainly understand generally how to use the particular technology (e.g., concept mapping software) but far more important, she must understand what the technology can and cannot do, and she must possess knowledge of:

- **The underlying *conceptual skills* associated with the technology:** For instance, analytical skills and understanding the variety of functions of mind maps for concept mapping software; the writing process for word processing software.
- **The underlying *instructional skills* associated with *teaching with a particular technology:*** For instance, knowing how to teach the writing process, and knowing how to develop open-ended questions as part of formative assessments with SRS.

Very few, if any, technology-based professional development programs instruct teachers in these multiple and requisite layers of teaching with technology.

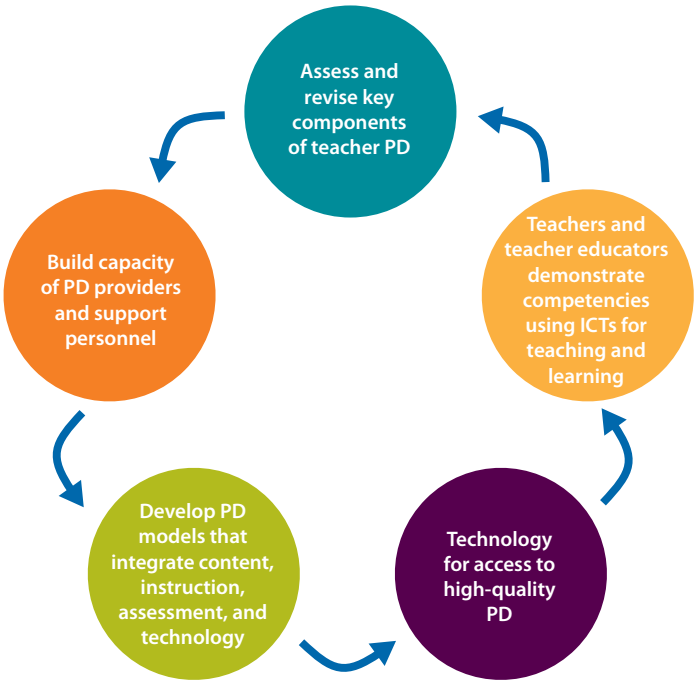
Figure 30: Three Classroom Technologies and the Conceptual and Instructional Skills Underlying Them

Technology	Conceptual Skills Needed	Instructional Skills Needed: *Teachers need to know how to . . .*
Concept-mapping software	• Analysis and synthesis • Organization of information • Visual and relational thinking • Knowing which types of concept maps to use for what purpose (e.g., cause-and-effect maps vs. Venn diagrams, etc.)	• Develop students' ability to think analytically (moving from general to specific) • Develop students' ability to think synthetically (moving from specific to general) • Help students think relationally • Use strong questioning techniques
Word processing	• Knowledge of the writing process (brainstorming, drafting, editing, revising, and rewriting) • Knowledge of various "genres" of prose writing—expository, narrative, persuasive, etc. • Synthesis (pulling separate ideas from different sources and weaving them together to create a coherent thesis) • Communication of key ideas in a coherent, organized, and evidence-based fashion (thesis statement, main ideas, and supporting evidence) • Knowing how to make a claim and support this claim through evidence	• Teach the writing process (brainstorming, drafting, editing, revising, and rewriting) • Help students develop disparate ideas from different sources and weaving them together to create a coherent argument • Help students formulate a thesis statement with supporting ideas and evidence and present it in an organized fashion • Help students understand grammar, language conventions, mechanics, word choice, spelling, and punctuation

Technology	Conceptual Skills Needed	Instructional Skills Needed: *Teachers need to know how to . . .*
SRSs	• Understanding most important points or "big ideas" of a topic • Ability to predict students' areas of conceptual difficulty in a particular topic • Understanding common misconceptions and traps associated with this topic • Design effective distractors for multiple-choice assessments	• Formulate open-ended and probing questions • Carry out diagnostic and formative assessment • Promote student reflection and metacognition • Organize cooperative learning opportunities

Overarching Goal

The greatest single contributor to student academic success is a highly qualified teacher. Therefore, the overarching goal for this component is that technology be a central part in providing teachers with high-quality professional development and support so that students receive a high-quality education. Thus, using Figure 30 again as an example, this strategic plan proposes that technology-related teacher professional development focus on content, content-specific pedagogies, and content-focused assessment strategies for measuring learning. Technology must be an important ingredient in this professional development, but not the main course.



But this professional development must be carried out within a larger system focused on coherence, quality, and support for teachers, so that teachers have the formation, the time, the support, and the opportunities for practice and refinement so they can use technology to promote deep learning for students.

Technology and Professional Development: Individual Goals and Objectives

To push for the development of highly qualified teachers and high-quality teaching, this strategic plan proposes that by 2017:

Goal 5.1: As a part of integrating ICT into the professional development system, MEHE and its partners will assess and revise critical elements of the current system of pre- and in-service teacher instruction to begin to design a new framework for teacher learning and define the roles and responsibilities of each partner.

Figure 31: Teachers as Professional Development Providers

Teacher Leader Capacity Building Model: Many schools across the globe use a *teacher leader model* at selected schools for professional development. Teacher leaders direct a variety of ongoing professional learning activities with their colleagues and use their own classrooms as demonstration classrooms. Technology plays a vital role here. District leaders gather and analyze data to examine evidence of change on teacher practice; professional development activities are recorded and uploaded on the school's intranet site as archives; and the teacher leader's classroom activity is also recorded and used for further study by teachers.

Attaining this goal will involve assessing and revising the current teacher selection, instruction, and support system by meeting the following objectives:

- **Objective 5.1.1 Teacher recruitment strategies:** Assess and revise procedures and criteria for recruiting, selecting, and instructing pre-service teacher candidates, especially as it relates to developing lesson plans and units of study, instruction, and assessment with technology.
- **Objective 5.1.2 Teacher professional development system:** Assess and revise the current teacher in-service professional development, support, and evaluation system so that highly qualified teachers understand how to use subject-specific technology and instructional practices and are required and supported in doing so. (See Figure 31 for one different model of teacher professional development.)
- **Objective 5.1.3 Responsibilities for teacher professional development:** Define or redefine the roles and responsibilities of all stakeholders to help target high-quality professional development and ongoing supports to teachers as they teach with (and without) technology.
- **Objective 5.1.4 Budget sufficient funds for professional development:** Allocate a certain percentage of all technology budgets for professional development and support for teachers.
- **Objective 5.1.5 Standards for teaching with technology:** Develop or adapt standards for effective teaching with technology.
- **Objective 5.1.6 Align pre- and in-service teacher education:** Put in place mechanisms to ensure increased collaboration, coordination, and coherence between pre-and in-service teacher education institutions, including the adoption of teacher competency standards for effective teaching with technology.
- **Objective 5.1.7 Vertical and horizontal alignment:** Vertically and horizontally align and integrate teacher learning and support so that all "levels" within the educational system—the ministry, CERD, regional centers, school principals, head teachers, and teachers—coordinate and efficiently carry out their responsibilities for ongoing teacher learning and support.
- **Objective 5.1.8 Evaluate professional development:** Ensure that schools and regions have reliable systems for evaluating the impact of professional development on teachers' practices and student learning.

Figure 32: Characteristics of High-Quality Professional Development (National Staff Development Council, 2001; Hord et al. 2006; Darling-Hammond, 1999; Gaible and Burns, 2007: p. 17)

High-quality professional development, with and without technology, exhibits the following characteristics:

- Addresses teachers' needs, as well as the needs of students and systemic educational goals
- Aligned with broader educational goals to ensure that professional development is supported by policy and national and school improvement plans
- Addresses teachers' ideas about learning, the developmental nature of learning, how students learn, teachers' roles in the classroom, and the roles of their students
- Long-term, ongoing, and sustained, giving teachers the opportunity to gain new knowledge and skills, reflect on their practice, and practice and receive feedback from a supportive expert
- Sequenced and coherent, so that activities build on each other in a comprehensive and cumulative way, all focused on the same set of outcomes
- Focused on student learning in ways that enable teachers to use their new knowledge and skills to directly affect student learning
- Uses modeling and learner-centered instruction so that teachers experience and reflect on the learning activities they will lead
- Combines various learning experiences that promote observation, direct experience, reflection, and practice
- Supports collaboration and peer support among teachers, enabling them to share knowledge and experiences of the implementation of new ways of teaching
- Includes vigorous follow-up that guides teachers in their approach toward change in teacher learning
- Engages school leadership in creating a school environment that promotes learning and experimentation and that supports the specific goals of professional development
- Incorporates formative evaluation and direct feedback from teachers, leading to summative evaluation that gauges change based on teachers' practices, student activities, and learning outcomes
- Targets lasting and systemic change, so that teachers know they are part of a larger movement toward improvement and that they are the linchpins for implementing what has been learned
- Builds professional learning communities among teachers and principals in solving important problems related to teaching and learning. The technical and social support provided by professional learning communities helps overcome the inertia of the status quo and helps teachers make complex changes

Goal 5.2: Enhance the qualifications and skills of MEHE, CERD, and partner organizations so they can develop and oversee the creation of an effective professional development program with high-quality professional development (as outlined in Figure 32) and support staff.

Attaining this goal will involve meeting the following objectives:

- **Objective 5.2.1 Standards for professional development:** Design or adapt international standards for high-quality professional development for the Lebanese context.
- **Objective 5.2.2 Standards for professional development providers:** Design or adapt international standards for high-quality professional development providers in the Lebanese context.

- **Objective 5.2.3 Build skills of professional development providers and support personnel:** Enhance the qualifications, skills, and competencies of existing professional development providers and DOPS staff so they can, in coordination with the central inspectorate, use technology to improve teachers' content knowledge, pedagogical content knowledge, instructional and assessment practices.
- **Objective 5.2.4 Capacity building through e-learning:** Provide opportunities for national professional development and support staff, as well as regional level staff, to access ongoing e-learning opportunities so they are continuously augmenting their knowledge and skills to work more effectively with teachers.
- **Objective 5.2.5 Build skills of school inspectors:** Provide ongoing professional development and support to school inspectors so that they can recognize and support best practices in instruction and assessment, with and without technology.
- **Objective 5.2.6 Assess effectiveness of teacher professional development:** Use technology to develop measures, gather information, and ascertain the effectiveness of teacher professional development programs and teacher support systems to support increased student achievement.

Goal 5.3: *MEHE, CERD, and partners* will design and implement a research-based professional development system that helps teachers integrate technology with content, instruction, and assessment.

Attaining this goal will involve meeting the following objectives:

- **Objective 5.3.1 Standards for teaching with technology:** Develop or adapt ICT competency standards for effective teaching with technology.
- **Objective 5.3.2 Institutional collaboration for teacher professional development:** Put in place mechanisms to ensure increased collaboration, coordination, and coherence between pre- and in-service teacher education institutions, including the adoption of teacher competency standards for effective teaching with technology.
- **Objective 5.3.3 Blended opportunities for teacher learning:** Implement a high-quality professional development program, both online and face-to-face, that adheres to best practice in teacher instruction (see Figure 32).
- **Objective 5.3.4 Develop professional development standards:** Adopt as Lebanon's national professional development framework the professional development standards designed by iNACOL[24] and the National Staff Development Council[25] with modifications for the Lebanese context.
- **Objective 5.3.5 Differentiate professional development:** Move beyond workshops and trainings to institute professional learning opportunities (such as lesson study, in-class coaching, etc.) that have been shown to improve teaching quality.

24 This is for high-quality online teaching. See http://www.inacol.org/research/nationalstandards/NACOL%20Standards%20Quality%20Online%20Teaching.pdf

25 See http://www.learningforward.org/standards/

- **Objective 5.3.6 Align professional development with the work of teaching:** As part of professional development, align teachers' learning opportunities with their real-life work experiences, using actual curriculum materials, lesson plans, assessments, and student work.
- **Objective 5.3.7 Provide ongoing support for teachers:** Provide ongoing in-person, online, and technology-based classroom support to help teachers implement, practice, and refine with their students what they have learned in professional development sessions. (See Figure 33 for one example of using technology to support teachers.)
- **Objective 5.3.8 Create school-based models of good practice:** Establish a number of professional development schools (PDSs) (see Figure 34) throughout Lebanon that will serve as models of technology excellence, to enhance professional development opportunities for teachers, and promote greater articulation between pre- and in-service teacher education.
- **Objective 5.3.9 Establish relationships between public and private schools:** Cultivate ties between private and public schools so that teachers in each school can share practices and ideas, model classroom activities, and share resources and experiences.
- **Objective 5.3.10 Teacher incentive system:** Develop an incentive system (both extrinsic and intrinsic) that encourages teachers to proactively seek and participate in relevant and high-quality ongoing professional development opportunities and further formal study.
- **Objective 5.3.11 Teacher accountability:** Incorporate mechanisms in the teacher evaluation system that hold teachers accountable for engaging in meaningful and regular professional development opportunities.
- **Objective 5.3.12 Assess teachers:** Use both teacher competency standards and the *ProGReSS SCaLe* observation tool to evaluate teachers so that integrating technology in combination with learner-centered practices form part of the observable criteria on which teachers are evaluated (see Figure 35).[26]

Goal 5.4: Technology will be used to provide equitable access to high-quality professional development for teachers and teacher educators in all grade levels, subject areas, and across all regions of Lebanon.

Attaining this goal will involve meeting the following objectives:

- **Objective 5.4.1 Equip teacher centers:** Teacher resource centers in all governorates will be equipped with appropriate infrastructure and applications to provide teachers and teacher educators with continuous access to technological tools, digital applications, and software.
- **Objective 5.4.2 Connect teachers in remote areas to larger communities:** Teachers and teacher educators in remote areas of Lebanon will engage in ongoing, convenient, relevant, and differentiated professional development

Figure 33: Using Technology to Support Teachers

Virtual Bug in the Ear (VBIE) technology involves live coaching using various technological tools. The in-class teacher, wearing a Bluetooth earpiece, receives instruction and support via the Internet (through a program such as Skype) from an off-site coach who watches the teacher's class via a Web camera. Coaching is live—the teacher receives help as she needs it, and an off-site coach can work with several teachers over the course of a day without having to lose valuable time traveling.

Figure 34: Professional Development Schools (PDSs)

Professional development schools (PDSs) bridge a teacher's pre-service and in-service experiences. Although they vary by detail, PDSs are essentially schools that have a professional relationship with a teaching college. Pre-service students can observe teachers at a PDS as part of their coursework and can conduct their teaching practicum at that PDS. Upon graduation from a teacher-education program, they can return to the same school to teach and receive support (including spending some time with a university professor). Professional development schools often provide the new teacher with a mentor, reduced teaching loads, and ongoing professional coursework for 1–2 years so that he or she can work on refining particular areas of need.

26 The *ProGReSS SCaLe* should be revisited in light of the adoption of teacher technology standards so that teachers are hired, assessed, and supported based on these integrated indicators.

Figure 35: The Importance of Teacher Evaluations (The New Teacher Project, 2010: p. 1)

Evaluations should provide all teachers with regular feedback that helps them grow as professionals, no matter how long they have been in the classroom. Evaluations should give schools the information they need to build the strongest possible instructional teams, and help districts hold school leaders accountable for supporting each teacher's development. Most importantly, they should focus everyone in a school system, from teachers to the superintendent, on what matters most: student academic success.

opportunities through regular access to online professional development resources and online communities.

- **Objective 5.4.3 Target learning for teachers and teacher educators:** Teachers and teacher educators in all regions of Lebanon will, via technology, participate in professional learning opportunities that allow them to deepen their own content knowledge, broaden their access to instructional practices, provide them with curriculum and content supports, view models of good instruction with and without technology, and promote reflection and dialogue with other teachers or content-area experts.
- **Objective 5.4.4 Real-time communication and collaboration:** Technology will be used to facilitate regular communication and collaboration between school leaders, teachers, teacher educators, and professional development institutions/facilities.
- **Objective 5.4.5 Just-in-time and just-as-needed professional development:** Using technology, teachers and teacher educators will have continuous and "just-in-time" opportunities to enhance the capacity and knowledge necessary to develop new teaching and learning processes that allow for the effective use of ICT in the classroom. (See Figure 36 for a definition of "just-in-time" professional development.)

Goal 5.5: As a result of Goals 5.1 through 5.4, teachers and teacher educators will demonstrate competencies in using a variety of technologies that research has demonstrated promote high-quality instruction that improves student learning.[27]

Figure 36: "Just-in-Time" Professional Development (Burns, 2011: p. 20)

In business, "just-in-time" is an inventory strategy to improve return on investment. It involves ordering materials as close as possible to the actual time of need.

Just-in- time professional development applies this concept to education by providing instruction in a particular strategy as close as possible to the teacher's actual implementation of the strategy. In so doing, this creates "low latency"—the amount of time that lags between learning and implementation.

Attaining this goal will involve meeting the following objectives:

- **Objective 5.5.1 Content mastery:** Learning with and through technology, help teachers attain and demonstrate mastery in the content areas that they teach.
- **Objective 5.5.2 Technology integration:** Teachers and teacher educators will understand how students learn and be able to demonstrate how to select and use appropriate digital content, devices, pedagogies, and assessment to support student learning.
- **Objective 5.5.3 Balanced assessment:** Teachers and teacher educators will be able to use various computer-based assessment and technology applications to develop formative and summative assessment tools, such as rubrics and digital portfolios.
- **Objective 5.5.4 Data analysis:** Teachers and teacher educators will be able to use technology for a variety of professional purposes that contribute to instructional quality—to analyze student data for effective interventions, differentiation, or remediation for students; to provide feedback and guidance to students; to plan interactive, engaging, and rigorous units of study lessons and activities; to supplement and complement other forms of content; and for diagnostic, formative, and summative assessments.

27 The outcomes listed in this goal are based on research (Bransford and Darling Hammond, 2005; OECD, 2008) identifying characteristics of high-quality instruction.

- **Objective 5.5.5 Use assistive technologies:** Teachers and teacher educators will be able to select, use, and evaluate assistive technology tools that are tailored to the students' individual needs, abilities, and experiences.
- **Objective 5.5.6 Collaboration:** Teachers and teacher educators will be able to use technology to collaborate with colleagues; to communicate with parents about their child's progress and performance; and for their own continuous formal and informal professional learning.
- **Objective 5.5.7 Learner-centered pedagogies:** Teachers and teacher educators will demonstrate competence in classroom-based use of ICT that supports the application of various models of learner-centered pedagogy.
- **Objective 5.5.8 Meet performance standards:** To prepare them for digital-age teaching, teachers and teacher educators will adhere to the technology-related competencies outlined by ISTE's NETS-T standard and teacher educators will adhere to both NETS-T and the National Teacher Leadership Standards.[28]

28 See http://www.teacherleaderstandards.org/

Chapter 6: Technology and Leadership

Overview

Schools that have made the most progress toward technology adoption and integration are headed by principals with a vision of technology's potential. These leaders model the use of technology, support innovative practices in instruction and assessment using technology, provide professional learning opportunities for their staff, and hold teachers accountable for innovative teaching and learning as part of technology use.

But leadership at the school level is not enough to secure successful integration of technology into schools. Strong administrative leadership among all levels of an educational system—by ministry, school boards, regional administrators, and principals—is a key factor in developing school environments conducive to the effective use of technology (Sandholz, Ringstaff and Dwyer, 1997).

Overarching Goal

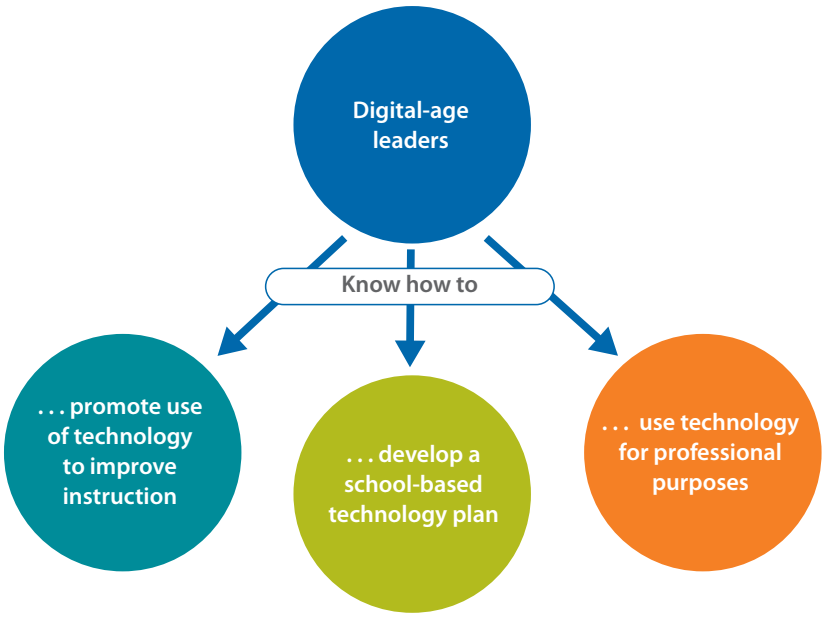


Figure 37: School Leaders Need to Understand the Value of Technology

It is no longer possible for administrators to be both naïve about technology and be good school leaders. (Mehlinger and Powers , 2002: p. 218)

The overarching goal for this leadership component is to focus efforts on developing digital-age leadership at the school level. Figure 38 outlines the qualities embodied by digital-age leaders.

To realize this overarching goal, the individual goals and objectives within this chapter advocate that digital-age leaders must be able to perform five key functions necessary to successfully integrate ICT in schools. These functions include the ability to (1) shape and communicate a

Figure 38: Digital-Age Leadership (National Association of Secondary School Principals, 2012)

Digital-age leaders:

1. Effectively and consistently model the use of the same technology tools that they expect teachers to use in their classrooms with students
2. Are consistent in their decisions and expectations about integrating educational technology in classrooms
3. Communicate clearly and reasonably about the pace and process of integrating educational technology in the classroom
4. Provide appropriate professional development time and resources to support effective classroom integration of technology
5. Support early adopters and risk takers
6. Make sure that teachers have early access to the same digital devices that students will be using in the classroom
7. Ensure that all decisions about technology are grounded in educational needs (not vice versa)
8. Support the expectations that student work will be completed, stored, and assessed using technology
9. Ensure that families and the public are kept informed about the schools' goals, actual use, and progress using technology as a learning resource
10. Are active and public champions for all students, teachers, and the school in general in advancing the vision of fully integrating technology into teaching and learning

vision of academic success for all students; (2) create a climate hospitable to experimentation and risk taking; (3) cultivate leadership in teachers; (4) actively work to improve instruction; and (5) manage people, data, and processes to foster school improvement. Each of these five functions must interact with the other four for any of them to succeed, and all of these together are key prerequisites for successful ICT integration (Fullan, 2011) and digital-age leadership. Indeed, as suggested throughout this chapter, digital-age leadership *is* high-quality leadership.

Technology and Leadership: Individual Goals and Objectives

To develop high-quality digital leadership around educational technology and all of the factors that enable its successful integration into teaching and learning, this strategic plan proposes that by 2017:

Goal 6.1: *MEHE, the Faculty of Education (FED) at the Lebanese University, and CERD* will build the skills of principals to function as digital-age leaders.

Attaining this goal will involve the above organizations carrying out together the following activities described in the following objectives:

- **Objective 6.1.1 Standards for school principals:** MEHE and FED will adopt and implement standards by which school principals will be recruited, retained, and assessed (One such example is the ISTE NETS-A described in Figure 39.).
- **Objective 6.1.2 Strategies for recruiting principals:** Through instruction that focuses on practical experiences and rigorous performance evaluation for principals, MEHE and FED will raise the caliber and qualifications of principals entering the school system.
- **Objective 6.1.3 Train school principals:** MEHE and FED will provide new principals with practices that have been shown to improve leadership effectiveness, such as high-quality induction programs and ongoing support programs (such as coaching, mentoring, and ongoing access to a community of peers); and greater decision-making authority and autonomy at the school level (Mourshed, Chijioke and Barber, 2010).
- **Objective 6.1.4 Continuous education and support for school principals:** MEHE and FED will offer opportunities for ongoing learning for principals, such as continuing education and support and the availability of challenging career tracks and promotions based on performance.
- **Objective 6.1.5 Professional development for regional staff:** MEHE, FED, and CERD will provide principals and staff of regional education departments with professional development that focuses specifically on using technology to improve instruction and assessment so that principals can better support teachers in these endeavors.
- **Objective 6.1.6 Hold schools accountable for using ICT:** MEHE will use ICT to create accountability systems that hold school leadership and regional education departments answerable for using ICT as part of teaching and learning.

Goal 6.2: *School principals* will demonstrate digital-age leadership by promoting the use of technology for high-quality instruction and assessment in their schools.

Attaining this goal will involve meeting the following objectives:

- **Objective 6.2.1 Demonstrate understanding of quality instruction:** School principals and heads of regional education departments will understand how technology can support and extend quality teaching, learning, and assessment well enough to actively monitor teachers in its implementation (see Figure 40 for one example of an initiative that does this).
- **Objective 6.2.2 Supportive leadership:** School principals will promote leadership and autonomy among teachers, encouraging risk taking and learning from mistakes, and facilitating the creation of a school-based community of practitioners.
- **Objective 6.2.3 Shared decision-making:** School principals will increase the level of teacher involvement in the development and adoption of ICT for instruction, assessment, and data management by encouraging and formally empowering teachers to assume leadership roles as part of educational technology planning and implementation.
- **Objective 6.2.4 Community outreach:** School principals will involve parents and community members in decisions around the use of ICT by inviting parents and community members to schools to sit in on lessons and soliciting their ongoing support, involvement, and ideas.
- **Objective 6.2.5 ICT literacy for parents:** Principals, in partnership with regional education departments, will construct and maintain networks and programs that raise parents' awareness of the use of technology in schools and provide them with opportunities to acquire basic technological skills.

Goal 6.3: Using this national educational technology strategic plan as their guide, *schools* will develop a school-based technology plan covering infrastructure, digital content and learning resources, teacher capacity, and intended learning outcomes for students.

Attaining this goal will involve meeting the following objectives:

- **Objective 6.3.1 Develop a vision:** School principals will develop and advance a formalized, school-based vision for innovative teaching and learning with technology, and communicate this vision to teachers, parents, community members, and other stakeholders. (See Figure 41 for one example of an initiative that helps principals do this.)
- **Objective 6.3.2 Set goals for using ICT:** Starting with the lowest-performing schools, set specific goals for using ICT to support improved student achievement at individual schools, including a fixed timeline for attaining goals.
- **Objective 6.3.3 Ensure school-based technology access:** Ensure that students have access to modern, high-quality digital devices, Internet

Figure 39: National Educational Technology Standards for Administrators

ISTE has developed the NETS-A, a set of standards for school administrators that can serve to guide and support administrators as they assume their role as technology leaders. These standards represent a national consensus among educational stakeholders of what best indicates effective school leadership for the comprehensive and appropriate use of technology in schools. The NETS-A have been adopted in many countries—numerous U.S. states, Singapore, and South Korea, to name a few. This strategy proposes the adoption of these standards for leadership in technology.

Figure 40: Measures of Effective Teaching Project

The Measures of Effective Teaching (MET) Project, funded by the Bill and Melinda Gates Foundation, endeavors to find the best ways to give teachers the information and support they want. The project has brought together 3,000 teacher volunteers in six different U.S. school districts with dozens of education experts and researchers. MET's goal is to find out how evaluation methods can best be used to tell teachers more about the skills that make them most effective and to help districts identify great teaching.

See http://www.metproject.org/ for more information.

connectivity, relevant and standards-based digital content, appropriate software and applications to meet particular learning needs, and innovative instruction and assessment supported by technology.

- **Objective 6.3.4 Enable accessibility for all students:** Secure assistive technology, universally designed content, and digital supports for students with particular physical or cognitive needs.
- **Objective 6.3.5 Provide training and support to teachers:** Provide additional financial and personnel resources (professional development, technical support, ongoing support for teachers, and support for consistent implementation of ICT initiatives throughout educational regions) to help teachers use ICT as part of instruction, assessment, and information management to improve student achievement.
- **Objective 6.3.6 Budget for technology:** School principals, in collaboration with MEHE, will provide a financial, long-term commitment to the school's technology program.
- **Objective 6.3.7 Ongoing communication among educational levels:** School principals and heads of regional education offices will communicate regularly with schools and stakeholders about program implementation.
- **Objective 6.3.8 Strategic choices around ICT:** School principals, in collaboration with MEHE and CERD, will learn how to make strategic choices in the context of using ICT, including infrastructure, training, budgeting, and support.
- **Objective 6.3.9 Data-driven decision-making:** Use ICT, such as SISs, in the data-driven decision-making process concerning instruction.

Goal 6.4: *Every school principal and regional education officer* will have a minimum set of professional technology skills, aligned with standards, for the purposes of productivity, communication, data management, and ongoing learning.

Attaining this goal will involve meeting the following objectives:

- **Objective 6.4.1 Support regional educational staff:** MEHE and CERD will provide principals and regional education officers with ongoing training and support in specific, job-related ICT operations (such as e-mail, search engines, spreadsheets, databases, and SISs).
- **Objective 6.4.2 Use technology for productivity purposes:** School principals and regional education officers will use a variety of electronic communication tools, such as e-mail, chat, VoIP, discussion forums, and social media to communicate digitally with teachers, other principals, parents, and national/governorate/regional educational personnel.
- **Objective 6.4.3 Use specific job-related technologies:** School principals and school financial officers will be able to use specific technology applications to keep track of school finances and plan and monitor school-based expenditures.

Figure 41: Helping School Leaders Develop Technology Leadership Skills

Empowering the 21st-Century Superintendent is an initiative by the Consortium for School Networking (COSN), dedicated to helping superintendents, school leaders, and district leadership teams build their knowledge, skills, and confidence as effective technology leaders. This site offers resources, podcasts, and access to school leaders and an online toolkit to help school and district leaders become technology leaders.

COSN also offers a number of vendor-neutral resources for school leaders in the areas of budgeting for ICT, exercising leadership around mobile devices, and calculating the Total Cost of Ownership (TCO).

To access these resources, see http://bit.ly/wkYRMy.

- **Objective 6.4.4 Ongoing professional development:** School principals and regional education officers will participate in online courses and conferences, discussion groups, professional social media sites, and online communities of practice to continuously augment and refine their managerial, communication, administrative, and instructional leadership skills.

Shared Accountability, Actions, and Resources by National, Regional, and Local Educational Entities

Implementing the goals and objectives listed in the six components of this strategic plan—technology access for schools, curriculum, instruction, assessment, teacher professional development, and leadership—will require joint and coordinated efforts by both MEHE/CERD and regional education offices and schools. While all levels of the educational system may not be able to contribute equally or identically, their resources, inputs, and supports are essential and should be coordinated and complementary. Figure 42 displays some examples of how the various educational levels can contribute to actualizing the goals and objectives of this strategic plan and ways these resources, inputs, and supports might be structured and shared.

Figure 42: Resources, Inputs, and Supports at National level and Regional and School Levels for the Six Components of the Educational Technology Strategic Plan

Access to Technology	
National-Level Resources, Inputs, and Supports	**Local Resources, Inputs, and Supports**
• Equipment • Connectivity • Digital content • Training • Technical support • Development of policies, procedures, AUPs, etc.	• Ensure implementation of all national initiatives, with feedback given to MEHE/CERD • Time for teacher training • Local partnerships with parent associations, businesses, and civic organizations to secure extra digital devices and connectivity • Partnerships with local businesses/tertiary institutions for teacher training • School "tech squads" for school-based technical support • Secure alternative sources of energy (generators, solar panels, etc.) • Ensure maintenance and security of equipment

Technology and Curriculum	
National-Level Resources, Inputs, and Supports	**Local Resources, Inputs, and Supports**
• Infuse technology into national curriculum • Training and support for teachers in using the new curriculum, as well as technology to support it • Ensure that all digital content is indexed to national curriculum • Develop curriculum maps, scope and sequence manuals, and pacing guides for the new curriculum • Formatively assess implementation of new curriculum through surveys, questionnaires, observations and focus groups with teachers, parents, principals, and students, and make implementation revisions based on this information	• Ensure implementation of new national curriculum with feedback to CERD/DOPS • Time for teacher training • Create local workshops around using curriculum maps, scope and sequence manuals, curriculum frameworks, and pacing guides to supplement national trainings • Facilitate communication around new competencies, protocols, and procedures between CERD, DOPS, content-area supervisors/inspectors, and teachers • Facilitate school-level professional development by lead teachers/master teachers in using the new curriculum • Offer formal release time for teachers to map lessons onto the new curriculum and co-develop common lesson plans and common assessments based on the new curriculum (e.g., in the form of lesson study)
Technology and Instruction	
National-Level Resources, Inputs, and Supports	**Local Resources, Inputs, and Supports**
• Develop national instructional standards and an instructional framework • Develop video models of high-quality instruction • Ensure that teacher assessment tools reflect high-quality teaching with technology • Develop national competency standards for students' use of technology • Create a communications strategy that explains instructional methods, such as learner-centered instruction, to the community at large to preempt and allay confusion about what it involves • Provide adequate hardware, software, connectivity, digital content, training, and technical support for schools • Connect teachers and students to international networks (iEARN, International Science and Engineering Fair, Classroom 2.0, etc.)	• Ensure implementation of models of high-quality/high-yield instruction, with feedback given to CERD/DOPS • Have classroom observations, monitoring, and support to help teachers implement new instructional models using ICTs • Secure parents' understanding of and support for new instructional methods • Ensure that teachers are provided with sufficient teaching and learning materials and technology • Offer incentives for teachers to integrate technology into high-quality instruction (e.g., attendance at national/international conferences, recognition, remuneration, additional technology, etc.) • Offer incentives for students to use ICTs as part of formal and informal learning (e.g., attendance at national/international conferences, recognition, remuneration, additional technology, etc.) • Give digital badges to students who seek additional instruction in technology, and encourage the recognition of badges by school officials • Administrators provide moral, logistical, and emotional support for teachers as they embark on new models of instruction

Technology and Assessment	
National-Level Resources, Inputs, and Supports	**Local Resources, Inputs, and Supports**
• National-level, multi-stakeholder discussion and examination of national assessment system, including discussions with international ministries of education who have revised their examination systems (e.g., France, the United Kingdom, Singapore) • Develop national test-bank items • As part of new framework/models for instruction, promote use of diagnostic and formative assessment • Provide professional development to teachers, principals, and regional educational officers on diagnostic and formative assessment to support instruction • Provide professional development to teachers, principals, and regional educational officers that focuses on using technology to support alternative assessments (e.g., portfolios, digital projects, etc.) • Where applicable, use technology to score national examinations	• Local education authorities and leaders must augment their own understanding of balanced assessment—assessment for learning, alternative assessment, authentic assessment, etc. • Ensure implementation of diagnostic and formative assessment through monitoring, support, modeling, etc. • Allow open lessons where teachers can observe others using diagnostic and formative assessment • Provide formal release time so teachers can co-develop common assessments, alternative assessments, rubrics, and scoring guides • Support teachers actively in uses of new assessment strategies, particularly if they face misunderstandings from the community
Technology and Professional Development	
National-Level Resources, Inputs, and Supports	**Local Resources, Inputs, and Supports**
• Coordination among MEHE, CERD, DOPS, and Faculties of Education to ensure that pre-service teachers receive sufficient preparation in high-quality instructional methods • Adoption of national standards for professional development and coaching • Develop national professional development models and frameworks, grounded in research and best practices, to standardize teacher professional development • Professional development for CERD, DOPS, and FED to help instructors provide professional development to teachers that integrates content, instruction, and assessment supported by technology • Further expansion and strengthening DOPS, including instruction on being a teacher coach • Develop models and pilots for coaching and mentoring	• Schedule teacher collaboration through release time, common planning time so that teachers can plan and collaborate • Encourage school-based models of professional development (open lessons, lesson study, observation, and assessment) • Reward teachers for evidence of implementing what they have learned in professional development sessions • Developing strategies for coaching and mentoring at the school level • Encourage teachers to pursue professional development opportunities formally and informally through recognition, acceptance of digital badges, and equipment and time to participate in online learning opportunities • Facilitating school-based communities of practice so teachers develop additional skills to plan, share, and teach together, observe one another's classrooms, and provide corrective and supportive feedback

Technology and Leadership	
National-Level Resources, Inputs, and Supports	**Local Resources, Inputs, and Supports**
• Establish performance-monitoring goals for principals • As part of the Principal Leadership Development Program (LDP), evaluate and provide ongoing feedback to principals • Establish mentoring/partnerships with exemplary educational leaders/business or civic leaders	• Develop organizational structures for improving instruction with technology • Hire strong teachers; provide time, resources, and encouragement for ongoing professional development • School-based incentives for teachers and students who show excellence in instructing with technology • Work with parents to encourage teachers in innovative instructional and assessment practices • Maintain a collaborative and supportive learning environment • Make all communication digital so that teachers are forced to use technology

Section 3:
Recommended Actions

The goals and objectives outlined in the previous sections of this strategic plan use technology as a tool for educational reform—to improve teaching and learning and, by extension, student achievement. Attaining these goals and objectives depends on a complex chain of causation and making policies and practices around ICT work depends on defining and connecting the links in that chain.

This section of the national educational technology strategic plan defines the critical "links in the chain"—recommended actions that must be designed, implemented, expanded, and/or institutionalized, and articulated to assure that the goals and objectives of this document are designed and carried out with fidelity, quality, coherence, and sustainability. Failure to adequately implement these recommended actions threatens the overall viability of Lebanon's educational technology strategic plan. Careful attention to such recommendations will increase dramatically the chances that the vision and goals of the proposed strategic plan will be successfully realized.

The links in this chain focus on advancing the vision, goals, and objectives of this national educational technology strategic plan through national policies and actions; building human and institutional capacity; and furnishing schools with technology and related supports. These recommended actions are not sequential or hierarchical; rather, all must occur simultaneously and in reference to one another.

National Policies, Initiatives, and Procedures

Recommended Action 1: *Create policies and procedures to ensure the capacity of MEHE to implement the goals and objectives of this national educational technology strategic plan.*

Lebanon's national educational technology strategic plan will be driven for the most part by the MEHE. This will place additional burdens on and may even strain, MEHE departments, staff, and the ability to carry out existing processes and procedures.

So that MEHE can successfully drive the vision, goals, and objectives of this educational strategic plan, the Strategic Planning Development Team (SPDT) urges that implementation of this strategic plan be made a national priority and treated with a sense of commitment and urgency. *If this does not occur, the imperatives of this strategic plan will fall victim to institutional inertia and other competing priorities.*

Once its status as a national priority is established, all mechanisms for funding, allocation of roles and responsibilities, coordination with regional offices and schools, and, above all, decision-making, must be streamlined and fast-tracked so that the goals and objectives in this strategic plan have a chance at being attained. Thus, this strategic plan further suggests that a separate educational technology unit be created within MEHE, comprised of individuals with expertise in the areas of technology, instruction, assessment, educational

management, curriculum, leadership, and professional development. These individuals should be empowered with the authority, resources, and support to implement the goals and objectives outlined in this strategic plan—and they must be held accountable for doing so.

Specifically, the educational technology unit would have the responsibility of implementing the goals and objectives of this national educational strategic plan. They would coordinate and carry out all ICT activities, and be mobilized to act in the following areas: cost and quality of operations; development or adoption of standards for teachers, students, principals, and professional development; support and maintenance of technology; and support for teachers, teacher and principal professional development. Further, they would publish annual performance measures for the appropriate distribution, delivery, and support of all initiatives and provide annual status reports.

This unit would report directly to and be given authority by an ICT in Education Executive Committee, which would provide leadership and decision-making around ICT in education. The Executive Committee would be comprised of the Minister of Education and two to three cross-ministry officials who would ensure that implementation is following the contours of the strategic plan; who approve or reject recommendations by the educational technology unit; and who become the national voice for Lebanon's ICT in education efforts.

Recommended Action 2: *Develop an accountability-based teacher evaluation system that reflects, among other behaviors, technology integration supported by learner-centered instruction and balanced assessment.*

Next to student assessment systems, the greatest systemic motivator in teacher practice is the teacher evaluation system. In the current system, curriculum, content, culture, and most important, the examination system favor traditional, teacher-centered, fact-based, rote instruction and fail to account for the use of technology. Moreover, there is presently no teacher evaluation system that assesses, evaluates, and holds teachers accountable for the quality of instruction. Thus, any teacher who wishes to use technology or shift instructional or assessment practices does so of his or her own volition.

Rather than relying on the personal goodwill or compliance of teachers, the Lebanese educational system must develop and adopt a teacher evaluation framework that institutionalizes the type of high-quality instructional practices, supported by technology, discussed in this national educational technology strategy plan. This way, the use of technology to support learner-centered instruction and assessment forms part of any teacher's ongoing and final appraisal. A major step toward this goal has been the development of the *ProGReSS SCaLe* teacher observation tool, which assesses teachers' uses of technology as part of learner-centered instruction and on which system personnel have already been trained.

However, this accountability system and the *ProGReSS SCaLe* should be further developed and modified, respectively, to reflect the teacher competency-based standards to be adopted by MEHE. Together, these competency-based standards and the *ProGReSS SCaLe* teacher observation tool could be used to recruit, instruct, and evaluate teachers.

Recommended Action 3: *Create an evaluation unit within the Ministry of Education and Higher Education so that independent evaluations can be conducted for purposes of accountability and learning.*

At present, MEHE's internal evaluation structures and staffing are limited. In terms of technology initiatives, this means that MEHE cannot use evaluation for the purposes of accountability or learning. It cannot independently verify the utility, quality, and impact of any initiative and must rely on outside organizations (some of whom end up evaluating themselves) to conduct evaluations.

Although the task is beyond the bailiwick of this strategic plan, MEHE's ability to conduct reliable and transparent evaluations of national technology initiatives is key to the success of Lebanon's national educational technology efforts. Therefore, this strategic plan recommends that MEHE enhance its evaluation capacity by:

- Identifying evaluation capacity within MEHE and building that capacity according to international standards for evaluators[29]
- Hiring evaluation specialists who specialize in particular areas of evaluation and who meet international standards
- Allocating initial human and financial resources, equipment, and space to the start-up of the evaluation unit
- Defining the roles and responsibilities of the evaluation unit within MEHE
- Developing a monitoring and evaluation plan for many components of ICT in education
- Overseeing development of an evaluation system and integrating evaluation into all MEHE efforts
- Providing ongoing financial and administrative support to the evaluation unit
- Promoting the use of data produced as a result of evaluations for decision-making and policymaking
- Reporting and making public evaluation findings

29 For a list of these skills, as identified by the Joint Committee on Standards for Educational Evaluation, see http://www.jcsee.org/personnel-evaluation-standards. See also Yarbrough, et al. (2011) in the Reference section of this strategic plan.

Recommended Action 4: *Rigorously evaluate technology initiatives before, during, and after their implementation.*[30]

Evaluation is typically the weakest component of any technology initiative. It is often difficult to isolate "technology" from other inputs and factors, such as instruction, assessment, and classroom organization. Donors and policymakers often want to see immediate results, but initiatives don't work that way—their trajectories are often recursive and nonlinear, change takes years to come about, and "impact" is often distal, not proximal. Many organizations fail to evaluate their models, practices, or innovations to see if they are worth scaling up. This resistance to evaluation is often more pronounced in the case of pilot projects, which are seen as different from regular projects.[31] Finally, evaluations of any educational technology program must solve a number of methodological problems, including the need for measures other than standardized achievement tests, differences among students in opportunity to learn, and differences in starting points and program implementation.

These are problems with the *execution* of evaluations, not with evaluations themselves. In fact, evaluation is essential for midcourse program correction and improvement and for judging the technical merit and impact of technology initiatives. This strategy argues for rigorous, carefully designed, and appropriate evaluations as part of all technology-related programs and initiatives. For instance, *process* evaluations can be conducted for pilots and early in the implementation as a "checkup" for purposes of fixing initial implementation problems associated with a technology roll-out; *outcome* evaluations can assess the results from placing computers in classrooms, while *impact* evaluations (with experimental designs that use direct assessment methods of student behavior and student work) can inform stakeholders about whether and to what degree technology has affected student learning.

In commissioning or planning evaluations of technology initiatives, this strategic plan recommends common standards of measurement; longer timelines for implementation and evaluation; clarity in evaluation-related terminology; addition of resources and support for evaluations; a firewall against the political demands of funders, politicians, educational organizations, and stakeholders so that evaluations can be conducted without bias or interference; and an underlying awareness that measuring impact in school settings, particularly using quantitative methods, is often a tricky proposition. "Impact" takes years—not months—to accrue. These long-term impact evaluations can be supplemented with shorter- and medium-term process evaluations and performance audits.

30 This recommendation has been placed here as an adjunct to the previous recommendation.

31 However, when pilot projects are evaluated, interpretation of the results can be challenging. If the project is unsuccessful, it may be because it faced implementation problems unique to the first phase of the program that can be resolved in a later iteration. If it is successful, it may be because more resources were allocated to it than would have been under a more realistic scenario, because the context was favorable or because the participants in the experiment had a sense of being part of something important and changed their behavior. This strategic plan therefore recommends that process evaluations be used for pilot projects.

Given MEHE's limited evaluation capacity, this strategic plan recommends that MEHE hold responsible all implementing agencies—technology companies, universities, governmental agencies, and nonprofit and for-profit companies—for contracting with independent evaluators who, with sufficient funds dedicated to the evaluation, conduct ongoing process evaluations and empirical summative impact evaluations of ICT-related initiatives.

Additionally, in commissioning or planning evaluations of technology initiatives, this strategic plan recommends that MEHE carry out the recommendations outlined in Appendix B of this national educational technology strategic plan.

Human and Institutional Capacity Building

Recommended Action 5: *Raise the capacity of the regional education offices of MEHE and regional centers of CERD so that they can successfully carry out the goals and objectives of this national educational strategic plan.*

For the goals and objectives of the strategic plan to be institutionalized and diffused throughout the school system, those working in MEHE's regional education offices and CERD's regional centers will need more training, support, and resources. They will also need budgeting authority, financial resources, procedures, and policies by which they can help to implement, support, and assess the goals of the national educational strategic plan, as well as mechanisms to communicate with MEHE and CERD. In addition, they must have standards by which their efforts at the regional level are monitored and assessed.

Recommended Action 6: *Enhance the leadership skills of principals and other administrators to offer instructional guidance to teachers and lead schools toward academic excellence in a digital age.*

As mentioned in Chapter 6, a national educational technology initiative can succeed only if it cultivates the skills of school leaders to provide critical *internal* support for teachers by setting *expectations* for them; establishing a *culture and climate* that encourage change, experimentation, and risk taking; providing the *time and resources* for them to practice what has been learned in professional development; and demonstrating *effective leadership* so that all parts of the school system are working to support change.[32]

From 2005 to 2007, MEHE's Principal Leadership Development Program (LDP) focused on building the capacity and enhancing the professionalization of more than 400 school principals in leadership skills, planning and management, educational supervision, and basic technology skills. The program will be launched again in 2012 to extend this professional development to "untrained"

32 Studies of effective educational technology initiatives, such as Chile's *Enlaces* program, identify committed and capable school leaders as the "key element" for change and as a "considerable element" in student achievement (Carlsen, Broe, Drewsen, and Spenceley, 2001).

principals so that by 2017, all Lebanese public school principals will have had this leadership training (see Figure 43).

Figure 43: LDP Training Targets for 2012–2017

2012–2013	2013–2014	2015–2016	2016–2017
300 principals	300 principals	300 principals	TBD

NB: 400 school principals completed the LDP prior to 2012.

The goals and objectives around "Technology and Leadership" and the goals of the LDP are highly aligned. Thus, this strategic plan proposes that the leadership goals and objectives outlined in Chapter 6 be actualized through this existing program, but with two modifications. The first is a proposed redesign/development of instructional activities to (1) help principals and other regional administrators develop an understanding of and appreciation for high-quality instruction and assessment that integrates ICT; (2) provide these leaders with facilitative leadership and communication skills so that they can monitor, support, and direct resources to teachers who are integrating technology into classroom practice; and (3) develop procedures for school-based technology procurement, budgeting, maintenance, and school-based technology support plans.

The second modification proposes, in addition to the principals' portal, which serves as an online network for communication and professional development, that *new and novice* principals be provided with some form of blended induction, coaching, or mentoring. As with teachers, induction, coaching, and mentoring programs for new and novice principals have been shown to lessen principal attrition rates while improving a principal's overall effectiveness (Silver, Lochmiller, Copland and Tripps, 2009).

Recommended Action 7: *Build the capacity of new and existing professional development providers and support personnel to design and carry out high-quality professional development and provide teachers with school-based support.*

The types of professional development and support suggested in the two previous recommended actions demand a cadre of highly qualified and highly skilled professional development providers and teacher support staff. This strategic plan suggests a concerted effort to upgrade the knowledge, skills, and abilities of current professional development providers and support staff so that they can guide, mentor, and assist teachers in implementing exemplary professional practices using technology; and monitor and support teachers' progress to help them improve what they do. In so doing, this strategic plan recommends that MEHE and CERD adopt or develop standards for qualifications of teacher professional development providers and support

personnel[33] (such as coaches, lead teachers, and mentors); that they carefully recruit, train, assess, and continuously upgrade the relevant skill set of professional development providers and support staff so they can help teachers use technology to improve instruction and assessment to deepen student content knowledge.

Recommended Action 8: *Provide ongoing, extensive professional development to teachers so that they know how to integrate technology into curriculum, assessment, and instruction.*

As stated throughout this document, a successful national educational technology strategic plan will depend on the presence of highly qualified and highly skilled teachers—teachers who are not just comfortable with technology, but who have deep content knowledge; pedagogical content knowledge; instruction, assessment, and classroom management skills; and a deep and empathetic understanding of how children learn. Without such highly skilled teachers, the goals and objectives in this strategic plan will be uneven, haphazard, or unrealized.

As noted in Chapter 5, MEHE, CERD, and Faculties of Education should use this strategic plan as an opportunity to review and improve recruiting, preparing, supporting, and compensating teachers on the pre-service front end rather than fixing issues of poor-quality instruction on the in-service back end. That said, however, MEHE, CERD, and Faculties of Education also should work together to develop a national, comprehensive, coherent, content-based professional development system that integrates content-specific pedagogies, content-specific uses of technology, and content-specific assessment methods. This framework, referred to as Technological Pedagogical Content Knowledge (TPACK), would replace the most common forms of professional development that teachers presently receive around technology—formation that leads with technology (how to use whiteboards to teach science, or making digital portfolios in Adobe Flash). Such professional development does little to improve the qualities that matter most in teaching; rather, the focus on technology skills may divert limited professional development funds, time, and efforts to practices that have little bearing on effective teaching.

Figure 32 (p. 61) of this strategic plan outlines the characteristics of high-quality professional development. A TPACK framework nested within a system of high-quality professional development would require the revision and redesign of current professional development offered by CERD and by technology companies, so that all professional development is focused on what matters most—content, instruction, and assessment—and the ways technology can support these elements. It would mean that future initiatives, such as the

33 The Teacher Leader Model Standards are one example of such standards. These standards contain a series of broadly stated expectations or "domains" that define critical dimensions of teacher leadership, helping to identify the full range of competencies teacher leaders will need in order to work with formal school leaders to guide, mentor and assist teachers in implementing exemplary professional practices that lead to improvements in student learning. Another set of standards for technology support personnel and/or coaches are ISTE's NETS for Technology Coaches (NETS*C).

European Union's professional development initiative, would be guided by this professional development approach. It would mean a shift away from professional development models, such as "train the trainers" approaches, "trainings," and workshops, which show no or limited impact, toward more long-term, sustained models of professional development (learning communities, lesson study, study groups, etc.) that have demonstrated impact on teacher performance. It would mean that all professional development programs and providers would be required to submit their programs to external, rigorous evaluations. And—since the process of changing teacher practice is not cheap, fast, or easy—it would mean a high degree of financial and institutional commitment to high-quality teacher professional development and support (see also Recommendation 9).

Figure 44: The Definition of Support (Burns, 2011: p. 204)

Support **is not simply one type of assistance, but rather a multilayered array of different types of infrastructure to help teachers successfully carry out their professional responsibilities. For teachers, support often includes:**

Administrative support: Leadership; compliance monitoring by principals; official recognition; serving as interlocutor between school and district or school and community; expressions of support for implementation of new innovations; and administrative decisions that provide teachers with the time and resources to carry out new instructional practices.

Instructional support: Typically, this is the professional development provider, instructor, lead teacher, coach, mentor, or in-class support person who models, guides, co-implements, or helps the teacher with content, instruction, assessment, classroom management, and the conceptual and logistical issues arising from the introduction of technology in the curriculum.

School-based community: A community of colleagues also undergoing the same professional development. This valuing of another teacher's perspective is a key component of constructivist learning theory.

Technical support: This includes help on how to use a particular application, troubleshooting, and on-site assistance to fix computers when they break down (as they inevitably will).

Community and/or family support: Formal and informal recognition and approval by parents of teachers' efforts. Tangibly, this support can manifest itself in terms of resources or materials for the classroom.

Teaching and learning materials and resources: The most basic level of support. Teachers need access to technology in the classroom, to authentic learning resources, and digital content or need to be able to purchase or create curriculum-specific teaching and learning materials.

Time: Release time for teachers to meet in-class support person; dedicated time during the school day or week to engage in the extensive planning that is a requisite for learner-centered instruction. Time is also invoked by teachers who feel unsure of how to embark on change.

Recommended Action 9: *Provide ongoing school-based supports to teachers to ensure that they implement innovations with fidelity and quality.*

Teacher learning does not end at the conclusion of a workshop or an online course. Indeed, the real struggles begin when teachers attempt to apply new learning to the classroom. *Support* is one of the more common, yet ambiguously defined terms in teacher professional development. The notion of support contains multiple meanings for teachers and encompasses numerous dimensions, as Figure 44 demonstrates.

Like school-based technical support, school-based instructional support for teachers is most often rare to nonexistent in many parts of the globe, which accounts in large measure for the failure of such initiatives. Presently, in Lebanon, there appears to be no functioning, school-based support system for teachers.

Yet without ongoing classroom-based support to help them internalize what they've learned in professional development, teachers will either fail to implement or abandon new instructional methods, particularly in the face of difficulties, such as a lack of resources, technology problems, an examination system misaligned with instructional practices, or lack of principal or colleague support. To unlearn less-than-optimal teaching practices and learn approaches that are amenable to student learning, teachers need the assistance of a school-based support person—preferably from within their school or region—who understands the educational system, curricular requirements, good instruction, and effective uses of technology.

There are numerous strategies that can be employed to provide teachers with ongoing support. These include:

- **Building school-based *coaching* automatically into every MEHE-approved/authorized professional development program:** Many measures of research on teacher professional development suggest that coaching—the structured, ongoing guidance of a well-qualified and highly skilled expert in a particular domain—can be more effective than actual professional development/coursework for improving the structural characteristics in classrooms (Neuman and Wright, 2010: pp. 63, 83). (Figure 45 discusses one technique for developing the capacity of educators to be school-based coaches)
- **Provide instructional technology *mentoring* by experienced teachers to less experienced teachers:** While a coach is an external educator, a mentor is often an experienced teacher based in the school who provides one-on-one assistance and support given by an experienced professional to a novice. Studies[34] of mentoring programs demonstrate that mentoring yields demonstrable evidence of improved teacher quality for mentees, aids in overall teacher retention, and improves the professional skills of mentor teachers.
- **Select professional development modes that are highly structured and by their very nature offer in-class supports:** If the models of professional development chosen (like workshops) cannot offer structured supports for teachers, stakeholders should at least consider highly structured in-class types of training or professional development such as observation/assessment, study groups, lesson study, and open lessons. (For explanations of these types of professional development options, see pages 116–117 in the "Concepts into Actions" section of this strategic plan.)

Figure 45: A Model for Building Coaching Capacity

In Indonesia, the USAID-funded and EDC-administered Decentralizing Basic Education 2 program built the capacity of 60 district education officials through a five-month online program that taught these education staff how to be school-based instructional technology coaches. Each week, coaches-to-be learned a particular coaching strategy and, with a partner, practiced these techniques with teachers, uploading video documentation of their practices on which they received feedback and guidance from their online instructor (a former instructional coach) and their online peers. Coaches worked in the same school with teachers four days per week to help teachers integrate a computer in their classroom to support learner-centered instruction. Coaches who passed the online program with a grade of 80 percent or higher received a coaching certificate—and the technology implementation rate of the 300 teachers who worked with a coach was 98 percent.

34 See, for example, Landry, Anthony, Swank and Monseque-Bailey, 2009; Moor, Halsey, Jones, Martin, Stott, Brown and Harland, 2005; Ingersoll and Strong, 2011.

- **Use technology to provide ongoing contact, interaction, and support between professional development providers and teachers:** There is no technological substitute for high-quality, in-person, face-to-face support. But to supplement and increase the frequency of supports, professional development programs can use technology to provide live coaching (via Virtual Bug in the Ear technology; see Figure 33 p. 63) and with asynchronous and synchronous communication tools such as e-mail, Voice over IP (VoIP), discussion forums, and Web-conferencing tools.

Recommended Action 10: *Involve parents and communities in all phases of technology-related initiatives to create buy-in and support.*

A parent is a child's first and most important teacher, and children benefit academically when educators and parents work together. The research is clear—student achievement is strengthened when parents are connected to schools, become acquainted with teachers, and get involved in their child's learning.

For Lebanon's national educational technology initiatives to succeed—for new forms of instruction and assessment (which may counteract parents' expectations about "teaching" and "testing") to become accepted, established, and supported, MEHE, regional education offices, and schools must reach out in a coordinated effort to include parents in the planning and implementation of educational technology initiatives.

To do this, schools must focus on building trusting and collaborative relationships among teachers, families, and community members. They must recognize, respect, and address families' needs and operate with the greatest sensitivity vis-à-vis any socioeconomic, cultural, and religious differences that exist. They should consult with all parents, not just well-connected ones, about school-related policies and activities concerning ICT-related initiatives. They should open classrooms and schools to parents so mothers and fathers can see the fruit of technology efforts on their child's learning. And parents and schools should work together as partners, with the shared goal of seeing every child succeed.

Technology can help in this endeavor. It can allow parents to access student grades, find out what the night's homework assignment is, communicate concerns to teachers, see a schedule of open houses, and view students' work online.

School-based Technology Provision and Related Supports

Recommended Action 11: *Furnish schools with portable digital devices.*

Technology needs to be available where teaching and learning occur—in classrooms. As noted in Figure 12 (p. 27), students are more likely to gain proficiency in ICT skills as a result of using computers as part of normal content coursework rather than from stand-alone IT classes. Further research shows that

true integration occurs when technology is part of normal content coursework, rather than having computers physically segregated from the classroom in a computer lab.

This strategic plan proposes a two-pronged approach toward provision of technology (digital devices) in learning spaces. "Digital device" means any mobile device (laptop, tablet, or any mobile device that may suddenly appear on the market before 2017). Each approach is outlined below.

1. **Develop a School Readiness Self-Assessment to Guide Tiered Models of ICT Provision:** MEHE should develop and administer a school readiness protocol to assert readiness for ICT that assesses the following areas:
    - *Infrastructure:* Electricity, Internet access, location of schools near existing Internet backbone, space, security, and structural stability, etc.
    - *Human capacity:* Teacher and student skills, knowledge of ICT for teaching and learning, etc.
    - *Human readiness:* Understanding of the potential value that technology adds to learning, willingness to participate in professional development, etc.
    - *Budget:* Money to cover the recurrent costs associated with ICT provision.

Using these data, as well as data from the national assessment of schools conducted by D-RASATI, MEHE would provide a tiered "suite" of digital equipment for each school or learning space. For instance, schools who score low in such indicators (infrastructure, human capacity, readiness, and budget—in addition to other criteria outlined in Figure 46, would receive a simple suite of technology (e.g., a shared projector and laptop) while schools demonstrating higher levels of overall readiness, capacity, budget, and infrastructure would receive a digital device for each teacher and student.

As stated in Chapter 1, not all schools have the physical, human, financial, and infrastructure "readiness" to be 1:1 environments. Thus, all schools, based on their baseline, will receive a suite of technology tools, including equipment, Internet access, enhanced technology training, professional development, leadership development, assistance with budgeting, and securing school-based technology support. The hope is that schools can be moved along a continuum from tier to tier, with the eventual goal of getting as many schools as possible to Tier 4 status, although this most likely will occur after 2017.

Given its current resources, the choked national Internet pipeline, and an unreliable electrical grid, MEHE conservatively estimates that by 2017, 10 percent of schools will be Tier 1; 50 percent Tier 2; 30 percent Tier 3; and 10 percent Tier 4. Tiers are explained in Figure 46. The number of Tier 3 and Tier 4 schools will increase if decisions can be taken to lower the cost of pent-up Internet bandwidth.

Figure 46: Tiered Technology Configurations

Tier 1 Schools (130 schools)	Tier 2 Schools (640 schools)	Tier 3 Schools (385 schools)	Tier 4 Schools (126 schools)
1. Access to Internet is planned but not yet available	1. Dial-up Internet access	1. Nonstop, low-speed Internet access	1. Nonstop, high-speed Internet access
2. Selected offline e-support content	2. Limited downloading bandwidth for accessing resources	2. Limited uploading and downloading bandwidth for accessing resources	2. Unlimited uploading and downloading bandwidth for accessing resources
3. ICT devices: • 1 shared projection device (Interactive Whiteboard (IWB), LCD projector, etc.) per school • 1 shared laptop/ notebook for all the teachers on a floor	3. Selected online e-support content	3. 1 caching server per school	3. Wireless, cable, Bluetooth, infrared setups for the school
4. Upgrade the existing ICT lab in school, if applicable, or 1 mobile laptop cart (mapping to 1 shared device per 4 students ratio)	4. 1 caching server per school (optional)	4. Wireless setup for school	4. Web-services, direct access
5. 1 printer per school	5. ICT devices: • 1 shared projection device (IWB, LCD projector, etc.) per floor • 1 PC/laptop/notebook for teachers per classroom	5. Rich online e-support and interactive content	5. Full online e-support and interactive content
6. 1 scanner per school	6. Upgrade the existing ICT lab in school if applicable	6. ICT devices: • 1 projection device (IWB, LCD projector, etc.) per classroom • 1 laptop/notebook for each teacher • 1 laptop/tablet for each group of 4 students per classroom (minimum) • 1 mobile laptop/ tablet cart (30 laptops) per floor—for 1:1 applications	6. ICT devices: • 1 projection device (IWB, LCD projector, etc.) per classroom • 1 laptop/notebook for each teacher • 1:1 environment for all students
	7. 1 mobile laptop cart (30 computers) per school (mapping to 1:1 device per student ratio)	7. Upgrade the existing ICT lab in school if applicable to accommodate advanced educational applications (virtual science labs)	7. Upgrade the existing ICT lab in school, if applicable, to accommodate advanced educational applications (virtual science labs)

Tier 1 Schools (130 schools)	Tier 2 Schools (640 schools)	Tier 3 Schools (385 schools)	Tier 4 Schools (126 schools)
	8. 1 printer per school	8. 1 printer per floor	8. 1 digital interactive table per classroom
	9. 1 scanner per school	9. 1 scanner per floor	9. 1 printer per classroom
			10. 1 scanner per classroom

The term device means a tablet, laptop, projector, or notebook.

As Figure 47 explains, MEHE will phase in the above four tiers of technology provision over five years, in six phases.

Figure 47: 4-5-6: Technology Provision by Phase (phases are yet undefined in terms of length)

Tiered Schools	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total by Tier
Tier 1	50	80					**130**
Tier 2	50	100	125	165	200		**640**
Tier 3	20	30	75	75	85	100	**385**
Tier 4	6	12	18	24	30	36	**126**
Total by Phase	**126**	**222**	**218**	**264**	**315**	**136**	**1,281**

2. **Expand the two national pilots (national digital tablet pilot and e-devices in classrooms pilot), coordinating them with the national educational technology strategy:** In May 2012, the MOT and MEHE began a phased rollout of digital tablets for approximately 10,000 students in Lebanon. This project aims at providing students in Lebanon with equal access to true broadband at a subsidized cost, as well as an open platform to facilitate access to educational portals and applications, which will help in driving equal development across all segments of the Lebanese people. The tablets will be equipped with third-generation (3G) wireless connectivity, will have a minimum of 16 gigabytes (GB) of storage space, and will house digitized textbooks, reference materials, multimedia learning tools, and other educational applications and materials. They will also have Internet parental control and safety applications. Each tablet will cost students the equivalent of US$10.

In January 2012, MEHE initiated a pilot project to equip approximately 400 students and teachers from grades 10 and 11 in 15 secondary public schools in all regions of Lebanon with e-devices (laptops or tablets) for use inside the classroom. These e-devices are preloaded with the basic formatted national curriculum's e-textbooks for the designated grades in all subject areas, supportive e-content in science and math for both grades to help students grasp difficult-to-learn concepts, and interactive e-content in the form of "e-books" matching the national curriculum for grade 10 specifically.

Though these are both pilot programs, and as such are fairly small, this strategic plan suggests that the pilots (if not these immediate pilots, then subsequent pilots) be evaluated to ascertain, not simply the effectiveness of digital devices as learning tools (particularly in terms of helping students grasp difficult content), but also in terms of such benchmarks as the Total Cost of Ownership (TCO),[35] Return on Investment (ROI), and Value of Investment (VOI).

If the evaluation data on tablets (in particular) are promising, this strategic plan proposes a full expansion of providing digital devices, primarily tablets, to schools in Lebanon, starting not with secondary schools but with the lowest grades, so that primary school students develop early facility with technology. This eliminates the need to train students in technology operations.

In addition to these strategies, this strategic plan further recommends that MEHE begin to investigate the feasibility, desirability, and tradeoffs associated with Bring Your Own Device (BYOD) programs as a possible strategy to increase the number of classroom digital devices available for use by students and subsequently alleviate budgetary pressures on MEHE and schools in terms of equipment purchases. This could also push MEHE closer to the stated target of creating a 1:1 student-to-computer ration in Lebanon.

Recommended Action 12: *Fast-track broadband connectivity to schools.*

The government of Lebanon recognizes the importance of offering high-speed broadband capacity and services to all schools throughout the country. Based on this premise, a joint committee was formed in 2011 to consolidate efforts and devise plans for the expansion of the Lebanese National Education Network (LEBNEN), which connects all public schools of Lebanon to each other and to the Internet via the MEHE headquarters. So far, 50 secondary schools are connected, with plans to connect 75 additional secondary sites. Both ministries will consolidate efforts to allocate necessary budgetary and human resources to implement these plans and have LEBNEN be the infrastructure enabler of educational services in Lebanon.

This strategic plan urges that these efforts to ensure high-speed Internet access to schools be fast-tracked and expanded with the release of pent-up bandwidth so that schools can upload and download the types of high-bandwidth, full-motion video and multimedia that provide rich learning experiences. This strategic plan also suggests that the government investigate subsidies to schools to lower the very high cost of Internet connectivity for schools.[36] Failure

35 Since tablets are so new, there is little knowledge about lifespan, maintenance costs, etc. Similarly, there are few rigorous evaluations as to the effectiveness of tablets as learning tools, particularly in non-Westernized countries. In addition to providing valuable information on the readiness of tablets as full-blown educational devices and decisions about procurement policies, such information would be highly valuable to other countries in the region, as well as countries with similar populations, demographics, or GDPs. It should be further noted, that as of now, few nations have embarked upon national digital tablet programs.

36 Some national examples that might be examined are the successful U.S. E-rate strategy (see http://www2.ed.gov/about/offices/list/oii/nonpublic/erate.html), the United Kingdom's National Grid for Learning (NGfL) initiative, and national efforts in South Korea, Singapore, and Taiwan, where 100% of schools have high-speed Internet access.

to release pent-up Internet bandwidth seriously jeopardizes the goals and objectives of this national educational strategic plan.

Recommended Action 13: *Assume and adopt a concerted and multifaceted approach toward developing, procuring, and using high-quality digital content.*

For students to learn in ways that are learner- and knowledge-centered, they will need access to rigorous and relevant digital content, material, and resources that stimulate, challenge, and assist them in achieving the desired learning outcomes and that promote self-expression, communication, and collaboration. Teachers and students will need access to academically appropriate, high-quality Arabic, French, and English educational digital content aligned to the new Lebanese curriculum standards. Principals and regional education officers will need administrative and data management resources and tools for processing information, building and curating digital information, and communicating with parents. This will demand coordinated efforts to develop and test high-quality, standards-based, relevant, local-language rich media, collaborative, and interactive multimedia and Internet-based activities, as well as up-to-date and accurate instructional and reference materials.

Digital learning content can support a variety of uses and purposes—it can be used for self-study, group study, to support curriculum, as a major focus of content, and for teacher professional development. Fortunately, given the ever-expanding inventory of rich digital content and the fact that Lebanese instruction is in Arabic, French, and English (three languages well represented by digital content), Lebanese educators are well positioned to do this. *However, any digital content used must be aligned with the standards and outcomes of Lebanon's new national curriculum.* It also should be accessible to learners with disabilities.[37]

MEHE and CERD have several options in securing high-quality digital content (see Figure 48 for additional approaches toward adopting or developing digital content). They can avail themselves of a plethora of open content,[38] open online courses,[39] open educational resources (such as learning objects), and open-source software. They can purchase digital content directly from educational companies; they can enlist universities, consortia, and educational agencies to develop digital content; they can broker content from countries with similar or shared curricular frameworks; or they can begin, with government assistance, to "grow" and encourage the development of local digital content providers. The latter should begin to occur in response to the introduction and eventual national expansion of the digital tablet program. Finally, MEHE should invest in helping students and teachers become designers of digital content.

37 For more on this, see the National Instructional Materials Accessibility Standard (NIMAS) at http://aim.cast.org/

38 For open content, see Curriki, Multimedia Educational Resources for Learning and Teaching Online (MERLOT), OpenLearn, the Open Learning Initiative, OER Commons; search all by title.

39 For open courses, see Connexions, MITX, and the National Repository of Online Courses (NROC); search all by title.

In additional to digital content addressed here, schools can, and should, access millions of free online supplemental resources at no cost.[40] A partial list of open educational content, resources and courseware is included in Appendix C.

Figure 48: A Concerted Approach Toward Adoption and Development of Digital Content

In developing high-quality digital content , MEHE and CERD should undertake the following actions:

- **Develop standards that govern the purchase and use of "high-quality" digital content, including clear definitions of what is meant by "interactivity" (see page 113)**
- **Solicit teacher participation and formal feedback (and training, as needed) in selecting digital content with support and guidance on integrating it into particular content areas; designing interactive units, apps (through Do-It-Yourself (DIY) applications); or activities around the digital content; and using it to engage students in deep learning about a particular topic**
- **Ensure that MEHE and individual institutions have in place robust, up-to-date and enforceable intellectual property rights, digital rights management, copyright, fair use, and acceptable use policies around digital content**
- **Develop and allocate digital content in a variety of formats (text, multimedia, streaming video, etc.) to accommodate a range of school bandwidth options**
- **Create an online repository or portal of digital content, complete with metatags, user guidelines, reference guides, and lesson plans**
- **Develop digital content with an eye toward the availability of other resources (e.g., assignments that require learners to use library reference materials are no good if the students do not have access to a library)**
- **Ensure that digital content is SCORM-compliant so that it can be shared across e-learning platforms**
- **Design digital content that is multimedia in format to account for students' cognitive and developmental abilities and learning preferences**
- **Create reliable and sustainable strategies for making an ongoing investment in digital content design and development**
- **Develop mechanisms and protocols for evaluating the worth or effectiveness of digital content and improving or retiring it where it is found to be less than effective**

Recommended Action 14: *Work with schools to address the increased energy demands associated with technology.*

The infusion of energy-hungry technology into schools across Lebanon will place additional demands on the national electrical grid, which has exhibited an inability to provide reliable and continuous electrical power. Similarly, the increase in technology will increase schools' electricity costs and most likely mean that the electrical system of many schools will need upgrading. This issue of reliable energy supply to schools must be addressed and contingency plans and workarounds developed. It is far beyond the scope of this strategy or expertise of the SPDT to elaborate further on these points, except to urge that the government work with electrical utility providers to ensure a steady electrical supply to schools. Barring that development, this strategic plan proposes several contingency plans that should be examined as part of the procurement and placement of technology:

- Attention to energy consumption requirements of digital devices
- Use of solar energy for electricity supply

40 Bookboon.com, for example, has free textbooks in French and English.

- Use of passive solar design techniques in existing and future schools to reduce electricity costs
- Expanded use of generators and Uninterruptible Power Supply (UPS) units

For further details on these contingency plans, refer to Appendix D of this strategic plan.

Figure 49: MOUSE Corps

As an example of student technical support, see MOUSE Corps, a career-readiness program for high schoolers that gives those students experience providing IT support for their schools, professional internships, mentoring, and skills-building workshops at http://www.mouse.org/

Recommended Action 15: *Provide school-based technical support.*

If technology is to be implemented in each school, each school will need immediate access to qualified technical support. This includes support for handling issues that are not necessarily transparent to end users but are essential to the functioning of the school (for instance, ensuring reliable and resilient operations of WAN, LAN, servers, phone systems, and telecommunications services). This also includes support for issues that are immediately transparent, and potentially disruptive, to end users, in particular the reliability of the Internet, tablets, laptops, projection devices, and access to digital content (particularly if housed on a central server).

A lack of timely and adequate support is one of the major reasons that educational technology initiatives fail and is, unfortunately, a tale that repeats itself across the globe with depressing regularity. When computers break down and the Internet stops working, teaching and learning cease, and teachers—particularly resistors and late adopters—abandon technology as "unreliable." The losers in such a scenario are students.

This reality is noted in MEHE's current ICT plan (Karam, 2011b), and MEHE will develop and coordinate with all schools a strategy outlining how timely and adequate technical support will be provided, by whom, and at what cost. There are a number of ways that this issue of technical support can be addressed:

- Leasing digital devices as opposed to purchasing, so that schools are always assured of updated hardware and software once the devices reach planned obsolescence (usually every three years).
- As part of the Request for Proposals (RFPs) and procurement, assigning responsibility for immediate technology support, maintenance, and replacement of faulty equipment and digital devices to technology vendors as a condition of purchase.
- Developing school-based technology support staff. These can be students who serve as a "tech squad" or run a help desk to assist all users with basic infrastructure and general troubleshooting (See Figure 49 for one such example of this).
- Increasing regional technical support staff and building in simple phone-based and virtual help systems (such as technical support via *TeamViewer*).
- Investigating partnerships with local businesses, such that the businesses provide free technical support in exchange for student interns who volunteer to work at the businesses in various functions (clerical work, for example).

Figure 50: Designing for Classroom Technology

- Furniture is flexible and modular to support various types of student configurations
- Fixed elements, such as the teacher's desk, are kept to a minimum so as to not encourage a traditional teacher "in front of the classroom" mode
- Easy access to resources and other learning areas (library, outside space, labs, and other classrooms)
- Technology is located in areas most optimal for student learning and collaboration (as opposed to what is most optimal for engineers)
- Electrical power outlets are located throughout the room so that students can use laptops as part of learning and they are not confined to a fixed place to work
- Classrooms have sufficient lighting for optimal student performance; low ambient noise from outside the classroom; and cross-ventilation to ensure thermal comfort

- For certain issues, the use of unsourcing or crowdsourcing (online communities of volunteers that enable peer-to-peer support). This has proved to be both effective and economical but should be one part of, not the only, technology support strategy.

Recommended Action 16: *Help schools budget for ICT for new equipment and maintenance of existing equipment and resources.*

Expanding and enhancing ICT resources in schools involve considerable costs in terms of a school's budgetary resources. Schools will need to receive sufficient budgetary allocations to purchase, maintain, and provide human supports in the area of technology. Further, they will need to carefully allocate these resources to cover the various capital, recurrent, hidden, and unanticipated costs associated with technology.

To take advantage of the abundant learning opportunities that technology can offer, students and teachers need to be able to download video, interact with online simulations, engage in content-specific virtual learning environments, and upload multimedia content for colleagues across Lebanon, the Middle East, and the globe. Globally, the minimum requirement for such Internet carrying capacity to schools is 1 GB, but such high-capacity connectivity is expensive.

For the Internet to become a thriving and fertile source for knowledge and engagement rather than an emblem of unmet promises, schools need sufficient funding to cover recurrent expenditures for high-speed connectivity and take into account refresh cycles for all technologies. They must also use existing resources to suppress costs where possible. In addition to the budgeting recommendations outlined in MEHE's current ICT strategic plan (Karam, 2011a,b), the SPDT urges investigation and/or adoption of the practices outlined in Appendix E of this strategic plan to make such cost savings a reality. Finally, to assist schools in employing strategies to ensure cost savings, MEHE will establish policies and procedures and ensure sufficient training for appropriate school personnel to help identify cost-efficient technologies that support teaching and learning.

Recommended Action 17: *Retro-fit existing classroom spaces and design future classroom spaces to accommodate the design demands required by teaching and learning with technology.*

The placement of technology in classrooms, as this strategic plan strongly advocates, along with the adoption of learner-centered instructional methodologies, re-engineers how learning occurs, and by extension, how classroom space is designed to support new learning configurations. This strategic plan has discussed necessary changes in attitudes, resource provision, assumptions about how teachers teach and students learn, and behavior by all stakeholders (teachers, students, principals, and parents). However, placing technology in schools and classrooms also demands changes in the allocation and physical design of learning spaces. Across the globe, we are witnessing greater cognizance of two complementary educational facility design

frameworks, both of which should be considered as Lebanese classrooms become increasingly digitized and shift toward more collaborative and interactive pedagogies:

- **Green design:** Green design, or environmentally sustainable design, is a design technique that systematically incorporates environmental considerations into the physical planning, construction, reconstruction, or renovation of buildings and interior space. Among other factors, green design includes accommodations for energy efficiency (the use of renewable energy sources, such as wind, geothermal, and solar power; adoption of low-energy devices; etc.), and healthy indoor environments (for example, adequate ventilation, low ambient noise, natural lighting, etc.).
- **High-performance design:** High-performance design (sometimes referred to as *intelligent building*) advocates the purposeful design of certain features within a space to maximize human performance within that space. These include such elements as increased amounts of natural light, increased thermal comfort, modern functioning technology, and reduction in sound reverberation for improved acoustics. Both educational and human performance research identify a number of benefits that schools, not just students and instructors, can realize by incorporating high-performance features into their facilities. For example, case studies (Knoll Group, 2009) demonstrate that students are more alert, engaged, and mentally active in buildings with natural light versus artificial. Other benefits of high-performance design include better academic performance, higher average daily attendance, and improved student and teacher satisfaction and retention.

Educational research clearly outlines the relationships among learning space, instructional practices, and learning. Academic engagement is encouraged by learning spaces that are comfortable, open, flexible, and appealing (see Figure 50). Students have described classes in innovative spaces as requiring more accountability on their part because there are few physical barriers between themselves and faculty (Oblinger, 2006). Students are most engaged in settings and in academic activities that encourage interpersonal interaction and that were supported by technology. In comparison, in more traditional classrooms with seats arranged in rows and the instructor at the front of the room, students reported they had less responsibility to participate (Hunley and Schaller, 2006). Thus, these new teaching and learning behaviors demand a new type of space that can facilitate such practices. Based on these examples, classrooms in such a learning environment must be designed to support easy human circulation, greater instructor interaction with students, and increased student collaboration in the classroom. Laptops, tablets, and other mobile devices, then, are a natural technology fit for such high-performance design requirements.

Figure 51: Summary of Recommendations

National Policies, Initiatives and Procedures

- Create policies and procedures to implement the goals and objectives of strategic plan
- Develop accountability-based teacher evaluation system reflecting technology use, learner-centered instruction, and balanced assessment
- Create an evaluation unit within MEHE to conduct independent evaluations
- Rigorously evaluate technology initiatives before, during, and after their implementation

Human and Institutional Capacity Building

- Raise capacity of MEHE regional education offices and CERD regional centers
- Enhance leadership skills of principals and other administrators
- Build the capacity of new and existing professional development providers and support personnel
- Provide ongoing, extensive professional development to teachers
- Provide ongoing school-based supports to teachers
- Involve parents and communities in all phases of technology-related initiatives

School-based Technology Provision and Related Supports

- Furnish schools with portable digital devices
- Fast-track broadband connectivity to schools
- Develop, procure, or leverage high-quality digital content
- Work with schools to address the increased energy demands associated with technology
- Provide school-based technical support
- Help schools budget for ICTs
- Retro-fit existing classroom spaces to accommodate teaching and learning with technology

Section 4:
Final Thoughts

This strategic plan sees technology as a major—but not the only—intervention in a suite of educational components necessary for upgrading critical elements of the educational system in order to provide students with high-quality digital-age learning opportunities. These components include teacher professionalism and administrator leadership; a competency-based curriculum that advocates depth over breadth of knowledge; innovative instruction; and assessment that judges not just students' academic worth but provides information that can be used to target instruction to help students learn better. Though many technology strategic plans eschew discussion of these components as falling beyond the scope of technology, this strategic plan adopts the position that technology alone cannot be planted in barren soil and expected to yield improvements in student learning. Rather, the education terrain itself must be tilled so that technology can take root and flourish within a supportive ecosystem that cultivates all components necessary for student learning.

Figure 52: Theory of Change (Bradach, 2003:p. 19)

A *theory of change* reflects an organization's view of why a program or initiative (such as educational technology) works and its belief about the norms and practices required to produce successful outcomes for its key constituents. The success of any ICT initiative will be strongly influenced by the complexity of the organization's *theory of change*—the degree to which it can be articulated and standardized and the number of activities required to create the desired outcomes. For organizations seeking to produce value on a broad array of dimensions, identifying the necessary interventions and ensuring that they are all in place is a complex undertaking.

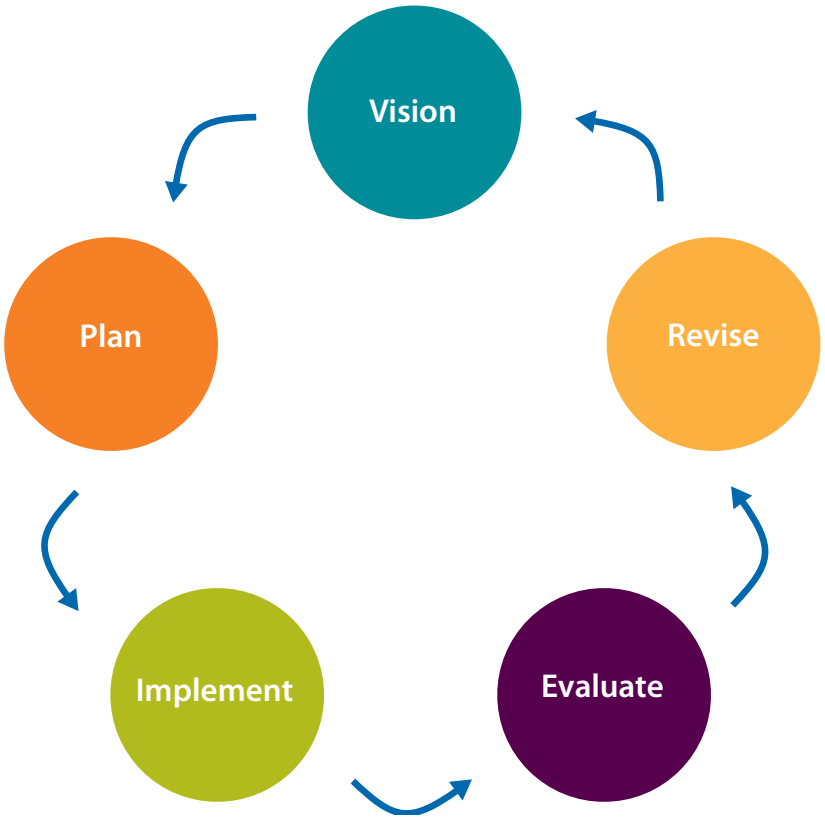
An organization with a strong theory of change will be able to specify not only how it is going to affect, for instance, students' increased literacy levels (through the use of digital "talking books" or the use of multimedia to scaffold a learner's ability to decode and comprehend text), but also which of its activities are essential in creating positive outcomes and how those activities must be executed. With a clear understanding of its theory of change, a school understands why it is doing what it is doing and can identify the activities and elements critical to nurturing successful interventions. Without a strong theory of change, implementation, replication of activities, and evaluating success becomes extremely difficult. It becomes hard to know what is working and why—and thus difficult to successfully extend, transfer and scale the practice.

Attaining the vision, goals, and objectives of this strategic plan demands that the following conditions be fulfilled. These are not options; they are necessities and include:

- Additional and sufficient budget allocations for MEHE to fully implement this national educational technology strategic plan
- Development and communication of a clear theory of change (see Figure 52) and a holistic model of reform that balances customized school-based and regional needs with a comprehensive and intensive approach to technology focused on the ultimate goal of student learning
- Responsive, proactive, and streamlined decision-making at the national level
- Development and nurturing of a dedicated corps of "champions" who consistently advocate, promote, cajole, model—and who are recognized, rewarded, and encouraged—to push innovations forward (Fixsen et al. 2005)

- A nationwide focus and meticulous planning by national entities such as MEHE, CERD, other ministries, Faculties of Education, and donors staying the course over many years to create and implement the framework, policies, enabling environment, pressures, and support needed to allow reforms around technology, curriculum, instruction, assessment, and teacher and principal capacity to coalesce and take root
- Adoption and/or development of high, clear, fair standards and establishment of mechanisms to ensure that all actions and inputs are geared toward attaining these standards
- A continuous and sequenced approach to initiatives, involving a vision, meticulous planning and goal setting, implementation, ongoing evaluation to uncover strengths and weaknesses in implementation, and revising and refining vision, goals, plans, and implementation (see Figure 53)
- Sufficient and flexible inputs—infrastructure, equipment, training, maintenance, and funding—and corrections and modifications to each as needed
- Ongoing decisions that are shaped, not by bureaucratic fiat, public relations, or political expediency, but by reliable data gathered from ongoing assessments and evaluation of initiatives, activities, inputs, outputs, and outcomes
- Ongoing and high-quality investment in human capital formation—in national and regional education officials, inspectors, teacher educators, principals, and teachers

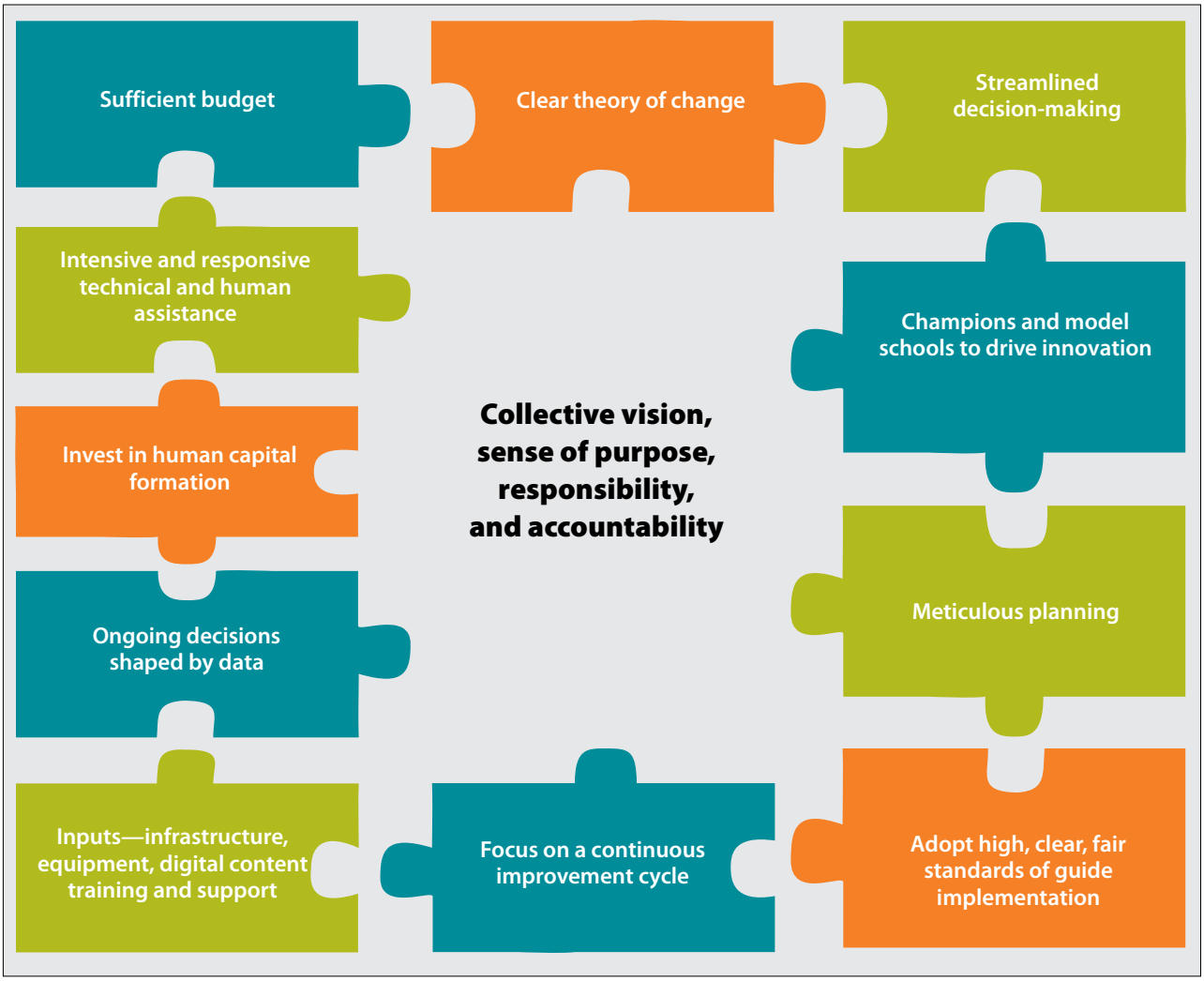
Figure 53: Vision, Planning, Implementation, Evaluation, and Revision



- Intensive and responsive technical and human assistance from well-trained and caring support persons to ensure that investments in leadership, professional development, hardware, software, digital content, and connectivity are not wasted

Above all, a collective vision, sense of purpose, responsibility, and accountability are crucial to making the goals and objectives of this national educational technology strategic plan a reality.

Figure 54: Summary of Conditions Necessary to Ensure the Success of Lebanon's Vision for Educational Technology



To do what this strategic plan proposes—to use technology to promote and extend reforms within the Lebanese educational system—is a complex undertaking. But if done well and in a manner faithful to this strategic plan, these efforts will yield great benefits for the constituency that matters most—our students.

Section 5:
Concepts into Action: Definitions of and Expectations for Educational Terms Used in This Strategic Plan

As with any domain, education and educational technology have their own language and lexicon. But without precise and shared definitions, language and terminology can serve as a source of divergence versus convergence and dissolve into buzzwords or clichés, devoid of meaning. For that reason, this section proposes a shared technical language for several key terms discussed throughout this strategic plan. By explicitly defining these terms, stakeholders can begin to develop a consensus around terminologies and taxonomies, hopefully resulting in more standardized and uniformly understood behaviors, uses, and best practices. The terms described in this section of the strategic plan reflect the SPDT's understanding of key educational concepts and outline what MEHE expects to see in terms of actual implementation.

Acceptable Use Policy (AUP): An AUP is a set of rules governing "acceptable use" of ICT infrastructure—the rights and responsibilities of all categories of technology users (administrators, teachers, and students). An AUP typically establishes parameters of use, which may include time limits on how long students may "surf" the Web online after school, policies about social media sites, filtering and blocking, the amount of bandwidth that may be used to download non-curriculum-related content, student-oriented search engines, and file size limits for up-loading or downloading content.

An AUP also includes consequences that accrue from abusing or misusing technology infrastructure (e.g., looking at pornographic websites or sites that promote sectarian or racial violence, knowingly sending e-mails that contain viruses or worms, breaking into a classmate's Facebook page or e-mail account, etc.). Such consequences may include a reduction or loss of computer privileges, suspension, and/or fines.

AUPs should be revised regularly to reflect changes in the ICT environment of the institution.

Access: In its simplest form, the term access refers to the ease and extent of obtaining, approaching and using a device, tool, or information. However, the presence of hardware, software, and connectivity is only half of the equation. The other half is how teacher and students use technology for learning. Equity of access is not achieved when some students—such as students in wealthy schools—use technology in ways that promote higher-order learning, critical thinking, and creativity, while students in poorer schools use technology in ways that reinforce lower-order, rote-based learning, such as drill-and-practice or remediation. Therefore, "access," in the context of Lebanon's national educational technology strategic plan, includes proximate availability of resources and the ability to use them with some degree of fluency.

Alternative assessment: As its name implies, *alternative* assessment is an alternative to traditional, standardized, norm- or criterion-referenced traditional "paper-and-pencil" selected response testing. Alternative assessment can include creating a project, doing an oral presentation, giving a demonstration, answering an open-ended question, working out a solution to a problem, performing a demonstration of a skill, or producing work other than a standard test or examination.

Assessment: Assessment refers to any of a variety of procedures used to obtain, quantify, and describe information about student performance. Assessment can include numerous types of measurement of knowledge skills and performance (tests, projects, essays, etc.). Assessment can be formative (ongoing) and summative (conclusive).

Assessment task: An assessment task is any task or performance opportunity that closely targets defined instructional aims, allowing students to demonstrate their progress and capabilities.

Assistive technologies: Assistive technologies are applications or technologies that have been modified in some way so they can help individuals with disabilities perform functions that might be difficult or impossible to do otherwise. A noneducational example of an assistive technology would be a wheelchair. In education, assistive technologies include hardware, software, and peripherals that assist people with disabilities in accessing computers or other information technologies, such as screen readers, voice-to-text systems/text-to-voice systems, and Braille readers.

Authentic assessment: These are assessment tasks that elicit demonstrations of knowledge and skills that resemble real life as closely as possible. Examples include writing a report or memo to a district education official about a topical item, and developing a public awareness campaign about a health issue.

Competency: The OECD (2003: p. 4) defines a competency as "more than just knowledge and skills. It involves the ability to meet complex demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a particular context. For example, the ability to communicate effectively is a competency that may draw on an individual's knowledge of language, practical IT skills, and attitudes towards those with whom he or she is communicating."

Competency-based learning: Competency-based learning involves cultivating in students a set of academic, personal, and professional skills that can be measured through competency-based assessments. These learning outcomes emphasize competencies that include application and creation of knowledge, along with the development of important skills and dispositions. Students advance to the next level upon mastery of these skills. Competency-based learning includes explicit, measurable, and transferable learning objectives that empower students; assessment that is meaningful and a positive learning experience for students; and the teacher providing timely, differentiated support based on students' individual learning needs (Patrick and Sturgis, 2011: p. 6).

Confounding: Two or more variables are distorted, or "confounded," when it is impossible to determine which variable is responsible for an observed effect. As a result, the measure of the effect of an intervention or exposure is distorted because an outcome cannot be attributed unambiguously to a single factor or interaction.

Connectivity: The term *connectivity* refers to technologies that specifically allow computers and other electronic devices to communicate with one another, particularly the use of telecommunications technologies such as e-mail, the Internet, and chat.

Control group: In an experimental design, a control group is the group that does *not* receive an intervention (such as technology training). This is in contrast to the treatment group—the group that *does* receive the intervention.

Curriculum: The curriculum is generally defined as a fixed course of study for a particular subject area at a certain developmental point (e.g., an age or a grade). It is a sequence of learning opportunities provided to students in their study of a particular content area (biology, Arabic, etc.). Curricula can be divided into *units* (for example, in biology, there are units on cells, on the skeletal system, etc.). *Unit plans* are long-range plans containing multiple lessons that are related to a particular unit of study. Units are often divided into smaller segments of study, often referred to as *lessons.*

Deep learning: This strategic plan speaks repeatedly of "deepening learning" and "deep learning." Deep learning requires that learners:

- Relate new ideas and concepts to previous knowledge and experience
- Integrate their knowledge into interrelated conceptual systems
- Look for patterns and underlying principles
- Evaluate new ideas and relate them to conclusions
- Understand the process of dialogue through which knowledge is created, and be aware that they must examine the logic of an argument critically
- Reflect on their own understanding and their own process of learning (Sawyer, 2006: p. 4)

Diagnostic assessment: Diagnostic assessment is an assessment that is used as a baseline to gather information about a particular situation and guide the creation of learning activities. Examples may include a survey before a workshop or a pretest.

Differentiation: The term *differentiation* refers to instruction that is tailored to the learning preferences of different students. Learning goals are the same for all students, but the method or approach of instruction varies according to the preferences of each student or what research has found works best for students in certain categories (U.S. Department of Education, 2010: p. 28). Examples of differentiated instruction include the use of tiered assignments and different starting points with the same content; varieties of instructional strategies; independent learning and tutoring; curriculum compacting (i.e., skipping parts of curriculum that learners know, while focusing in depth on "hard-to-learn" areas); and parallel curricula (Winebrenner, 2001).

Digital badges: Digital badges are merit-like qualifications (in the form of official recognition) certifying that students have successfully completed a

course of study or attained a qualification or skill. For more on badges, see the Mozilla Foundation at https://wiki.mozilla.org/Badges

Digital competence: Digital competence involves basic competences in ICT—the use of computers to seek, assess, store, produce, present, exchange information, and communicate and collaborate with networks of learners over the Internet.

Digital learning: According to the International Reading Association (2012), digital learning is "any instructional practice that effectively uses technology to strengthen the student learning experience. Digital learning encompasses a wide spectrum of tools and practices, including using online and formative assessment, increasing the focus and quality of teaching resources and time, online content and courses, applications of technology in the classroom and school building, adaptive software for students with special needs, learning platforms, participating in professional communities of practice, providing access to high level and challenging content and instruction, and many other advancements technology provides to teaching and learning."

Digital literacy: Literacy in a digital age includes an expanding array of competencies. Students must be functionally literate (in reading, writing, and numeracy), but this literacy extends to the ability to do all of the following:

- Perform tasks effectively in a digital environment
- Read print-based, hyperlinked, and multimedia text from a variety of digital tools
- Decode and comprehend the messages conveyed by still and moving images
- Compose coherent messages in a variety of *genres* (expository, narrative, persuasive, etc.) using a variety of *media* (blogs, microblogs, documents, etc.) communicated in a variety of *formats* (text, video, images, animations, audio, mashups, etc.) for a variety of *audiences* using language and formats appropriate to those media and audiences
- Vet relevant information from a variety of electronic and print-based sources and viewpoints, making sense of it, evaluating it, making educated and informed judgment about it, and communicating understanding and ideas about this information

Broadly, digital literacy requires that learners attain three main competencies (Edelson, 2012):

- *Interaction:* Awareness that the world is composed of interacting systems, such as social, political, economic, cultural, or technical systems.
- *Interconnection:* Understanding that the aforementioned systems are connected to one another and to the learner.
- *Implication:* As a result of these interactions and interconnections, the ability on the part of the learner to make well-reasoned decisions.

Equity: Equity means that learners are treated equally and, more important, if inequities do exist, that measures are taken to redress them. Equity is largely output- and outcome-based—it means not just that all learners receive the same inputs, but that they achieve comparable outputs, and where discrepancies exist among groups, genders, or by geographic area, class, or languages spoken, that they are addressed.

Equity in results or outcomes is not the same as equity of access (Samoff, 2003: p. 37).

Experimental inquiry: Experimental inquiry is the process of generating and testing explanations of observed phenomena. It includes observation of interests and describing what is seen; application of specific theories or rules to what has been observed; generation of hypothesis based on rules to predict a logical outcome; development of an experiment/activity to test hypothesis; explanation of experiment results; and deciding if a hypothesis was correct, followed by additional experiments/activities in the case of an incorrect hypothesis (Dean, Hubbell, Pitler and Stone, 2012: p. 142).

Fairness: Fairness means providing equal conditions for all assessments so that the lack of conditions or inputs does not affect test performance (or result in errors in valid interpretation and scoring of results). For instance, this can include such factors as giving all students the same amount of time, assistance, and resources to complete a measured task and training all exam scorers. However, fairness may also involve providing special accommodations to special populations, such as granting more time to complete an exam to a learner with a motor disability.

Formative assessment: The term *formative assessment* refers to periodic or continuous monitoring of the progress of student learning. Formative assessment is diagnostic versus judgmental and conducted as part of instruction, as opposed to after instruction (as in the case of an exam). Formative assessment techniques include questioning, observation, quizzes, exercise sheets, student performance, listening to students talk, journal writing, etc.

High-quality teachers: *Teacher quality* refers to a set of qualifications and attributes around a teacher's competence and fitness for teaching. These include:

- **Qualifications or level of competence:** University grades, examination scores, university grades in content areas, and demonstrated mastery and credentialing/certification in content areas that he/she teaches
- **Classroom abilities:** Preparation, classroom management skills, demonstrated ability to use appropriate content-specific pedagogical practices, multiple forms of assessment, feedback for student learning, and tailoring instruction, pace, and levels of difficulty to individual learner needs

- **Communication skills:** Uses clear, effective, whole-class communication; provides clear directions; uses good questioning techniques; has the ability to summarize student thinking and main points of a lesson; rephrases and repeats directions and points as needed or requested by students; involves all students in sharing ideas and answering questions; and provides verbal reinforcement and acknowledgment of good student work
- **Personal attributes:** Establishes a positive classroom climate, high degree of efficacy (expectations for and belief in students' ability to succeed), fairness, love of children, exhibited characteristics of caring for students, and lack of prejudice toward students of different religions, classes, genders, socioeconomic background, and regional background
- **Effective teaching:** Demonstrates the ability to raise student achievement scores, develops students who excel based on measures of learning, develops successful learners, and cultivates an exhibited joy about and engagement with learning

High-quality teachers exhibit mastery of these qualifications and attributes.

Hands-on (learning/activities): Hands-on learning/activities allow students to engage physically with phenomena by interacting with materials and resources, using technology, and handling scientific equipment. Because hands-on learning exceeds simple manipulation of objects, the term "hands-on/minds-on" is often used to denote that the purpose of physically interacting with tools is to help students learn in more concrete and higher-level ways.

Impact evaluation: An impact evaluation measures an initiative/program's effects and the extent to which its goals were attained.

Ipsative standards: These involve using the learner's prior performance as the basis for comparison of his or her current performance. Ipsative standards are often referred to as "growth" model standards and are often used for goal setting and motivation.

Indicator: A measure yielding statistics that describe performance related to student learning goals (outcomes). An indicator must have a common, agreed-upon definition and standard against which a performance can be judged.

Information management skills: This includes the ability to search for, organize, validate, annotate, and produce new types of information, and communicate this information in a variety of formats.

Innovative teaching practices: By *innovative* pedagogy or instructional practices, this strategic plan refers primarily to learner-centered instruction. Learner-centered instruction is not a single pedagogical approach but rather a *family of instructional approaches* in which learning goals and content drive how information is organized, understood, presented, and assessed. Depending upon the content area, one should expect to see not only one approach, but many of these approaches employed to help students better understand,

analyze, synthesize, evaluate, and communicate content. The characteristics of each of these innovative/learner-centered instructional methods are outlined in Figure 55.

Figure 55: Learner-Centered Pedagogies

Learner-Centered Approach	Characteristics
Collaborative learning	• **Positive interdependence:** Team members need one another to complete a task • **Individual accountability:** Each team member is responsible for a certain part of the task or plays a certain role. • **Social negotiation:** Team members must learn to handle conflict and argue constructively. • **Face-to-face accountability:** Team members work together, in a common space, to complete their task. • **Group processing:** Team members help one another understand how learning occurred. (**Source:** Johnson and Johnson, 1988)
Project-oriented learning	• **Organizing issue/question:** Builds on students' knowledge or interest. • **Complex:** Focused on an issue of some complexity—a project. • **Real world:** Provides a meaningful and authentic context for learning. • **Learner responsibility:** Learners must access and manage their own information and design process for reaching a solution. • **Higher-level thinking:** Learners apply information to new situations; analyze, synthesize, and evaluate information; and create a product. • **Assessment:** The final product is not a test, but a project or report. Typically performance-based. (**Source:** Buck Institute of Education, 2011)
Inquiry-based learning	• **Question:** Begins with a learner's scientifically oriented question/inquiry. • **Observe:** Learners observe and question phenomena. • **Hypothesize:** Learners describe and explain what they observe. • **Experiment:** Learners devise and conduct experiments using real-world tools to collect data to support or contradict their theories. Learners give priority to evidence in responding to questions. • **Generate knowledge:** Learners analyze data and draw conclusions from experimental data. Learners formulate explanations from evidence. Learners connect explanations to scientific knowledge. • **Test and apply knowledge:** Learners design and build models and communicate and justify explanations. (**Source:** National Science Teachers Association, 2011)

Learner-Centered Approach	Characteristics
Problem-based learning	• **Begin a real-world problem:** Problems are relevant and contextual. • **Reliance on problems to drive the curriculum:** The problems do not test skills; they assist in the development of the skills themselves. • **Ill-structured:** There is not one solution, but multiple solutions. As new information is gathered in a reiterative process, perception of the problem—and thus the solution—changes. • **Use of real-world tools and resources:** These resources include technology, primary-source data, and experts. • **Self-directed learning:** Learners must be independent and make their own decisions based on the availability of evidence. • **Cooperative teaming:** Learners work together in a team to solve a problem. (**Source:** University of Maastricht, 2007)
Case-based learning	• **Organized around a case:** Students learn desired educational objectives through interaction with a "case"—a real-world story presented in either narrative, audio, or video format. • **Context-based:** The case is relevant and realistic. • **Engaging:** Motivates learners to explore, investigate, and study. • **Situated decision-making:** All important concepts, facts, and decision-making skills are learned within the context of the case. • **Skills cultivated:** Promotes autonomy, creativity, and problem-solving abilities while simultaneously building hands-on skills needed for success as entrepreneurs. (**Source:** Harvard University, 2012)

All of the above learner-centered approaches are characterized by:

Authentic learning: Authentic learning typically focuses on real-world, complex problems and their solutions using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice. The learning environments are inherently multidisciplinary and similar to some real-world application or discipline: for example, managing a city, building a house, flying an airplane, setting a budget, or solving a crime. Students immersed in authentic learning activities cultivate the kinds of "portable skills" that newcomers to any discipline have the most difficulty acquiring on their own:

» The *judgment* to distinguish reliable from unreliable information

» The *patience* to follow longer arguments

» The *synthetic ability* to recognize relevant patterns in unfamiliar contexts

» The *flexibility* to work across disciplinary and cultural boundaries to generate innovative solutions (Lombardi, 2007: pp. 2–3).

Higher-order thinking/critical-thinking skills: The concept of higher-order or critical thinking involves thinking or learning that demonstrates attainment of the upper levels of Bloom's taxonomy. This includes *application and transfer of learning* to new settings; *analysis* of "big ideas" into their

constituent elements; *synthesis or creation* of new ideas or *problem-solving* based on divergent information sources, previous experiences, and observations; and *evaluation* or judgment of the merit of an idea based on considering evidence.

ICT/Technology: The use of ICT to support these practices and support learning-specific and concrete learning goals.

Inquiry: In inquiry-based lessons, students actively engage in posing scientifically oriented questions, designing investigations, collecting evidence, analyzing data, and answering questions based on evidence.

Integration: Integration is the use of technology by students and teachers to enhance teaching and learning and to support existing curricular goals and objectives. It does not mean computer classes or some other sort of stand-alone technology curriculum that focuses just on teaching students about technology. For instance, current information technology classes are not examples of technology integration. Rather, technology integration is teachers in regular classes using different technologies to support the learning of all students within and across curriculum areas.

Interactivity: Interactivity involves learner interaction with an object or person in a way that allows learners to improve their knowledge and skills in a particular domain. To be truly interactive, an activity of learning experience must:

- Involve multiple communication between learners around an object of study, a tool, or an experience
- Provide learners with the opportunity to control and/or adapt a program or set of outcomes based on learner inputs (Sims, 2003)
- Be reciprocal, involving information exchange and sharing ideas between students and students or students and teachers
- Provide multiple forms of synergistic participation and communication that aid the development of meaningful learning
- Involve sufficient stimuli to cause progression along and interplay between various cognitive levels

Individualization: Individualization is instruction that is paced to the learning needs of different learners. Learning goals are the same for all students, but students can progress through the material at different speeds according to their learning needs. For example, students might take longer to progress through a given topic, skip topics that cover information they already know, or repeat topics they need more help with (U.S. Department of Education, 2010: p. 28).

Investigation: Investigation is the process of identifying and resolving issues regarding past events about which there is confusion or contradiction. Steps in investigation include the following:

- Identify the situation clearly (i.e., a concept to be defined, an event to be explained, or a hypothesis to be defined)

- Identify what is already known or agreed upon
- Offer a hypothetical scenario based on an understanding of the situation
- Seek out and analyze evidence to determine if a hypothesis is plausible (Dean, Hubbell, Pitler and Stone, 2012: p. 144)

Knowledge: The United Nations Development Programme (2003: pp.36–37) defines knowledge as "consist(ing) of data, information, instructions and ideas . . . it encompasses facts, stories, pictures, and any mental construct informing human behavior, whether documented, oral, or implicit. Knowledge can be explicit (recorded in one form or another) or implicit (in the form of spontaneous behavioral prescriptions). Knowledge transcends the mere acquisition of information . . . it is widely disseminated, absorbed, and used, and its most fundamental driver is learning. Individual and collective learning are the two most important capabilities for building knowledge capital."

Learning goals: Learning goals are broad educational competencies that students will have attained after a particular unit of study. Goals, unlike outcomes, are not necessarily measurable. An example of a learning goal is: *Students will understand the impact of decolonization on present-day political events in the Middle East.*

Learning environment: The term *learning environment* is the actual physical place and space where formal learning occurs (e.g., a school, a classroom, a library, or an online learning community). But its meaning transcends physical definition. Learning environments are also the set of relationships, behaviors, and attitudes that create a supportive environment for every learner's development. Within this strategic plan, learning environments are viewed as "the support systems in which students learn best—the structures, tools, and communities that accommodate the unique needs of every learner; the attitudes, behaviors and conditions that promote the positive human relationships needed for learning; the ability and skills of teachers to inspire learners; and schools where teachers, principals, and students embody" the goals and objectives outlined in this strategic plan (Partnership for 21st-Century Skills, n.d.).

Learning outcomes: A learning outcome is a specific and measurable educational competency or target (typically a knowledge, skill, or disposition) that the student knows, is able to do, or feels, as a result of a particular set of learning activities. An example of an outcome is: *Students will be able to identify three important events leading to the fall of the Ottoman Empire.* Assessment methods should measure learning outcomes.

Mathematical literacy: According to the Programme for International Student Assessment (PISA), mathematical literacy is "an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments, and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned, and reflective citizen" (Programme for International Student Assessment, 2003: p. 24).

Media literacy: Media literacy is defined as "the ability to access, analyze, evaluate, and create media content. Media literacy is vital in the acquisition of other skills, including critical thinking, problem solving, personal autonomy, and social and communicative skills as well as its role in encouraging informed discussion in the public sphere [that] can engage citizens as active stakeholders in governance reforms" (Martisson, 2009: p. 3).

Mobility: Mobile devices include laptops, netbooks, tablets, and smart phones. Mobility means using technology to accommodate students, faculty, and staff regardless of where they are, when they are where they are, and who they are with. It is the ability to access digital resources that are not restricted to a physical location. To be mobile in a digital age means that students and teachers can keep their chosen devices with them at all times, and that the devices work wherever they happen to be.

Outcome: The term *outcome* refers to the effects/results of program or project activities on the affect, attitudes, beliefs, behaviors, skills, or knowledge of the targeted audience. Outcomes can also be impersonal: access to resources, change in policies, improvement of environmental conditions, etc.

Performance assessment: Performance assessment involves direct observation of student performance or student work and the professional quality of that performance.

Performance standard: A performance standard is an established level of achievement, quality of performance, or degree of proficiency.

Personalization: Personalization is instruction that is "paced to learning needs, tailored to learning preferences, and tailored to the specific interests of different learners. In an environment that is fully personalized, the learning objectives and content as well as the method and pace may all vary… personalization encompasses differentiation and individualization…" (U.S. Department of Education, 2010: p. 28).

Portfolio: A portfolio is a purposeful collection of student work that exhibits the student's efforts, progress, and achievements in one or more areas of the curriculum. The collection must include the following:

- Student participation in selecting content
- Criteria for selection
- Criteria for judging merits
- Evidence of a student's self-reflection

Portfolios should represent a collection of students' best work or best efforts; student-selected samples of work experiences related to the outcomes being assessed; and documents demonstrating growth and development toward mastering identified outcomes.

Problem solving: According to Murray, Owen and McGaw (2005: p. 16), "Problem solving involves goal-directed thinking and action in situations for which no routine solution procedure is available. The problem solver has a more or less well-defined goal, but does not immediately know how to reach the goal. This incongruence of goals and admissible operators constitute a problem. The understanding of the problem situation and its step-by-step transformation, based on planning and reasoning, constitute the process of problem solving."

Professional development: Teacher professional development is the instruction provided to teachers to promote their development as teaching professionals in a certain area (e.g., technology, reading instruction, content, etc.). It may also be referred to as *in-service* (instruction, education or training) or *teacher education*. Professional development connects the efforts of policymakers, donor agencies, and ministry personnel with what happens in schools and classrooms and is the tool by which a project's vision for change is disseminated and conveyed to teachers. Though the immediate recipient of professional development is the teacher, the ultimate intended beneficiary is the *student*. Thus, professional development is often the most critical component of any initiative.

Though most programs tend to favor workshops or trainings because they are seen as more cost-effective, there is little research supporting the efficacy of workshops in helping teachers truly implement, adopt, and adapt an innovation. In fact, other more time- and resource-intensive types of professional development, such as study groups, school-based lesson study, formal courses (face-to-face or hybrid), lesson study, and observation/assessment (which is also part of peer coaching) programs have been shown to yield far greater results than workshops (Sparks and Loucks-Horsley, 1989). Therefore, this strategic plan advocates professional development that implementers provide these sorts of ongoing, differentiated, and high-quality professional development models versus one-shot and one-size-fits-all workshops or trainings.

- *Observation/assessment:* In an observation/assessment model of professional development, the professional development provider—a master teacher in a school, a specialist working district wide, a very experienced teacher colleague—observes teachers in their classrooms, assessing their instructional practices and providing structured feedback.

  Observation/assessment may be used as a support measure following workshops or periodically throughout the school year as a peer coaching form of professional development. There are numerous variations of the observation/assessment model, from entire-class clinical observations, to 10-minute "snapshots," to "learning walk" approaches.

  Peer coaching is a form of the observation/assessment model that promotes transfer of learning to the classroom. In peer observations, teachers visit one another's classrooms, gather objective data about student performance or teacher behavior, and give feedback in a follow-up conference.

- *Open lessons:* In an open-lesson model of professional development, teachers create lessons and invite colleagues (and in some cases, parents, and teachers from other schools) to observe the lesson and provide feedback in a post-observation session. In contrast to lesson study (see the next point), the focus of open lessons is on *teacher* behavior. Open lessons have a long tradition in Russia, China, and Azerbaijan and are used informally throughout the globe. Where there is structured feedback, time for discussion, and teacher incorporation of feedback into a future lesson, open lessons can help teachers build on and refine skills.
- *Lesson study:* In a lesson-study model of professional development, teachers collaboratively plan, develop, or improve a lesson; field-test the lesson in a classroom; observe it; make changes; and collect data to see the impact of the lesson on student learning. This usually occurs over a period of months. In contrast to open lessons, where the focus is on teacher action, the lesson study approach focuses on *student* actions. Lesson study originated in Japanese schools, but now it has spread across the globe.
- *Study groups:* In the study-group model, teachers collaborate, as a single large group or in smaller teams, to study a particular issue with the goal of solving a common problem or creating and implementing a plan to attain a common goal. The study—the reading, discussion, writing, and reflection, often led by a skilled facilitator—is the key component of a study group. During the study process, they may use print-based and technology-based resources, classroom materials (such as work created by students), and their experiences as part of their approach to the problem.

Quality: Quality is invoked extensively throughout this strategic plan. The term *quality* in this strategic plan means adherence to a set of standards of content, design, instruction, assessment, and technology specifications that are based on excellence, relevance, and meaningfulness; proof that interventions have resulted in demonstrable student learning and/or student learning gains; the development set of useful and usable knowledge and skills by teachers, students, and principals as a result of technology initiatives; and verification of all of these by external evaluation. Quality is defined through explicit standards so that it can be monitored, evaluated, and improved. Within education, content, curriculum, instruction, and assessment should be of the highest quality. Quality is a product of planning, monitoring, control, and coordination.

Reliability: Reliability is defined as the repeatability of a measurement—the extent to which a measure of a concept would deliver the same results whenever applied. Reliability answers the question: How reliably or consistently does an assessment measure something without being affected too much by the situation in which the assessment takes place?

Return on investment (ROI): ROI is a performance measure that divides the tangible benefits of an investment (new clients or customers, reduced costs, increased revenues, etc.) by the total cost of the investment. To calculate ROI, take the gain of an investment, subtract the cost of the investment, and divide the total by the cost of the investment. This formula is ROI= (Gains—Cost)/Cost. The ROI is expressed as a ratio or percentage.

Scientific literacy: PISA (2005: p. 17) defines scientific literacy as "the capacity to use scientific knowledge, identify scientific questions, and draw evidence-based conclusions, to understand and help make decisions about the natural world and the changes made to it through human activity."

Total Cost of Ownership (TCO): TCO refers to the financial estimate of all costs associated with a particular program, purchase, or intervention. Using technology as an example, it includes all capital and recurrent costs for equipment, connectivity, supplies, supporting infrastructure, training, and support for a fixed period (five years, a decade, etc.).

Universal Design for Learning (UDL): Universal Design for Learning (UDL) provides a blueprint for creating instructional goals, methods, materials, and assessments that work for everyone—not a single, one-size-fits-all solution but rather flexible approaches that can be customized and adjusted for individual needs (CAST, 2012). A universally designed curriculum includes multiple means of *representation* (to allow various ways of acquiring information and knowledge), multiple means of *expression* (to allow alternatives for demonstrating knowledge), and multiple means of *engagement* (to challenge appropriately, to motivate, and to allow learners to express and participate in their interests) (National Center on Accessible Instructional Materials, 2012).

Validity: In assessment, validity is the degree to which evidence and theory support an interpretation of assessment scores. In other words, is what the teacher is seeing really true? There are multiple types of validity, among them:

- *face validity:* in which the assessment must be related to course content
- *content validity:* in which assessment must test the main outcomes or objectives of the course
- *construct validity:* in which each component of the test must be related to the other components so that the test is measuring a specific set of knowledge
- *predictive validity:* in which the assessment must be able to predict what it is supposed to predict

Value on investment (VOI): VOI is a benchmark that measures the tangible and intangible value of investing in technology within a knowledge economy. Tangible values include such indicators as cost reduction because of automation of processes or increased revenue. Intangible values include collaboration, knowledge sharing, and change in culture.

Appendices

Appendix A: Summary Table: Goals, Objectives, and Recommended Actions

Appendix A serves as a summary of all goals, objectives, and recommended actions for Chapters 1–6 of this national educational strategic plan. Please note that many of the objectives and recommended actions may be repeated throughout the various tables. This is not in error or because of inadvertent redundancies. Rather such repetition is indicative of the highly inter-connected and recursive relationships between technology, curriculum, instruction, assessment, professional development, and leadership and suggests that concerted and comprehensive actions and programs can and should address several components simultaneously.

Summary Table 1

Chapter 1: Access to Technology (Goals, Objectives, and Recommended Actions)

Goals	Objectives	Recommended Actions
Goal 1.1: *100 percent of students and teachers in Lebanon* will have ready access to appropriate classroom technologies that support the fulfillment of curricular and instructional objectives in all subject areas.	• **Objective 1.1.1 Individual access to technology:** 100 percent of students will have access to a shared digital device (tablet, laptop, etc.) as part of classroom learning activities. • **Objective 1.1.2 School/classroom access to technology:** 100 percent of schools will be provided with sustainable and affordable instructional technology of various configurations. • **Objective 1.1.3 Minimum 1:4 student-to-computer ratio, with a future target of 1:1:** At least 40 percent of schools (Tier 3 and 4 schools) will *meet the minimum recommended standards* of having one digital device for every four students but with the eventual goal of achieving a 1:1 ratio. • **Objective 1.1.4 Access for special populations:** Students will have access to appropriate assistive technologies to accommodate differences in their physical and cognitive abilities and maximize their opportunities of benefiting from the general education curriculum. • **Objective 1.1.5 Mobile computer labs:** In schools without fixed computer labs, introduce mobile technology labs through the provision of digital device carts. • **Objective 1.1.6 Secure technology access:** Develop partnerships with public institutions, private companies and industries, local community partners, universities, and research institutions to explore emerging technologies that could be potentially useful in teaching and learning.	• Develop readiness protocols to assess where, how much and in what schools technology can be placed. • Digital devices (Laptops/Tablets) initiatives: assess, revise and where successful, expand. • MEHE will provide various "tiered" technology configurations based on a certain set of criteria and pre-conditions. • Expand new and leverage existing Public-Private Partnerships to secure ongoing stream of up-to-date equipment. • Train principals and teachers on using technology for productivity purposes (communication, lesson planning, data management, etc.).

Goals	Objectives	Recommended Actions
Goal 1.2: Approximately 90 percent of Lebanese schools will have affordable Internet connectivity and access to networks, including wide area networks (WANs) and local area networks (LANs), to support flexible learning options to allow students and teachers to interact with video, online learning opportunities, and digital media that deepen and broaden students' grasp of a particular content topic.	• **Objective 1.2.1 Establish Internet connectivity:** Guarantee constant, cost-effective broadband Internet access to 90 percent of schools to connect students and teachers to outside sources of information. • **Objective 1.2.2 Address the digital divide:** Prioritize networking for all schools in regions of the country that suffer from poor access to technology and networking. • **Objective 1.2.3 Set up Internet access in schools and/or classrooms:** Provide an enabling environment for the introduction of new communications technologies (two broadband wireless access points, two network points, and two electrical outlets in each classroom to run multiple digital devices). • **Objective 1.2.4 Use the Internet for communication:** Ensure through policies, procedures, and practices that classroom technology offers online interaction among students and educators, within each school, each region across the country, and throughout the globe. • **Objective 1.2.5 Upgrade existing facilities:** At schools where fixed computer labs exist, upgrade networking and hardware in each lab. • **Objective 1.2.6 Install Internet security:** Develop tools for safe and secure online knowledge sharing and collaboration including social networking (Web 2.0) systems.	• National commitment to release pent-up bandwidth for schools. • Explore alternative Internet providers inside and outside of Lebanon. • As part of school reconstruction efforts, add wireless access points, network points and electrical outlets to classrooms. • Upgrade networking and hardware in each school through expansion of LEBNEN and through procurement of laptop carts (Computers on Wheels)—and other needed equipment mapping to set configurations (Tiers 1 to 4).

Goals	Objectives	Recommended Actions
Goal 1.3: 100 percent of schools will have access to high-quality digital learning resources and software that are linked to the national curriculum and student learning outcomes.	• **Objective 1.3.1 Secure digital content:** Employ both domestically and internationally produced content in Arabic, English, and French, as well as open educational content and open courseware, to enrich students' learning in the classroom, at home, and wherever they choose to work or study. • **Objective 1.3.2 Higher-level digital content:** Select, develop, or adapt digital content that stimulates inquiry, higher-level thinking, creativity, and problem solving by students and educators. • **Objective 1.3.4 Standards for assessing content:** Develop or adapt standards for assessing the quality of digital content. • **Objective 1.3.5 Guidelines for digital content:** Develop a national model for content supply—with guidelines, standardized metadata, interoperability frameworks and systems—that is adopted by jurisdictions, cultural organizations, and commercial providers, among others. • **Objective 1.3.6 Centralized access to digital content:** Develop an online portal that provides easy access to relevant, approved, high-quality digital content that is linked to national curricular topics and student learning outcomes. • **Objective 1.3.7 Centralized access to information:** Provide access to "learning portals," supporting curriculum planning and delivery, progress monitoring, and communication between students, teachers, and parents.	• Develop standards, procedures, and repository for open content creation and procurement. • Develop or contract out the creation of a national repository for digital information for teaching and learning. • Train relevant MEHE staff, CERD, DOPS, regional educational officers, inspectors, principals, teachers, students and interested parents on using this repository. • Investigate/Contract (where applicable) with educational developers of digital content. • Help teachers learn how to create their own curriculum-based digital content.
Goal 1.4: 100 percent of teachers and administrators in Lebanon will have access to technology tools for administrative and productivity purposes: to manage data, keep electronic records and grades, plan lessons, assess student learning, and communicate with parents, other teachers, students, and administrators.	• **Objective 1.4.1 Technology training:** Provide all administrators and teachers with professional development and support in using ICT for job-related purposes. • **Objective 1.4.2 Data management:** Provide for the collection of, access to, and exchange of data by administrators and teachers to use for informed educational decision-making. • **Objective 1.4.3 Technology and productivity:** Enable educators to manage content standards and performance indicators, and link them to locally developed curriculum, instruction, and assessment. • **Objective 1.4.4 Parent involvement:** Enable parents to be able to view online student programs and progress and communicate with teachers and school leaders at all times.	• Develop Educational Management Information System (EMIS). • Establish culture of and procedures for data collection, management, analysis, use and decision-making. • Expand Principal Leadership Development Program (which covers many of these existing activities). • As part of national curriculum revision, train teachers on linking performance indicators to curriculum, instruction, and assessment.

Goals	Objectives	Recommended Actions
Goal 1.5: 100 percent of students, teachers, and principals in Lebanon will be able to use digital technology effectively to learn and work successfully in an increasingly complex, technology-based society.	• **Objective 1.5.1 General use of technology:** Students, teachers, and principals will be able to conduct research, organize data and solve problems, create original works, and communicate information and ideas. • **Objective 1.5.2 Acceptable and ethical uses of technology:** Students, teachers, and principals will demonstrate the responsible, legal, and ethical use of information and technology (e.g., respecting copyright rules and fair use and using technology only for legal academic purposes). • **Objective 1.5.3 Find information:** Students, teachers, and principals will use effective and efficient strategies to explore and use a wide range of information and technology resources to gain knowledge, deepen understanding, make informed decisions, and solve problems for educational, career, and personal pursuits. • **Objective 1.5.4 Manage information:** Students, teachers, and principals will be able to locate, evaluate, interpret, and synthesize information from print and nonprint sources. • **Objective 1.5.5 Technical support for technology:** Students, teachers, and principals will be supported in these pursuits by technical assistants who understand the learning goals of the students, the school, and the teachers.	• MEHE will adopt/adapt international standards on technology use for teachers, students and administrators (e.g., ISTE's NETS-A standards, NETS-T standards, NETS-S standards, UNESCO ICT Competency Framework for Teachers, etc.). • MEHE will link all technology-related professional development to international standards on technology use for teachers, students and administrators. • MEHE will work with schools to develop school-based technology support programs (part of this can be mandated by MEHE as part of RFP process for technology vendors). • MEHE will work with DOPS to provide school-based instructional support for teachers using ICT.

Goals	Objectives	Recommended Actions
Goal 1.6: Government agencies, such as MEHE and MOT, will provide an enabling environment for widespread, national educational technology use through continued development of ICT in education-related policies and procedures.	• **Objective 1.6.1 Standards for technology use:** Adopt competency-based standards for technology use that students, teachers, and principals must attain and to which all entities must adhere. • **Objective 1.6.2 Policies for technology use:** Establish privacy safeguards, Acceptable Use Policies (AUPs), protection of intellectual property rights through legislation and digital rights management infrastructure, and policies to cultivate a legal software download culture in the education community. • **Objective 1.6.3 Frameworks for technology use:** Develop interoperability frameworks that enable the sharing of systems and information between sectors and jurisdictions, and industry-specific data and technology standards to facilitate the provision or exchange of data, educational content, and/or learning objects. • **Objective 1.6.4 Data sharing:** Make public, through digital repositories, the publication of documents, data, and educational materials, complete with metadata, so that educational objectives and activities are transparent and available to teachers, students, parents, principals, and community members. • **Objective 1.6.5 Cybersecurity:** Put in place all procedures, mechanisms, and protections to protect digital identities and digital property from theft or corruption, and protect the privacy and safety of all users, especially students.	• MEHE will develop all policies and procedures related to use of technology in schools. • MEHE will develop/adopt, codify and disseminate all standards governing equipment, connectivity, software, digital content, and data use.

Summary Table 2

Chapter 2: Technology and Curriculum (Goals, Objectives, and Recommended Actions)

Goals	Objectives	Recommended Actions
Goal 2.1: CERD will integrate appropriate and relevant technologies to promote key competencies outlined in Lebanon's newly revised curriculum.	• **Objective 2.1.1 Support key content-related competencies:** Identify the types and uses of technology and specific applications to support content-related key competencies. • **Objective 2.1.2 Identify key *digital* competencies:** Identify key student digital competencies necessary to thrive in a digital world in which fluency with technology and various forms of literacy are essential for academic and vocational success. • **Objective 2.1.3 Authentic learning:** In all content areas, teachers and students will use a variety of content-related technology resources, such as multimedia, online applications, and simulation sites, to carry out and complete authentic tasks required by core subject areas. • **Objective 2.1.4 Hard-to-teach areas:** Identify and begin to integrate into specific content areas and curriculum frameworks those technologies that have proven to be most effective in helping students grasp difficult content topics or concepts. • **Objective 2.1.5 Standards for digital content:** Adopt clear standards evaluating "high-quality" digital content, as well as guidelines for integrating digital content into high-priority content areas such as math, science, and English. • **Objective 2.1.6 Develop digital content:** Procure, adapt, and/or develop high-quality digital content aligned with competencies outlined in the revised curriculum. • **Objective 2.1.7 Develop models:** Prepare model activities that demonstrate how to use digital content and tools (e.g., electronic games, learning objects, digital media, and educational software) to support content and curricular objectives. • **Objective 2.1.8 Instructional design:** Help teachers develop learner-centered activities supported by technology to address curriculum standards. • **Objective 2.1.9 Extend learning opportunities:** Identify appropriate online courses, e-learning opportunities, online universities, and education portals so that advanced learners, homebound learners, learners with special needs, and/or learners in regions lacking access to such courses can benefit from learning opportunities as needed.	• Beginning with Cycle 1, begin process of identifying learning outcomes that can be supported by technology and link the use of technology to support these intended learning outcomes. • MEHE and CERD will develop/adopt standards for digital content. • Pilot, evaluate, and revise the above technology-based activities. • Integrate technology use to support new national curriculum. • As part of the national curriculum revision, instruct teachers in developing lesson plans and units of study, and using technology to instruct and assess students in the new curriculum.

Goals	Objectives	Recommended Actions
	• **Objective 2.1.10 Assistive technologies and special needs:** Address learning diversity through identifying assistive technology tools and materials that respond to learners with a variety of cognitive and physical needs and abilities. • **Objective 2.1.11 Assistive technologies to support curriculum:** Help teachers use assistive technologies to build tools and materials that will improve students' understanding of content and support their mastery of identified learning outcomes.	
Goal 2.2: CERD will integrate technology into the revised curriculum to deepen the learner's *content mastery*.	• **Objective 2.2.1 Technology for content mastery:** Beginning at the primary level and continuing until the end of secondary school, students will learn how to use a variety of technology tools and applications to develop mastery of the most important topics. » **Objective 2.2.1.1 Support mathematical literacy:** Students will use appropriate digital tools and content to enhance mathematical literacy. » **Objective 2.2.1.2 Support science literacy:** In math and science classes, students will use appropriate digital tools and content to enhance scientific literacy. » **Objective 2.2.1.3 Technology and writing:** In language and social science classes, teachers and students will use word processing software and online writing applications as part of the formal writing process to improve students' written communication abilities. • **Objective 2.2.2 Technology for authentic learning:** In all content areas, students will use technology as part of authentic learning, in complex, content-related tasks that require them to collaborate with use higher-order thinking skills. • **Objective 2.2.3 Technology for knowledge formation:** In all content areas, students will be able to use various Web-based applications and functions, multimedia applications, and various forms of digital media to organize and classify data, produce meaningful reports and presentations, and discuss particular content topics. • **Objective 2.2.4 Technology and higher-order thinking:** In all content areas, students will be able to use digital tools, such as concept/mind maps to break down or analyze "big ideas" of the content or topic into their constituent parts/concepts and display visual relationships among these concepts. • **Objective 2.2.5 Universal Design for Learning (UDL):** The curriculum will be universally designed to provide all students with multiple means of representation, expression, and engagement, with and without technology.	• Provide content-specific professional development based on TPACK (Technological Pedagogical Content Knowledge) to help teachers understand how technology, pedagogy, and content can interact with one another to produce effective discipline-based teaching with educational technologies. • CERD/MEHE committee begins to investigate and plan for potential e-learning offerings.

Goals	Objectives	Recommended Actions
Goal 2.3: Technology is embedded within the curriculum to cultivate in learners the essential "literacies" required to be successful workers and learners in a digital age.	• **Objective 2.3.1 Research:** Students will be able to demonstrate a command of information retrieval skills and strategies to search for, identify, locate, evaluate, and use digital and nondigital resources to conduct research, solve problems, answer questions, or address an issue. • **Objective 2.3.2 Information management:** Students will be able to apply information from a variety of sources and formats using evaluative criteria to interpret, analyze, organize, and synthesize information from digital and nondigital sources. • **Objective 2.3.3 Knowledge creation:** Students will know how to use computers and other technology devices as tools for productivity, problem solving, and learning across content areas. • **Objective 2.3.4 Communicate information:** Students will be able to use appropriate digital devices, software, and applications to create written, visual, oral, and multimedia products to communicate ideas and information. • **Objective 2.3.5 Collaboration:** Students will be able to use digital networks and Web 2.0 tools (such as social media and collaboration ware) to collaborate with other students in class or online for information gathering and processing. • **Objective 2.3.6 Evaluate information:** Students will be able to assess digital information for credibility, logic, veracity, and bias through analysis of visual, text-based, numeric, tabular, graphic, and oral information. • **Objective 2.3.7 Ethical uses of technology:** Students will demonstrate the responsible, legal, and ethical use of information resources, digital communication tools, computers, and other technologies.	• Revision of national curriculum that links ICT use to outcomes/ competencies. • MEHE will adopt ISTE's NETS-S standards. • School-based technical and instructional supports to assist teachers. • Professional development to help teachers integrate technology to support revised curriculum.

Summary Table 3

Chapter 3: Technology and Instruction (Goals, Objectives, and Recommended Actions)

Goals	Objectives	Recommended Actions
Goal 3.1: At the system level, MEHE and CERD will ensure that major inputs are in place to ensure that technology is used effectively to improve the overall quality of teaching and learning in all schools.	• **Objective 3.1.1 Develop guidelines for technology use:** Develop, adopt, or adapt guidelines, standards, and competencies for content-specific innovative instructional practices using ICT. • **Objective 3.1.2 Research-based technology use:** Using research and best practices as guides, integrate technology into all content areas and all grade levels to enable students to learn in ways that are unavailable without these technology resources. • **Objective 3.1.3 Technology aligned with curriculum, instruction, and assessment:** In all content areas and in all grade levels, align technology with curricular objectives, instructional activities, and assessment to support deep learning. • **Objective 3.1.4 Digital repository:** Develop a national portal/ digital platform for teachers and students containing models and lesson plans of content-based, learner-centered activities that use technology; archived video lectures for student reference and self-learning; and e-learning courses for teachers and students. • **Objective 3.1.5 Ongoing professional development for teachers:** Develop a system of ongoing professional development and continuous school-based support for teachers to help them integrate ICT into instruction and assessment. • **Objective 3.1.6 Evaluate technology use:** Design and implement ongoing outcome and impact evaluations of the efforts described in this chapter and revise programs, inputs, and resources based on results from these evaluations. • **Objective 3.1.7 Assess teachers' use of technology:** For purposes of support and evaluation, ensure ongoing assessment of teachers' use of technology. • **Objective 3.1.8 Community outreach regarding technology:** Develop a dissemination strategy that involves communities, families, and businesses as partners in student learning who can furnish physical, emotional, and technical supports for schools. • **Objective 3.1.9 Block scheduling:** Investigate or experiment with block scheduling to organize the school day into fewer, but longer, class periods to allow flexibility for learner-centered instructional activities.	• MEHE oversees coordination of teacher pre-and in-service activities between Faculties of Education and CERD. • MEHE and CERD undertake review, assessment of current models of professional development and revise system based on research about effective professional development that integrates technology into content areas. • Upgrade knowledge and skills of current Faculty of Education and PD providers, particularly in TPACK framework. • Develop standards for digital content and a national digital repository. • Along with design of technology initiatives, contract with external evaluation agency/ies to develop process and impact evaluations. • MEHE develops a comprehensive teacher support system and enhances knowledge and skills of support staff. • Principal Leadership Institute adapts content to help school principals become instructional leaders so they can support use of technology in service of new pedagogies. • Implement use of *ProGReSS SCaLe* tool to assess and support teachers' uses of technology to support high-quality learner-centered instruction.

Goals	Objectives	Recommended Actions
Goal 3.2: In concert with the introduction of technology in schools, create and promote a national system of "high-quality" instruction.	• **Objective 3.2.1 Targeted and differentiated instruction:** Teachers will use technology to differentiate instruction for students based on their particular level of expertise and skill, learning styles, and needs. • **Objective 3.2.2 Learner-centered instruction:** Teachers will use a variety of learner-centered methods, such as project-based, problem-based, inquiry-based, case-based, and collaborative learning. • **Objective 3.2.3 Higher-order thinking:** Teachers will advance students' higher-order thinking skills by using a wide range of technologies, instructional practices, and assessment activities. • **Objective 3.2.4 Inductive and deductive reasoning:** Teachers will advance students' inductive and deductive reasoning skills and higher-order thinking skills by using a wide range of technologies, instructional practices, and assessment activities. • **Objective 3.2.5 Balance collaborative and independent learning:** Based on the intended learning outcome and complexity of the task, teachers will demonstrate an ability to balance the use of collaborative learning (to support understanding of concepts, skills, and procedures that are part of more complex units of study) and individual learning (to support independent practice for mastery of skills). • **Objective 3.2.6 Learning beyond the classroom:** The teacher will move beyond 2 x 4 learning to integrate resources, experiences, and issues from the community at large and, where possible, to connect student learning to real-life, community issues. • **Objective 3.2.7 Online and face-to-face collaboration:** The teacher will design well-structured face-to-face and online collaborative learning activities with clearly defined learning goals, roles, and responsibilities for each member, characterized by positive interdependence, individual accountability, and group interaction so that students can learn from each other's scholarship, skills, and experiences.	• MEHE adapts/adopts standards for using ICT as part of teaching and learning • Placement of technology and wireless connectivity in classrooms (initially through tablet and LEBNEN pilots—then expanded nationwide). • MEHE, with schools, develops a system for school-based technical support. • Assess, revise and expand existing CERD professional development programs to create closer links between technology, competency-based curriculum, instruction and assessment. • Content-based professional development based on TPACK framework.

Goals	Objectives	Recommended Actions
Goal 3.3: The teacher will exhibit the knowledge, skills, and dispositions necessary for teaching in a digital age.	• **Objective 3.3.1 Orchestrate student learning:** Through the use of technology and learner-centered instruction, the teacher will shift from being the sole provider of knowledge to a "conductor" of student learning, thereby allowing students to become active participants in setting their own educational goals, managing their own learning, and assessing their own progress. • **Objective 3.3.2 Technology for productivity:** The teacher will use technology for a variety of productive purposes (for instructional design, instruction, assessment, and data management). • **Objective 3.3.3 Model attitudes toward learning:** Through technology and instructional practices, the teacher will model curiosity, intellectual flexibility, open-mindedness, a willingness to listen to different points of view, and a desire for continuous learning. • **Objective 3.3.4 Achieve technology competencies:** Teachers will attain the technology proficiencies defined by the National Education Technology Standards for Teachers (NETS-T) and UNESCO's ICT Competency Framework for Teachers, both of which will be adapted to the Lebanese context. • **Objective 3.3.5 Represent learning in multiple formats:** The teacher will help students use a variety of media to produce linguistic (text) and nonlinguistic representations (for example, drawings, videos, or audio) that demonstrate their learning and help them better understand content-related topics and concepts. • **Objective 3.3.6 Promote student choice:** The teacher will provide opportunities for students to self-select resources and arrange content in personally meaningful ways to produce higher levels of intrinsic motivation and higher levels of student engagement with content. • **Objective 3.3.7 Capitalize on student interest in technology:** The teacher will capitalize on students' uses of computers, mobile devices, and the Internet outside of school to cultivate engaging learning experiences inside of school.	• Attainment of these objectives is contingent upon carrying out the recommendations listed in Goals 3.1–3.2.

Goals	Objectives	Recommended Actions
Goal 3.4: Through the integration of technology and high-quality instruction, students will become digital-age learners.	• **Objective 3.4.1 Independent learners:** Teachers will allow and encourage students to independently, autonomously, and routinely use technology to complete required academic assignments. • **Objective 3.4.2 Attain digital-age skills:** Students will engage in learning activities that foster creativity and innovation, communication and collaboration, and critical thinking, problem-solving, and decision-making. • **Objective 3.4.3 Pursue their own interests:** Students will use technology to pursue particular interests, formulate their own beliefs and opinions, draw their own inferences supported by facts, and choose how to present information (e.g., through the creation of a video or Web-based slide show) as appropriate to the learning assignment. • **Objective 3.4.4 Higher-level thinking:** Students will be able to use technology and non-technology resources to generate, test, and revise hypotheses via deductive and inductive reasoning skills; apply, analyze, synthesize, and evaluate information; and create, not simply consume, information. • **Objective 3.4.5 Attain technology competencies:** Through the authentic use of technology as part of the actual learning process, students will develop skills and competencies in a variety of technologies defined by the National Education Technology Standards for Students (NETS-S). • **Objective 3.4.6 Online collaboration:** Through the use of structured and collaborative face-to-face and online activities that use communication technologies, students will learn how to collaborate with other learners, where they must work together on a common task with defined roles, responsibilities, and deadlines, and work with people whose ideas, personalities, and working styles may be different from theirs—all of which are essential skills for a 21st-century workplace. • **Objective 3.4.7 Express knowledge in multiple formats:** Through the use of all types of assistive technologies, all students, regardless of their abilities, will be able to complete their work, achieve learning goals, and express what they have learned.	• Attainment of these objectives is contingent upon carrying out the recommendations listed in Goals 3.1-3.3.

Summary Table 4

Chapter 4: Technology and Assessment: Goals, Objectives, and Recommended Actions

Goals	Objectives	Recommended Actions
Goal 4.1: MEHE and CERD begin to develop a national, balanced, learner-centered, and school-based assessment system that blends multiple *types* of assessment (diagnostic, formative, and summative); that conforms to *standards* of good assessment (fairness, reliability, validity, and transparency); and that builds on known *best practices* in assessment, with and without technology.	• **Objective 4.1.1 Review current assessment system:** Undertake a national evaluation of the current assessment system, developing a framework for new models of assessment to be aligned with (1) a newly revised, competency-based curriculum; (2) new models of instruction; and (3) the integration of ICT into all content areas. • **Objective 4.1.2 Expand current understanding of assessment:** Help all educators understand the multiple purposes of assessment, multiple types of assessment, multiple methods of assessment, and the variety of strategies that can be employed to measure student learning. • **Objective 4.1.3 Assessment of learning progress:** Move beyond the current system of simply certifying student learning to create new policies, mechanisms, criteria, and indicators that promote the use of diagnostic and formative assessments to measure students' progress within a given domain. • **Objective 4.1.4 Competency-based assessment:** Move away from the current assessment system to a competency-based assessment system that is tightly aligned with curriculum standards/competencies/benchmarks and instruction. • **Objective 4.1.5 Professional development:** Provide mechanisms, professional development, support, and outreach to help parents, principals, and teachers understand the rationale for and new mechanisms for assessment. • **Objective 4.1.6 Align grading with new modes of assessment:** Review all procedures for grading and reporting and align these with new modes and models of assessment. • **Objective 4.1.7 Analyze and use assessment data:** Continuously collect and analyze student assessment results to guide national, regional, school, and classroom decisions about curriculum and instruction.	• MEHE and CERD convene a national panel to examine high-stakes examination system (Brevet and Baccalauréat) drawing on examples from other nations that have revised their systems. • Before, and continuing after 2017, MEHE and CERD begin to align national examinations with the new curriculum. • MEHE and CERD, in particular as part of the new curriculum, and as part of technology-based instruction that is part of this national strategy, begin to put in place mechanisms, protocols and instruction for all stakeholders so they understand, use and support more balanced learner-centered assessment approaches within the classroom.

Goals	Objectives	Recommended Actions
Goal 4.2: MEHE and CERD will implement the use of technology to support, automate, and increase the efficiency of this balanced assessment system.	• **Objective 4.2.1 Digital item bank:** Develop a digital repository of test items, as well as metadata about the test items, extensive information regarding test development, and psychometric characteristics of the items. • **Objective 4.2.2 Public assessment data:** Make all summative student assessment data available to parents, students, teachers, and principals via a secure and searchable Internet-based Student Information System (SIS). • **Objective 4.2.3 Technology and assessment:** Integrate into content areas technologies such as computer-aided instruction, simulations, digital learning games, and virtual worlds to provide students with a developmental sequence of increasingly difficult challenges; and embedded, just-in-time feedback so that learners are working at their highest ability. • **Objective 4.2.4 Computer-based testing:** Shift summative and high-stakes assessments to the online or digital realm so that students can receive immediate results and feedback on their performance. • **Objective 4.2.5 Computer Adaptive Testing (CAT):** In particular, for summative and high stakes assessment, use CAT to maximize the precision of the exam, provide more precise and reliable scores for test-takers, and generate immediate feedback for test-takers.	• MEHE will develop a Tests Management Information System. • Begin process of moving Brevet and Baccalauréat from paper-based examination systems to computer-based examination systems. • Contract with technology-based assessment companies to develop computer adaptive tests based on revised Lebanese national curriculum. • Focus some component of this, or future tablet pilots, on using tablets to gather and provide instant assessment data. • Include technology integration into professional development mentioned in Chapters 2, 3 and 5.

Goals	Objectives	Recommended Actions
Goal 4.3: MEHE and CERD will develop teachers' abilities to measure and assess student knowledge and skills—with or without technology.	• **Objective 4.3.1 Expand teacher understandings of assessment:** Expand teacher understanding of characteristics of good assessment, types of assessment (formative and summative), and the purposes of assessment (e.g., determining readiness/baseline understanding of a topic, providing valuable information about their understanding of topics to modify instruction, and certifying mastery). • **Objective 4.3.2 Assess digital-age skills:** Provide teachers with the knowledge and skills to design and develop authentic assessments that measure digital-age skills in real-world settings, such as critical thinking, collaboration, drawing inferences, justifying positions, and managing information. • **Objective 4.3.3 Use assessment data for instruction:** Provide teachers with the knowledge and skills to use assessment information, not for judgment of student performance at the end of a unit, but to tailor instruction, provide remediation or enrichment, make available individual or peer tutoring, and modify units of study to help students successfully grasp the key concepts of the unit of study. • **Objective 4.3.4 Common assessments:** Provide teachers with the knowledge and skills to develop and administer common assessments for similar courses or grade levels. • **Objective 4.3.5 Assess different types of knowledge:** Provide teachers with the knowledge and skills to assess declarative, procedural, and conceptual knowledge in the core concepts and main ideas in a particular topic using multiple forms of assessment (e.g., performance-based assessments, portfolios, essays, etc.). • **Objective 4.3.6 Questioning techniques:** Provide teachers with the knowledge and skills to assess and promote deep learning via deep questioning, such as inferential, analytical, and hypothetical questioning techniques. • **Objective 4.3.7 Design scoring guides:** Provide teachers with the knowledge and skills to design and use holistic and analytical rubrics, checklists, and scoring guides that reliably and consistently measure student performance. • **Objective 4.3.8 Grading and feedback:** Provide teachers with the knowledge and skills to use appropriate grading, immediate, corrective, and informative feedback, and reporting strategies that are aligned with new technology-based modes and balanced, learner-centered models of assessment.	• Integrate these objectives, where applicable, into national curriculum review. • Include these objectives into professional development mentioned in Chapters 2, 3, 5 and 6. • MEHE should ensure ongoing support to teachers and principals so that teachers can successfully employ these new assessment strategies. • MEHE should ensure that CERD, DOPS, regional education officers and inspectors are instructed and supported in these assessment strategies so they can support teachers in the same. • MEHE, regional entities, and school should apprise and help parents understand new classroom-based models of assessment.

Goals	Objectives	Recommended Actions
Goal 4.4: Based on the professional development provided as part of Goal 4.3, teachers will use technology to support balanced assessments that inform teaching and learning.	• **Objective 4.4.1 Technology as part of assessment:** Ensure that, as part of learning, students use various and appropriate technologies to produce products and projects that demonstrate their mastery of particular content-related concepts or competencies. • **Objective 4.4.2 Authentic assessment tasks:** As part of instruction, integrate technologies to develop authentic learning tasks that, by their nature, blend assessment with instruction. • **Objective 4.4.3 Focus on content, not technology use:** Ensure that technology-rich products can be evaluated directly and accurately in relation to the intended learning outcomes of the curricular topic (not according to levels of technology use). • **Objective 4.4.4 Assess digital-age competencies:** Use various technologies as appropriate to assess student digital-age competencies. • **Objective 4.4.5 Assess hard-to-measure skills:** Use technology to allow for the creation of more learner-centered, digital-based products, such as digital portfolios, that can easily assess harder-to-measure competencies, such as student creativity, and which can be more easily updated and archived and shared. • **Objective 4.4.6 Self- and peer-assessments:** Integrate technology into learning activities to allow for teacher assessment, peer-based assessments, and self-assessment of learning and help students reflect on what and how they have learned, and articulate their thinking and progress on a range of topics. • **Objective 4.4.7 Assistive technologies for students with special needs:** Use assistive technologies to monitor students' responses, provide immediate feedback, and increase accessibility using particular exam software for students with particular physical and cognitive needs.	• Integrate these objectives, where applicable, into national curriculum review. • Include these objectives into professional development mentioned in Chapters 2, 3, 5 and 6. • MEHE should ensure ongoing support to teachers and principals so that teachers can successfully employ these assessment strategies. • MEHE should ensure that CERD, DOPS, regional education officers and inspectors are instructed and supported in these assessment strategies so they can support teachers in the same. • MEHE, regional entities, and school should apprise and help parents understand new classroom-based models of assessment.

Summary Table 5

Chapter 5: Technology and Professional Development: Goals, Objectives, and Recommended Actions

Goals	Objectives	Recommended Actions
Goal 5.1: As a part of integrating ICT into the professional development system, MEHE and its partners will assess and revise critical elements of the current system of pre- and in-service teacher instruction to begin to design a new framework for teacher learning and define the roles and responsibilities of each partner.	• **Objective 5.1.1 Teacher recruitment strategies:** Assess and revise procedures and criteria for recruiting, selecting, and instructing pre-service teacher candidates, especially as it relates to developing lesson plans and units of study, instruction, and assessment with technology. • **Objective 5.1.2 Teacher professional development system:** Assess and revise the current teacher in-service professional development, support, and evaluation system so that highly qualified teachers understand how to use subject-specific technology and instructional practices and are required and supported in doing so. • **Objective 5.1.3 Responsibilities for teacher professional development:** Define or redefine the roles and responsibilities of all stakeholders to help target high-quality professional development and ongoing supports to teachers as they teach with (and without) technology. • **Objective 5.1.4 Budget sufficient funds for professional development:** Allocate a certain percentage of all technology budgets for professional development and support for teachers. • **Objective 5.1.5 Standards for teaching with technology:** Develop or adapt standards for effective teaching with technology. • **Objective 5.1.6 Align pre- and in-service teacher education:** Put in place mechanisms to ensure increased collaboration, coordination, and coherence between pre-and in-service teacher education institutions, including the adoption of teacher competency standards for effective teaching with technology. • **Objective 5.1.7 Vertical and horizontal alignment:** Vertically and horizontally align and integrate teacher learning and support so that all "levels" within the educational system—the ministry, CERD, regional centers, school principals, head teachers, and teachers—coordinate and efficiently carry out their responsibilities for ongoing teacher learning and support. • **Objective 5.1.8 Evaluate professional development:** Ensure that schools and regions have reliable systems for evaluating the impact of professional development on teachers' practices and student learning.	• MEHE and CERD will undertake assessment, review and revision of current professional development and support system. • MEHE, CERD, the Faculty of Education at the Lebanese University and regional education departments articulate and coordinate roles and responsibilities vis-à-vis teacher placement, professional development, support, monitoring, and evaluation. • MEHE oversees coordination of teacher pre-and in-service activities between the Faculty of Education at the Lebanese University and CERD. • In addition to *ProGreSS SCaLe* teacher assessment tool, MEHE undertakes the creation of a accountability-based teacher evaluation system. • MEHE and CERD undertake review, assessment of current models of professional development and revise system based on research about effective professional development that integrates technology into content areas. • MEHE will work with schools to develop school-based technology support programs (part of this can be mandated by MEHE as part of RFP process for technology vendors).

Goals	Objectives	Recommended Actions
Goal 5.2: Enhance the qualifications and skills of MEHE, CERD, and partner organizations so they can develop and oversee the creation of an effective professional development program with high-quality professional development and support staff.	• **Objective 5.2.1 Standards for professional development:** Design or adapt international standards for high-quality professional development for the Lebanese context. • **Objective 5.2.2 Standards for professional development providers:** Design or adapt international standards for high-quality professional development providers in the Lebanese context. • **Objective 5.2.3 Build skills of professional development providers and support personnel:** Enhance the qualifications, skills, and competencies of existing professional development providers and DOPS staff so they can, in coordination with the central inspectorate, use technology to improve teachers' content knowledge, pedagogical content knowledge, instructional and assessment practices. • **Objective 5.2.4 Capacity building through e-learning:** Provide opportunities for national professional development and support staff, as well as regional level staff, to access ongoing e-learning opportunities so they are continuously augmenting their knowledge and skills to work more effectively with teachers. • **Objective 5.2.5 Build skills of school inspectors:** Provide ongoing professional development and support to school inspectors so that they can recognize and support best practices in instruction and assessment, with and without technology. • **Objective 5.2.6 Assess effectiveness of teacher professional development:** Use technology to develop measures, gather information, and ascertain the effectiveness of teacher professional development programs and teacher support systems to support increased student achievement.	• MEHE will adopt/adapt international standards on technology use for teachers, students and administrators (e.g., ISTE's NETS-A standards, NETS-T standards, Nets-C Standards (for coaches and teacher support personnel), NETS-S standards, UNESCO ICT Competency Framework for Teachers, etc.). • MEHE will design/adapt standards outlining high-quality professional development. • Upgrade knowledge and skills of current Faculty of Education, CERD and DOPs staff in research-based, high-quality professional development (See Figure 31)—particularly in TPACK framework. • Link all technology-related professional development to international standards on technology use for teachers, students, and administrators. • MEHE and CERD will develop measures of effective professional development and teacher outcomes (linked to *ProGress SCaLe* tool) and measure professional development programs against these measures. • MEHE will work with DOPS to provide school-based instructional support for teachers using ICT.

Goals	Objectives	Recommended Actions
Goal 5.3: *MEHE, CERD, and partners* will design, implement, and oversee models of professional development system that helps teachers integrate technology with content, instruction, and assessment and that is aligned with research findings and best practices on high-quality teacher professional development.	• **Objective 5.3.1 Standards for teaching with technology:** Develop or adapt ICT competency standards for effective teaching with technology. • **Objective 5.3.2 Institutional collaboration for teacher professional development:** Put in place mechanisms to ensure increased collaboration, coordination, and coherence between pre- and in-service teacher education institutions, including the adoption of teacher competency standards for effective teaching with technology. • **Objective 5.3.3 Blended opportunities for teacher learning:** Implement a high-quality professional development program, both online and face-to-face, that adheres to best practice in teacher instruction. • **Objective 5.3.4 Develop professional development standards:** Adopt as Lebanon's national professional development framework the professional development standards designed by iNACOL and the National Staff Development Council with modifications for the Lebanese context. • **Objective 5.3.5 Differentiate professional development:** Move beyond workshops and trainings to institute professional learning opportunities (such as lesson study, in-class coaching, etc.) that have been shown to improve teaching quality. • **Objective 5.3.6 Align professional development with the work of teaching:** As part of professional development, align teachers' learning opportunities with their real-life work experiences, using actual curriculum materials, lesson plans, assessments, and student work. • **Objective 5.3.7 Provide ongoing support for teachers:** Provide ongoing in-person, online, and technology-based classroom support to help teachers implement, practice, and refine with their students what they have learned in professional development sessions. • **Objective 5.3.8 Create school-based models of good practice:** Establish a number of professional development schools throughout Lebanon that will serve as models of technology excellence to enhance professional development opportunities for teachers, and promote greater articulation between pre- and in-service teacher education.	• MEHE will adopt/adapt ISTE's NETS-T or UNESCO's ICT Competencies for Teachers Framework. • Continued and robust expansion of LEBNEN and release of sufficient bandwidth to schools and teacher centers to support access to multimedia, streaming video and e-learning for MEHE will adopt/adapt iNACOL or JISC's standards for quality online professional development. • Part of above-mentioned assessment of teacher professional development system will focus on optimal modes of professional development (online, face-to-face and blended) and designing for each. • MEHE will begin to identify high-quality providers of e-learning for continued teacher professional development. • MEHE will introduce school-based coaching programs that enhance the skills of DOPS to support teachers in using ICT for teaching and learning while simultaneously supporting teachers in these endeavors. • MEHE will begin to identify necessary teacher incentives and relationships between private and public schools.

Goals	Objectives	Recommended Actions
	• **Objective 5.3.9 Establish relationships between public and private schools:** Cultivate ties between private and public schools so that teachers in each school can share practices and ideas, model classroom activities, and share resources and experiences. • **Objective 5.3.10 Teacher incentive system:** Develop an incentive system (both extrinsic and intrinsic) that encourages teachers to proactively seek out and participate in relevant and high-quality ongoing professional development opportunities and further formal study. • **Objective 5.3.11 Teacher accountability:** Incorporate mechanisms in the teacher evaluation system that hold teachers accountable for engaging in meaningful and regular professional development opportunities. • **Objective 5.3.12 Assess teachers:** Use both teacher competency standards and the *ProGReSS SCaLe* observation tool to evaluate teachers so that integrating technology in combination with learner-centered practices form part of the observable criteria on which teachers are evaluated.	

Goals	Objectives	Recommended Actions
Goal 5.4: Technology will be used to provide equitable access to high-quality professional development for teachers and teacher educators in all grade levels, subject areas, and across all regions of Lebanon.	• **Objective 5.4.1 Equip teacher centers:** Teacher resource centers in all governorates will be equipped with appropriate infrastructure and applications to provide teachers and teacher educators with continuous access to technological tools, digital applications, and software. • **Objective 5.4.2 Connect teachers in remote areas to larger communities:** Teachers and teacher educators in remote areas of Lebanon will engage in ongoing, convenient, relevant, and differentiated professional development opportunities through regular access to online professional development resources and online communities. • **Objective 5.4.3 Target learning for teachers and teacher educators:** Teachers and teacher educators in all regions of Lebanon will, via technology, participate in professional learning opportunities that allow them to deepen their own content knowledge, broaden their access to instructional practices, provide them with curriculum and content supports, view models of good instruction with and without technology, and promote reflection and dialogue with other teachers or content-area experts. • **Objective 5.4.4 Real-time communication and collaboration:** Technology will be used to facilitate regular communication and collaboration between school leaders, teachers, teacher educators, and professional development institutions/facilities. • **Objective 5.4.5 Just-in-time and just-as-needed professional development:** Using technology, teachers and teacher educators will have continuous and "just-in-time" opportunities to enhance the capacity and knowledge necessary to develop new teaching and learning processes that allow for the effective use of ICT in the classroom.	• MEHE will adopt/adapt teacher competency standards for teaching with ICT and use these as basis by which to design high-quality professional development programs. • As part of re-assessment of teacher professional development system, MEHE and CERD will focus on using TPACK framework of professional development in which focus of professional development is augmenting teachers' content skills and using technology, content-related pedagogical practices and assessment within that particular content area. • The Principal Leadership Development Program is revised to help principals become instructional leaders. • CERD/MEHE include inspectors in professional development so they can recognize and encourage good instructional practice with technology. • MOT and MEHE expand connectivity through LEBNEN into all areas of country, particularly traditionally underserved regions. • MEHE identifies high-quality e-learning providers. • MEHE, with school leaders, officially increases required number of teacher professional development days, institutionalizes a mix of internal and external incentives to encourage teachers to pursue professional development opportunities and secure release time for teachers to do so.

Goals	Objectives	Recommended Actions
Goal 5.5: As a result of Goals 5.1 through 5.4, teachers and teacher educators will demonstrate competencies in using a variety of technologies that research has demonstrated promote high-quality instruction that improves student learning.	• **Objective 5.5.1 Content mastery:** Learning with and through technology, help teachers attain and demonstrate mastery in the content areas that they teach. • **Objective 5.5.2 Technology integration:** Teachers and teacher educators will understand how students learn and be able to demonstrate how to select and use appropriate digital content, devices, pedagogies, and assessment to support student learning. • **Objective 5.5.3 Balanced assessment:** Teachers and teacher educators will be able to use various computer-based assessment and technology applications to develop formative and summative assessment tools, such as rubrics and digital portfolios. • **Objective 5.5.4 Data analysis:** Teachers and teacher educators will be able to use technology for a variety of professional purposes that contribute to instructional quality—to analyze student data for effective interventions, differentiation, or remediation for students; to provide feedback and guidance to students; to plan interactive, engaging, and rigorous units of study lessons and activities; to supplement and complement other forms of content; and for diagnostic, formative, and summative assessments. • **Objective 5.5.5 Use assistive technologies:** Teachers and teacher educators will be able to select, use, and evaluate assistive technology tools that are tailored to the students' individual needs, abilities, and experiences. • **Objective 5.5.6 Collaboration:** Teachers and teacher educators will be able to use technology to collaborate with colleagues; to communicate with parents about their child's progress and performance; and for their own continuous formal and informal professional learning. • **Objective 5.5.7 Learner-centered pedagogies:** Teachers and teacher educators will demonstrate competence in classroom-based use of ICT that supports the application of various models of learner-centered pedagogy. • **Objective 5.5.8 Meet performance standards:** To prepare them for digital-age teaching, teachers and teacher educators will adhere to the technology-related competencies outlined by ISTE's NETS-T standard and teacher educators will adhere to both NETS-T and the National Teacher Leadership Standards.	• Fulfillment of these objectives is contingent upon meeting the recommendations outlined in Goals 5.1-5.4.

Summary Table 6

Chapter 6: Technology and Leadership: Goals, Objectives, and Recommended Actions

Goals	Objectives	Recommended Actions
Goal 6.1: *MEHE, the Faculty of Education (FED) at the Lebanese University, and CERD* will build the skills of principals to function as digital-age leaders.	• **Objective 6.1.1 Standards for school principals:** MEHE and FED will adopt and implement standards by which school principals will be recruited, retained, and assessed. • **Objective 6.1.2 Strategies for recruiting principals:** Through instruction that focuses on practical experiences and rigorous performance evaluation for principals, MEHE and FED will raise the caliber and qualifications of principals entering the school system. • **Objective 6.1.3 Train school principals:** MEHE and FED will provide new principals with practices that have been shown to improve leadership effectiveness, such as high-quality induction programs and ongoing support programs (such as coaching, mentoring, and ongoing access to a community of peers); and greater decision-making authority and autonomy at the school level. • **Objective 6.1.4 Continuous education and support for school principals:** MEHE and FED will offer opportunities for ongoing learning for principals, such as continuing education and support and the availability of challenging career tracks and promotions based on performance. • **Objective 6.1.5 Professional development for regional staff:** MEHE, FED, and CERD will provide principals and staff of regional education departments with professional development that focuses specifically on using technology to improve instruction and assessment so that principals can better support teachers in these endeavors. • **Objective 6.1.6 Hold schools accountable for using ICT:** MEHE will use ICT to create accountability systems that hold school leadership and regional education departments answerable for using ICT as part of teaching and learning.	• MEHE will provide technology and Internet connectivity to schools and classrooms through a variety of programs (expansion of tablet initiatives and of LEBNEN plus nationwide provision of technology and connectivity in various configurations). • MEHE will establish a nationwide education management information system (including Student Information System) and train principals and teachers on its use. • MEHE and FED will examine current requirements for new principals and explore feasibility of high-quality induction and mentoring programs for principals. • Expand functionality of principals portal (part of Principals' Leadership Development Program), principals' summer institutes, and online mentoring for new principals. • Expand Principals' Leadership Development Program, which presently focuses on these objectives.

Goals	Objectives	Recommended Actions
Goal 6.2: *School principals* will demonstrate digital-age leadership by promoting the use of technology for high-quality instruction and assessment in their schools.	• **Objective 6.2.1 Demonstrate understanding of quality instruction:** School principals and heads of regional education departments will understand how technology can support and extend quality teaching, learning, and assessment well enough to actively monitor teachers in its implementation. • **Objective 6.2.2 Supportive leadership:** School principals will promote leadership and autonomy among teachers, encouraging risk taking and learning from mistakes, and facilitating the creation of a school-based community of practitioners. • **Objective 6.2.3 Shared decision-making:** School principals will increase the level of teacher involvement in the development and adoption of ICT for instruction, assessment, and data management by encouraging and formally empowering teachers to assume leadership roles as part of educational technology planning and implementation. • **Objective 6.2.4 Community outreach:** School principals will involve parents and community members in decisions around the use of ICT by inviting parents and community members to schools to sit in on lessons and soliciting their ongoing support, involvement, and ideas. • **Objective 6.2.5 ICT literacy for parents:** Principals, in partnership with the regional education departments, will construct and maintain networks and programs that raise parents' awareness of the use of technology in schools and provide them with opportunities to acquire basic technological skills.	• The Principals' Leadership Development Program is under revision—new modules will be added to help principals in these endeavors. • In addition to principals' portal, MEHE will offer monitoring and support to help principals attain these objectives.

Goals	Objectives	Recommended Actions
Goal 6.3: Using this national educational technology strategic plan as their guide, *schools* will develop a school-based technology plan covering infrastructure, digital content and learning resources, teacher capacity, and intended learning outcomes for students.	• **Objective 6.3.1 Develop a vision:** School principals will develop and advance a formalized, school-based vision for innovative teaching and learning with technology, and communicate this vision to teachers, parents, community members, and other stakeholders. • **Objective 6.3.2 Set goals for using ICT:** Starting with the lowest-performing schools, set specific goals for using ICT to support improved student achievement at individual schools, including a fixed timeline for attaining goals. • **Objective 6.3.3 Ensure school-based technology access:** Ensure that students have access to modern, high-quality digital devices, Internet connectivity, relevant and standards-based digital content, appropriate software and applications to meet particular learning needs, and innovative instruction and assessment supported by technology. • **Objective 6.3.4 Enable accessibility for all students:** Secure assistive technology, universally designed content, and digital supports for students with particular physical or cognitive needs. • **Objective 6.3.5 Provide training and support to teachers:** Provide additional financial and personnel resources (professional development, technical support, ongoing support for teachers, and support for consistent implementation of ICT initiatives throughout educational regions) to help teachers use ICT as part of instruction, assessment, and information management to improve student achievement. • **Objective 6.3.6 Budget for technology:** School principals, in collaboration with MEHE, will provide a financial, long-term commitment to the school's technology program. • **Objective 6.3.7 Ongoing communication among educational levels:** School principals and heads of regional education offices will communicate regularly with schools and stakeholders about program implementation. • **Objective 6.3.8 Strategic choices around ICT:** School principals, in collaboration with MEHE and CERD, will learn how to make strategic choices in the context of using ICT, including infrastructure, training, budgeting, and support. • **Objective 6.3.9 Data-driven decision-making:** Use ICT, such as SISs, in the data-driven decision-making process concerning instruction.	• The Principals' Leadership Development Program is under revision—new modules will be introduced to help principals in these endeavors. • In addition to principals' portal, MEHE will offer monitoring and support to help principals attain these objectives. • MEHE will work with principals on planning around securing reliable electrical supply, school design and refurbishment to support technology, technical support, results-based management, and budgeting for technology.

Goals	Objectives	Recommended Actions
Goal 6.4: *Every school principal and regional education officer* will have a minimum set of professional technology skills, aligned with standards, for the purposes of productivity, communication, data management, and ongoing learning.	• **Objective 6.4.1 Support regional educational staff:** MEHE and CERD will provide principals and regional education officers with ongoing training and support in specific, job-related ICT operations (such as e-mail, search engines, spreadsheets, databases, and SISs). • **Objective 6.4.2 Use technology for productivity purposes:** School principals and regional education officers will use a variety of electronic communication tools, such as e-mail, chat, Voice over Internet Protocol (VoIP), discussion forums, and social media to communicate digitally with teachers, other principals, parents, and national/governorate/regional educational personnel. • **Objective 6.4.3 Use specific job-related technologies:** School principals and school financial officers will be able to use specific technology applications to keep track of school finances and plan and monitor school-based expenditures. • **Objective 6.4.4 Ongoing professional development:** School principals and regional education officers will participate in online courses and conferences, discussion groups, professional social media sites, and online communities of practice to continuously augment and refine their managerial, communication, administrative, and instructional leadership skills.	• Expand Principals' Leadership Development Program which presently focuses on these objectives. • MEHE's communication to schools will be via electronic networks so that principals are required to use networked communications tools. • School-based technical support to help principals (and teachers) troubleshoot basic technology problems and to attain proficiency in productivity skills.

Appendix B: Technology Evaluation Recommendations

As noted in Section 3, the majority of current technology-related initiatives in Lebanese schools conduct either no evaluation or the most perfunctory type of evaluation on their programs. This represents a lost opportunity to find out what truly works and to fix what doesn't work. The utility of evaluations can be enhanced greatly if they include ongoing monitoring, continuous interim data collection and analysis, and necessary revision so that accumulated data about major outcomes are available before the initial funding or program ends.

Despite the absence of unit-level evaluation capacity at the MEHE, rigorous and unbiased evaluations should be an ongoing part of any technology initiative. Until such time that MEHE develops such unit-level capacity, the SPDT proposes the following:

- **Make technology-program implementers responsible for the evaluation of these programs:** As part of the formal tender or Request for Proposals (RFP) process, potential implementers and providers of all current and future technology-related initiatives should secure an external, unaffiliated evaluator to provide ongoing and final assessments of technology-related initiatives. The funding for this evaluation would come out of the total amount of funding given to implementers to carry out educational technology initiatives.
- **Make evaluation an ongoing component of the implementation plan:** Evaluations should be planned during the actual program design and conducted during implementation. Indeed, many of the objectives listed in this strategic plan can serve as a set of metrics and indicators, serving as a foundation for sets of measurable programmatic and contextual outputs, outcomes, and impact.
- **Make sure that impact evaluations ask the right questions and choose effective measures:** Plan an evaluation of sufficient size and duration to measure the impact and investigate plausible causal claims. Where attribution of impact is more of a conjectural nature, it is important to complement impact evaluations with process evaluations (Feinstein, 2012: p. 111).
- **Make sure that the program is "ready," or mature enough to be evaluated:** The process of implementation is a multiphased one. Evaluations of newly implemented programs may yield poor results, not because the program is ineffective but because the results were assessed before it was completely implemented (Fixsen et al. 2005: p. 18).

This speaks to the importance of allowing programs to "mature" and making sure that evaluations are not themselves premature. Programs, like people, need time to settle, consolidate, and mature. While process evaluations are

helpful in determining what needs to be corrected and revised during start-up and pre-consolidation phases of a program, outcome and impact evaluations should be undertaken only after programs are fully operational. A premature and unflattering evaluation can eradicate a program that might have been highly successful had it been allowed to mature and continue. Careful decisions about the maturity of a program should be part of any logic model design and program design.

- **Ensure that the treatment group is compared to something**—either to itself, before the start of the program, or better still to a control group or a comparison group who share similar characteristics with the treatment group but who did not receive the intervention. The comparison group is used to identify the counterfactual of what would happen *without* this program. The comparison group may be created through randomization or propensity matching. Without the establishment of a comparison group, seemingly positive results may be the result of a variety of confounding factors—teacher maturation, self-selection bias, etc.[41]

It is recommended that control groups be used wherever feasible. Where doing this is not feasible, it is important to consider rival plausible hypotheses and use evidence to determine if these hypotheses have more solid foundations (Feinstein, 2012: p. 111).

- **Dedicate time and resources to evaluations:** The multiple components of evaluations (design, process analysis, observation of interventions, periodic site visits, monitoring to assess program implementation and generalizability, interviewing beneficiaries, and assessing client outcomes and satisfaction) consume a good deal of time and resources. Skimping on resources for evaluation assures that the evaluation will be shoddy. It is important that there be a dedicated budget for evaluation. We suggest that program implementers be required to dedicate a line item to the total funding of the intervention to be used exclusively for evaluation.
- **Create timelines of impact:** In multifaceted initiatives, such as the implementation of a national technology strategy, consider using timelines of impact. Simply put, a timeline of impact specifies how long it should take for a given process to affect some proximal indicator in the causal chain. For example, while it may take a year and a half to provide hardware and connectivity for schools, productive use of this hardware and software may take longer and teacher attitudinal shifts about the utility of computers as learning tools longer still. These temporal differences need to be acknowledged and considered in program planning for a number of reasons. First, they allow stakeholders to develop clear expectations very early on about the areas and ways in which the program can affect outcomes. Next, they help stakeholders understand that causality can be affected by temporality and build this knowledge into program design (e.g.,

41 For a variety of reasons, many governments and donors settle on **a within groups pre- and post-test design**. Yet a pre- and post-test design provides no interpretable evidence because, without a control group, it's impossible to determine whether any gains are due to professional development, to maturation, or to other causes.

use knowledge gained to build and revise subsequent stages of a program). Third, they help stakeholders distinguish among failures in program impact to determine whether the next step in the model has simply not occurred yet or whether it will ever occur (Sridharam, Campbell, and Zinzow, 2006). Finally, in addition to informing program design, timelines of impact can inform the evaluation design by answering questions around the timing of data collection and resource allocation for data collection.

- **Develop standards by which to measure the impact of computers on student learning:** Presently, there are no internationally comparable standards about ICT effectiveness, nor are there such standards within Lebanon. Therefore, it is often impossible or ineffective to compare results from one classroom technology program to that of another in a different geographic location, or even among schools in the same location. Governments or donors often allocate little in terms of resources and personnel to carry out meaningful evaluations. By developing standards and associated metrics by which impact could be measured, the Lebanese government could accurately assess the effect of ICT and compare results across schools, jurisdictions, or regions with some degree of confidence. Further, by measuring the impact of the first cohort of teachers, students, and schools to integrate ICT into teaching and learning as part of a national initiative, MEHE will have longitudinal data against which they can measure implementation over subsequent years and which will allow them to build a full body of data by which the effectiveness (or lack thereof) of efforts can be best understood.

Appendix C: Open Education Resources[42]

OER Projects: Object Repositories, Courses, and Courseware:

- Carnegie Mellon University (OLI): http://www.cmu.edu/oli/
- Creative Commons: http://creativecommons.org
- Curriki: http://www.curriki.org/
- HippoCampus (NROC): http://new.HippoCampus.org
- MIT+K12 videos: http://k12videos.mit.edu/
- NROC Math: http://nrocmath.org
- OER Commons: http://www.oercommons.org/
- Open High School of Utah: http://www.openhighschool.org/
- Open CourseWareConsortium: http://www.ocwconsortium.org
- Rice Connexions: http://cnx.org
- Saylor Foundation: http://saylor.org

Open Textbook Projects:

- California Learning Resource Network: http://www.clrn.org/home/
- CK12: http://www.ck12.org/flexr/
- College Open Textbooks: http://collegeopentextbooks.org/

Open Portals, Repositories, Referatories, and Specialized Collections:

- Digital Learning Commons: http://www.learningcommons.org/
- EdModo: http://edmodo.com
- Georgia Virtual Learning: http://www.georgiavirtuallearning.org/Resources.aspx
- ide@s (U of Wisconsin System): http://www.ideas.wisconsin.edu
- iTunes U: http://www.apple.com/education/itunes-u/
- K12 Open Ed Wiki: http://www.k12opened.com/
- Khan Academy: http://www.khanacademy.org/
- Merlot: http://www.merlot.org
- National Science Digital Library: http://nsdl.org/
- NOAA: http://www.education.noaa.gov/
- PBS Teachers: http://www.pbs.org/teachers/
- PhET: http://phet.colorado.edu/en/simulations/category/new
- Teacher's Domain: http://www.teachersdomain.org/

42 Courtesy of the National Repository of Online Courses (NROC) 2012.

- Teacher Tube: http://www.teachertube.com/
- Wisc-Online: http://www.wisc-online.com

Other Information:

- Connexions online course about working with OER: http://cnx.org/content/m15211/latest/
- Copyright issues: http://creativecommons.org/
- Free rubrics for evaluating OER: http://www.achieve.org/OER-rubrics
- Overview of open content and terminology and developing open content: *Distance Education for Teacher Training: Modes, Models and Methods* (Chapter 18, pages 222–241): http://go.edc.org/07xd
- UNESCO OER Toolkit: http://oerwiki.iiep.unesco.org/index.php/Main_Page
- WikiEducator OER Handbook for Educators: http://wikieducator.org/OER_Handbook/educator_version_one/Introduction/Why_OER%3F

Appendix D: Energy Provision Contingency Strategies

Without a reliable electricity supply, many schools will be unable to participate in the activities of this strategic plan. Conventional, grid-based electricity generation and supply is uneven at best in Lebanon, and this adversely affects a number of schools. This strategic plan offers some suggestions of workarounds to address these issues, noting that these ideas are not substitutes for a fully functional and reliable national grid.

- **Attention to energy consumption requirements of digital devices:** Not all digital devices consume the same amount of electricity. For instance, desktops demand a constant power supply, while laptops have 3–5 hours of battery life, tablets 8–10 hours, and black and white e-reader batteries may last up to 10 days.[43] Wattage requirements vary among the same devices depending on screen resolution, type of ink, and year of make. MEHE should examine the purchase of digital devices that require less electrical consumption.[44] This could involve forgoing desktop computers for laptops and tablets and migrating from fixed broadband Ethernet connections to exclusive wireless connectivity.[45]
- **Use solar energy for electricity supply:** Lebanon, particularly certain regions of the country, has a high rate of solar insolation (the total number of sunny days per year)—particularly during non-winter months. Solar paneling[46] can be used to run individual low-consumption technology devices. For instance, one 100-watt solar panel can generate 400 watt-hours of electricity. Solar power can be used for low-power devices (such as charging cell phones), while electricity can be used for high-power devices (a roomful of computers).[47] Globally, the cost of solar equipment has fallen by one-third since 2010 (Economist, 2012), meaning that solar power inevitably will be affordable even without subsidies. Thus, MEHE should investigate the costs and feasibility of solar paneling provisions for schools, particularly in areas with unreliable power supplies.
- **In existing and future schools, use passive solar design techniques to reduce electricity costs:** In addition to solar panels, passive solar design techniques, such as direct and indirect sunlight gain systems, sunspaces, and natural day lighting techniques can also be used by schools to minimize reliance on the electricity supply within classroom and office space. Similarly, day lighting techniques, such as changing the size and

43 These are general, broad 2011 data.
44 Although energy requirements vary, the quality remains the same.
45 For a variety of reasons, fixed broadband, along with wireless, is a preferable mode of connectivity in schools.
46 This particularly applies to south-facing schools with appropriate roofs or sufficient yard space for solar panels.
47 A solar panel with a controller, charger, battery, 220 AC converter, or one that goes directly to DC costs about $115 (2011 data). It will, however, lose approximately 15 percent of electricity in conversion.

orientation of window openings, the use of skylights, large windows, and light shelves with translucent glazing that allows light into spaces without excessive heat gain can minimize the need for artificial light (or cooling systems) in classrooms and school offices. This in turn will result in some reduction in electricity costs. In some cases, this may involve retrofitting buildings, while in other cases, it can be part of existing and ongoing building rehabilitation. This, along with other green design techniques, should be standard practice in the design of new schools.

- **Expand the use of generators and Uninterruptible Power Supplies (UPS):** Schools can continue to run electricity through generators (although the presence of more computers will demand more generators and more fuel) and use UPS units for servers. However, this is more of a "Band-Aid" fix than a means of actually solving the problem of unreliable energy.

Appendix E: Strategies for Lowering the Costs Associated with Technology Purchases

Access to equipment and high-speed connectivity is the foundation for this technology strategic plan, and obviously, the presence of and requirements around technology will impose new costs on schools. With that in mind, this strategic plan proposes a number of strategies that regions, sets of schools, and individual schools may investigate in order to defray and/or lower the costs associated with technology.

- **Investigate TCO models:**[48] MEHE should work with schools to ensure that budgeting aligns to national and school goals; that it is transparent, with specific line items for specific technologies; that stakeholders (such as teachers, parents, students, and principals) are granted input in budgeting decisions; and above all, that it factors in technology's total cost of ownership from 2012–2017.
- **Bring Your Own Device/Bring Your Own Technology (BYOD/BYOT) programs:** To reduce the need for purchasing digital devices and reduce budget pressures, many local education agencies in many nations are promoting BYOD/BYOT programs, in which students who have laptops or tablets at home bring them to school. This way, schools purchase equipment to be used in school by students with no access to technology. Although there are numerous networking issues associated with such a strategy, it leverages students' home technology to increase technology access in schools and lower purchasing costs.
- **Tap into existing high-speed connections:** MEHE and MOT should work with existing institutions, municipalities, or businesses to allow schools to "piggyback" off existing fiber-optic connections and fixed infrastructure. This way, schools can use existing high-speed backbones for high-capacity Internet connectivity (such as e-learning and accessing online, multimedia-based educational websites) and procure their own lower-capacity Internet capacity or WiFi for low-speed Internet use, such as administrative uses of the Internet (e-mails or accessing alphanumeric online databases).
- **Investigate Internet providers outside of Lebanon:** There are a number of international for-profit and not-for-profit entities that provide reliable, and in many cases, lower-cost Internet connectivity to schools than is currently the case in Lebanon. If it is not already the case, the regulatory environment should be modified or exemptions established to allow educational institutions to purchase Internet bandwidth from these entities in order to fulfill a critical element of this national ministerial strategic plan.

48 See, for example: http://www.vitalwaveconsulting.com/pdf/2011/Affordable_Computing_June08.pdf or http://www.cosn.org/initiatives/classroomtotalcostofownership/cosngartnert-cotool/tabid/5124/default.aspx

- **Take advantage of economies of scale:** MEHE should work with schools to enforce standardization through single-point purchasing to increase bulk purchase discounts, decrease the inventory of spare supplies, and reduce the need for technical support. MEHE will issue specific requirements for technology companies (such as leasing, maintenance, replacement, upgrading, training, and technical support) as standard components of any purchasing agreements.
- **Practice sustainable technology:** MEHE should work with schools to ensure that they do not purchase more technology than they can regularly maintain, replace, or upgrade. MEHE will rotate some technology (buying new computers with the fastest available processors and the most Random Access Memory (RAM) for tasks that require these elements—e.g., highly graphics-intensive programs). As an example of rotation, new equipment could go to classrooms, while any classroom equipment that newer digital devices replace could go to IT classes. Computers from IT classes could move to the library. The oldest machines could be used for less processor-intensive activities like writing.

MEHE could also work with schools to identify and remove computers that are at the end of their lives. This equipment consumes space, electricity, and maintenance budgets even when it is not being used, as is often the case. MEHE could work with schools to sell this equipment at reduced prices to families or else recycle it. Similarly, MEHE could help schools develop criteria for accepting donated digital devices, especially those nearing their end of life cycle, from businesses.

- **Capitalize on free and open content:** As has been mentioned in this strategic plan, one place where schools can save money on technology is software, by using open-source software applications and open educational content,[49] as well as allowing students to take free online courses through open courseware initiatives, Massively Open Online Courses (MOOCs), and online social learning communities (like *Sophia,*[50] for example) for which they could receive digital badges conferring some degree of school credit. Schools could also save money by purchasing minimally featured versions of commercial products (as opposed to full-featured), using Web-based software applications such as Google Apps, and employing "the cloud" for free storage and retrieval of data. Appendix C of this strategic plan lists a number of open-content repositories and resources for education.
- **Use e-books instead of paper textbooks:** Digital textbooks (e-books) are less expensive than print-based textbooks, in terms of updating and distributing content, and only promise to become more so—by orders of magnitude. School systems across the globe are taking advantage of such savings by switching from print-based textbooks to e-books. MEHE should help schools do the same.

49 For another list of free and open-source educational content, see School Computing: Best Free Software at http://schoolcomputing.wikia.com/Best_Free_Software

50 See http://www.sophia.org/

- **Stop supporting obsolete technologies:** Further school technology savings can be realized by jettisoning old equipment, software, and technologies, such as VHS tapes and players, overhead projectors, 16-mm film projectors, cassette tapes and players, and many types of desktop-based software (wherever cloud-based software alternatives prove to be equal or superior in terms of functionality). In some cases, these technologies account for higher energy consumption and more maintenance than newer technologies.

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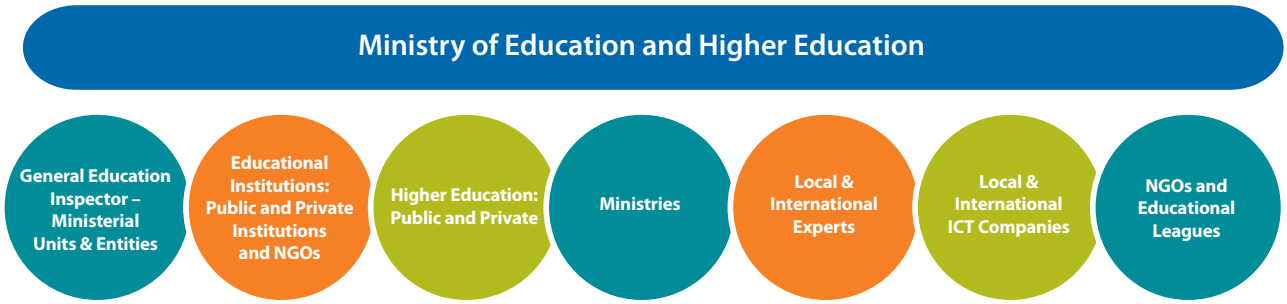
Review of This Strategic Plan

Oversight and review of Lebanon's national educational technology strategic plan was provided to the SPDT by a group of reviewers March–May 2012, followed by a one-day meeting on June 8, 2012, with a number of Lebanese stakeholders. The latter group included the following:

Group Reviewers



Institution/Association	Category
Al Ourfan Association	Local and International NGOs and Educational League
Amal Educational Institutions	Local and International NGOs and Educational League
American University of Beirut (AUB)	Higher Education
Amideast/D-RASATI	Local and International NGOs and Educational League
Association of the Lebanese Software Industry (ALSI)	Local and International NGOs and Educational League
Azm Educational Campus	Pre-educational Institution—Public and Private
BMB	Local and International ICT Companies
British Council	Local and International NGOs and Educational League
Center for Educational Research and Development (CERD)	General Education Inspector—Ministerial Units and Entities
Choueifat Official Secondary School	Pre-educational Institution—Public and Private
Cisco	Local and International ICT Companies
Cooperative Housing Foundation (CHF)	Local and International ICT Companies
Dhour El Shweir Official Secondary School	Pre-educational Institution—Public and Private
Education Development Center EDC/D-RASATI Project	Local and International Experts
Educational Research Center (ERC)	Local and International Experts
Edulab	Local and International Experts
Habib Publishers	Local and International NGOs and Educational League
Haigazian University	Higher Education
Intel	Local and International ICT Companies

Institution/Association	Category
International College (IC)	Pre-educational Institution—Public and Private
International Education Association (IEA)	Local and International ICT Companies
International Orthodox Christian Charities (IOCC)	NGOs and Educational Leagues
Lebanese American University (LAU)	Higher Education
Lebanese Association of Educational Studies (LAES)	Local and International NGOs and Educational League
Lebanese International University (LIU)—Faculty of Education	Higher Education
Lebanese University—Faculty of Education	Higher Education
Mabbarat Association	NGOs and Educational Leagues
Microsoft Corporation	Local and International ICT Companies
Midware Data Systems (MDS)	Local and International ICT Companies
Ministry of Education and Higher Education (MEHE)	Ministries
Ministry of Telecommunications (MOT)	Ministries
Mustafa's Schools Islamic	Pre-educational Institution—Public and Private
Notre Dame Louaize	Higher Education
Office of the Prime Minister	Ministries
Primary Education League	NGOs and Educational Leagues
Promethean	Local and International ICT Companies
SABIS International Schools	Pre-educational Institution—Public and Private
Syndicat des editeurs scolaires	NGOs and Educational Leagues
Telecommunications Regulatory Authority (TRA)	Local and International ICT Companies
Triple C	Local and International ICT Companies
U.S. Agency for International Development (USAID)	Local and International NGOs and Educational League

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