



# **Projects for the use of Information and Communication Technologies in Education**

**Conceptual Framework**

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Development Bank**

Education Division  
(SCL/EDU)

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# **Projects for the use of Information and Communication Technologies in Education**

## **Conceptual Framework**

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### **Summary**

Incorporation of Information and Communication Technologies (ICTs) into areas of education is no longer optional. Countries, regions and schools are driven to develop new initiatives that take into consideration the incorporation of these tools into teaching and learning processes, so that education systems can connect the society's new demands for knowledge with the new characteristics of the learners who are part of these systems.

This document presents and describes a Conceptual Framework that endeavors to support the design, implementation, monitoring, and evaluation of projects that aim to incorporate the use of ICTs for the purpose of improving the quality of education. It also presents a list of indicators that can aid in achieving this purpose if aligned with the Conceptual Framework itself.

This work is part of the IDB-led initiative to develop, in tandem with other international organizations, a common Framework and Indicators that will lend support to decision making in different countries.

## I. Introducción

Insufficient evaluation of initiatives to incorporate ICTs into education is the result of intuitive development that often lacks rigor, but it is also related to a lack of specific reliable instruments for measuring these impacts, properly separating them from other innumerable variables present in education processes, and that are dynamically affected by the introduction of ICTs.

Measurements available to date, therefore, are not conclusive to inform the decision making process involving what to do and how to do it with the aim of improving the quality of education.<sup>1</sup> Lack of clarity regarding this map of options and of the areas to be affected by these interventions represents an obstacle to development of successful projects aimed at incorporating ICTs into education.

Most likely, this lack of instruments is the natural consequence of incipient development of this process. If we consider that personal computing has existed for barely 30 years, that computers first got to schools only 20 years ago (originally intended to strengthen the education of programmers to supply the emerging computer industry), it seems reasonable for us to still have many unanswered questions regarding the way in which ICTs can produce their best contribution toward improving the quality of education.

In fact, recent literature has drawn attention to the lack of innovation phenomenon in educational practices incorporating ICT, with the caveat that so far the greatest amount of experience has been limited to "computerization" of processes and practices, which continues to repeat the same actions of the past, but now with the support of computers and other technological devices. The predictable consequence is that impact on results will be quite limited.

This document presents a general Conceptual Framework to support the design, implementation, monitoring and evaluation of projects where Information and Communication Technologies have been incorporated to improve education quality.

The basic assumption behind this conceptual framework is that all education projects focus their concern on their students achieving better learning experiences. The objective expected and measured in these projects must then be the impact that it has on learning

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<sup>1</sup> The exercise to establish a "knowledge map" developed by the World Bank InfoDev (Michael Trucano, 2005) showed how, beyond the large investments made in many countries to use ICTs in education systems, data to support the affirmation of its role in improving education are limited and debatable.

experiences and on changes resulting from their implementation and the introduction of ICTs into education systems.

While focusing on learning experiences, we must consider that expected results may be of a different order. We must first take into consideration:

- Improvements in students' commitment to and involvement with the learning process as reflected in their participation and continuance in this process
- Changes in the practices of teaching and learning of students, educators, schools, and communities

These changes and improvements have a direct, necessary relationship with producing effective impacts on the improvement of:

- Cognitive (curricular) learning experiences;
- Development of the non-cognitive skills or "21<sup>st</sup> Century Skills," including the acquisition of skills in Information and Communication Technologies management itself<sup>2</sup>

The proposed Framework identifies five inputs that should be considered in an education system or in each specific project, its planning processes and products, and those processes that, though not directly involved, can be affected by the development of the project.

It also aims to incorporate the process of monitoring and evaluating each project in a more attentive and rigorous fashion than that applied to date. Review of relevant data before the specific intervention (Baseline), during the implementation process (Follow-up or monitoring) and at the conclusion of the project's formal intervention (Final evaluation), form a fundamental, active part of the general framework proposed.

The use of indicators to measure the level of development and maturity of the systems will be an indispensable tool for policy decision-making supported by solid data and specific knowledge.<sup>3</sup> Plans and projects have not always taken sufficiently rigorous evaluation processes into consideration and when they have, very seldom have they focused on the impacts.

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<sup>2</sup> In the case of students from low-income families, the flexibility of schools is even smaller. Wealthier schools attract the best teachers, leaving the least prepared teachers to schools in poor and remote areas. [...] Consequently, these systems perpetuate social inequalities, lose excellent students victims of boredom, increase the cost of education through the high dropout and repetition rates, and pass the cost of training their graduates to employers or other systems. (Wadi D. Haddad & Alexandra Drexler, 2002)

<sup>3</sup> The World Summits on the Information Society (WSIS) concluded that: "We must develop a realistic plan for evaluating results and setting benchmarks (both qualitative and quantitative) at the international level, through comparable statistical indicators and research findings to follow-up on the implementation of the current Action Plan's goals and objectives, taking into account the circumstances of each country". (WSIS 2005).

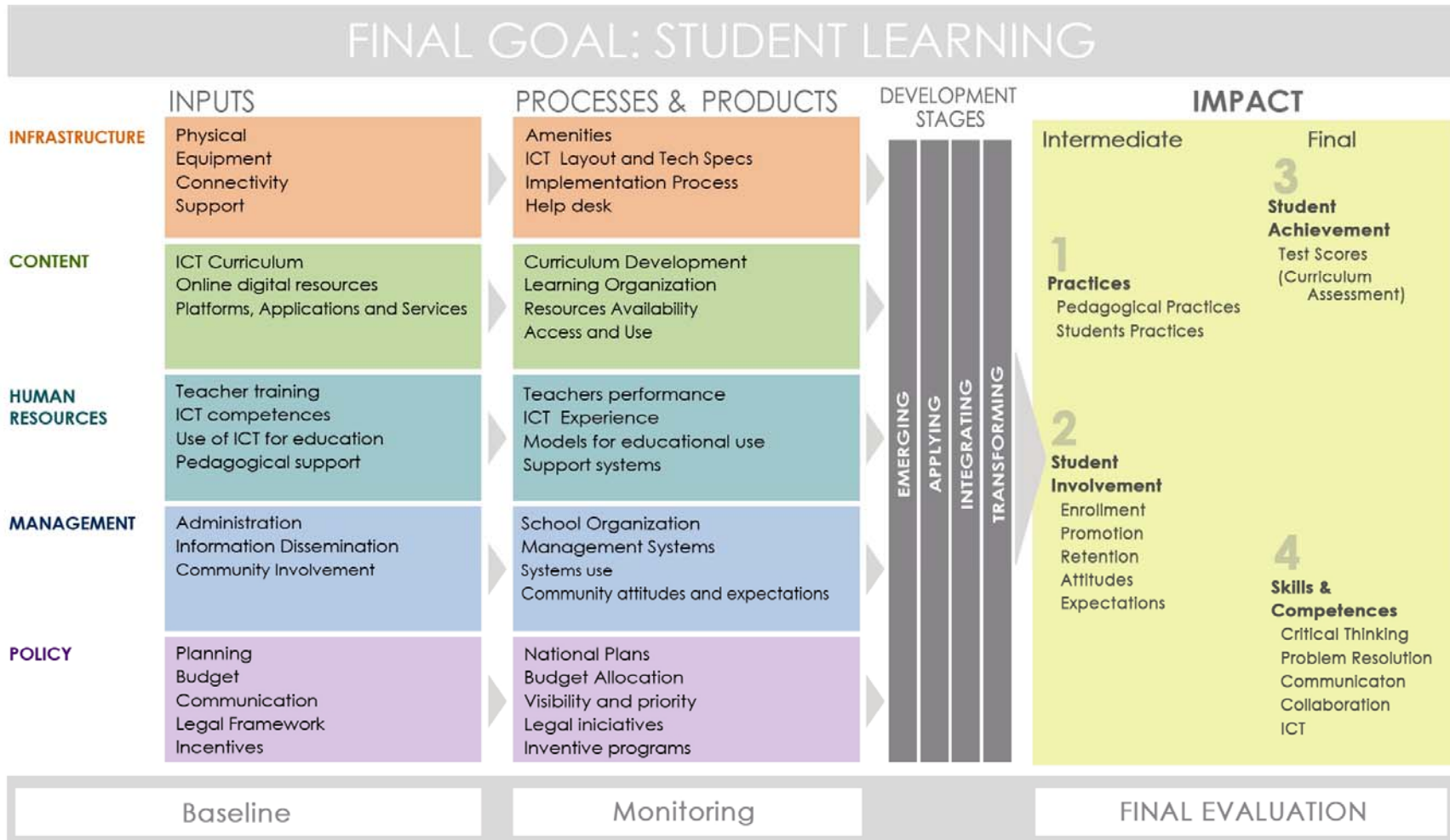
Finally, the variety of initiatives is so wide that there has been no general framework that is broad and flexible enough to take projects into consideration that are diverse in nature, in very different contexts and in various stages of development and maturity.

Application of this framework and indicators at different levels of education systems (national or subnational) aims to provide a holistic and integrated vision of ICT incorporation in order to support decision making regarding actions that can or should be made based on the available information, taking into consideration all necessary areas or inputs.

At the specific project level, use of quantitative and qualitative methodologies for data collection and observation will provide a set of indicators. This evaluation will allow measurement of the project's efficiency and monitor its development by those carrying out the project and other stakeholders, making it easier to determine promising practices and promote the development of new initiatives for use of ICTs in education areas.

## II. Conceptual Framework

The Conceptual Framework for the design, implementation, monitoring and evaluation of ICT projects in Education (ICT4E Framework) is presented in the following table:





As shown in the table, the framework includes the following elements:

- Student Learning, as the main goal of all project implementation. Students must be considered the direct beneficiaries of any ICT use in education initiatives.
- The Results and Impacts on expected student learning experiences and on the conditions that facilitate them, as a project output, measured broadly and through different integrated variables.
- The Inputs refer to the lines of action considered in the project.
- The Processes and Products are those elements that will be modified by the project and should demonstrate the results of the implementation.
- The projects' Impact and the conditions that allow such outcomes are measured broadly with different variables.
- Development Stages: four stages are described which will impact the design, implementation and evaluation of the projects.
- The process of Monitoring and Evaluation includes different sources of data and information.

The elements included in the Framework are described below:

## **1. Student Learning**

Student learning is the purpose and main goal of an education system's actions and must remain so regarding use of ICTs in educational processes.

In each specific project, students are direct beneficiaries, so the expected results should be directly linked to the learning that the project explicitly aims to impact or which will be indirectly impacted by the project's action.

The project's impact (positive, negative or 'no change') and its effectiveness will depend on evidence of change that can be demonstrated in students learning.

## **2. Outputs**

### Results

#### *2.1 Practices*

The use of ICTs in education implies the reasonable expectation that modifications in teaching methodologies and student learning processes will occur.

ICTs offer a unique opportunity for access and knowledge construction. In order to achieve effective, comprehensive use of ICTs in education development of new learning practices, strategies and methodologies must be put into place. A review of the literature

indicates that in instances where ICTs have been incorporated as an additional tool to 'maintain the status quo,' educational impacts are scant or nonexistent.

This is an important field for innovation, where ICT4E plays an important catalyzing role. The link between teaching and learning practices and the growing daily interaction of students with digital, multimedia and interactive environments make this a key aspect of the Framework and an important element to connect projects with expected results.

### *2.2 Student involvement*

One of the fundamental components of educational processes is student commitment. Although it may be obvious, the motivation and ongoing participation of students are necessary for project success. Furthermore, student motivation and enthusiasm in activities have a positive impact, not only with respect to potential learning results and development of new competencies but also to the learning environment, in stakeholder expectations and results for student promotion from one level to another. These processes also generate change regarding the motivation and expectations of parents and teachers. Both are intertwined with student motivation and expectations, resulting in the ongoing development of learning.

Data on attendance, repetition, promotion and drop-out rates are usually available and facilitate the performance of straightforward impact analysis. Measuring motivation requires other instruments which, when applied correctly, can yield important information about the effects of ICT4E projects.

## Impact

### *2.3 Student achievement*

The first area where ICT-EDU project impacts should be sought is in cognitive learning experiences, usually associated with subjects into which curriculum contents are subdivided, or into learning goals or expected competencies.

Typically, this impact has been evaluated in subjects such as language, mathematics and science, since these are the subjects evaluated in most standardized tests (focus groups or by census) and therefore, data are available in many countries (e.g., standardized tests such as TIMMS and PISA). Even though these instruments have had a small, limited field of measurement to date (limited to only certain skills and content), studies have revealed positive but moderate correlations between ICT projects and test results<sup>4</sup>.

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<sup>4</sup> Cf.: E-learning Nordic (2006), SITES (2006), ImpaCT2 (2002), OECD PISA (2003-2006), World Bank - Colombia (2009).

There are some challenges in countries that do not have national tests or participate in international standardized tests. In these cases the project could develop ad-hoc standardized tests to be administered before, during and after the project implementation (baseline and evaluation) or among groups that do or do not participate in the project (control and comparison groups).

Evidently both people and governments reasonably expect that use of ICT in education (usually a complex and expensive process) will improve student learning, and this needs to be proven empirically.

#### *2.4 Skills and competences*

It is fairly common to point out that ICT use in education has an impact on the development of new skills and competencies in students. These competencies have often been described as “superior level skills” or “21<sup>st</sup> century skills” due to their importance in a knowledge society age.

The most ambitious initiative to define these competencies, and to propose instruments to measure them, is the partnership of five prestigious universities backed by CISCO, Intel, and Microsoft: Transforming Education: Assessing and Teaching 21<sup>st</sup> Century Skills.<sup>5</sup> They have already proposed a Working Framework that defines expected competencies and are completing development of instruments to facilitate their measurement.

In its draft document, this international group has proposed a framework incorporating the following 10 competencies, grouped together into four categories:

##### *Ways of Thinking*

- *Creativity and innovation*
- *Critical thinking, problem solving, decision making*
- *Learning to learn, metacognition*

##### *Ways of Working*

- *Communication*
- *Collaboration (teamwork)*

##### *Tools for Working*

- *Information literacy (includes research on sources, evidence, biases, etc.)*
- *ICT literacy*

##### *Living in the World*

- *Citizenship – local and global*

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<sup>5</sup> <http://www.atc21.org>

- *Life and career*
- *Personal & social responsibility – including cultural awareness and competence*<sup>6</sup>

Information and Communications Technologies are instruments that are a regular part of a range of work and development opportunities. Even a basic understanding of ICT use can result in opportunities for access and growth, both personally and professionally, which can make the difference in a country's overall development.

### **3. Development Stages**

Clearly, the type of projects to develop and evaluate (as well as the impacts expected) will depend on the respective stage of development in the use of ICT in and the educational context where each project will be applied.<sup>7</sup>

The development stage reached through incorporation of ICTs into education systems is strongly correlated to the type and depth of potential changes in application contexts. Thus, the intensity of use and the impact increase to the extent that efforts toward incorporation are sustained over time.

Following Morel's Matrix (2001), four project phases are proposed which are vital in the project's design, implementation, follow-up and evaluation steps, and in the follow-up of comparable education systems. Therefore, by analyzing the indicators described in "Processes and Products" column, you can determine the development stage of the project (emerging, applying, integrating, and transforming) and inform the expected outcome with results indicators.

For example, you can generically describe these steps for each domain considered in the General Framework, as follows:

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<sup>6</sup> Draft White Paper 1 Defining 21st century skills Marilyn Binkley, Ola Erstad, Joan Herman, Senta Raizen, Martin Ripley with Mike Rumble, January 2010.

<sup>7</sup> Countries which are at the initial stages of ICT incorporation in education have different assessment needs than those who already have a long tradition of ICT use. For example, initially it is important that teachers and students have access to software and hardware and that they have acquired basic skills in computer science. In the case of countries at more advanced stages, other considerations such as management of educational innovations, changes in educational curricula and other organizational changes in schools, and ongoing support and training for staff are more important'. (Manual for the production of statistics on the information economy, UNCTAD, 2008)

	Emergency	Application	Integration	Transformation
Infrastructure	Isolated PCs for administrative processes, restricted access to computers for students and educators.	Computer laboratories, broadband Internet access. Educator or administrator prepared to provide technical support.	Computer networks in laboratories and classrooms used in combination with other devices (cameras, scanners, etc.). Continuous access to computers for students and educators. Wireless networks. Local staff specialized in support.	Diverse platforms available for communication and learning, Web-based communication and collaboration services, self-managed learning systems. Local staff highly specialized in support and solutions development.
Contents	Curriculum does not exclusively take into account the use of ICTs. Office automation and educational games applications. CDs or local software with educational content (encyclopedias). Teacher-centered pedagogy.	Curriculum takes into account the basic development of ICTs competencies. Educational portals with access to digital resources that support the curriculum. E-mail and Web search services available. Teacher-centered pedagogy.	Curriculum contemplates all inclusive use of ICTs. Educational contents and applications enriched and adapted to specific practices. Basic applications for content creation and reconstruction of teaching and learning objects. Collaborative, student-centered pedagogy.	Curriculum comprehensively incorporates the use of ICTs as a knowledge building strategy. Advanced options for the development of content and collaboration among diverse stakeholders. Platforms for experimentation and publication of resources. Student-centered pedagogy: critical-thinking, collaborative, experiential.
Human Resources	Training according to individual interests. There is no pedagogical support for the integration of ICTs.	General training in ICTs through in-service teacher training programs. There is no local pedagogical support for ICTs integration.	Initial and in-service training associated with the curriculum and with educational uses for ICTs in the classroom. Training of local staff for support in the pedagogical integration of ICTs.	Peer learning networks, self-managed continuing education systems. Peer networks and online collaboration.
Administration	Pragmatic view based on individual interests. There is no pedagogical support for the integration of ICTs	Practical view based on the adoption of new technologies. Information technology administration of some systems, but they are not interconnected. Isolated, partial involvement of the organized community.	Holistic view aiming to integrate processes by incorporating technologies. Complex, interconnected information technology systems for system-critical recording and communication. Regular incorporation of the community into formal processes and communications.	Proactive, innovative view aiming to generate developments that allow for new, better systems for information, recording and communication. Community actively seeking solutions and engaged in the collaborative building of shared knowledge.
Policies	Causistic and experimental development of isolated ICTs initiatives. Without policies or budgets allocated over the long term. There are no adjustments to the legal framework nor are specific incentives being considered.	Limited development of ICTs plans, based on centralized, concentrated decisions. Partial, generic policies that take into account some components at various depth levels. Short term budgets (associated with specific projects). Indirect generic adjustments to the legal framework (telecommunications and education plans). Pilot programs for specific incentives.	Development of broad, comprehensive ICTs policies covering the set of domains with similar depth levels, allowing flexible areas for specific context-dependent adaptations. Medium term budgets guaranteed. Legal adjustments facilitating incorporation of ICTs and their use in education. Incentive systems integrated into predefined educational achievements.	Development of Educational Plans and Policies that take ICTs into account holistically together with their strategies and components, allowing broad areas for their specific inclusion into context. Inclusive budgets over the long term. Legal framework completely adapted to new requirements. Incentives associated with the system's overall learning achievements.

This table operates in practice as a section for reading the indicators present in a system or project, which allows for ascertaining maturity or stage of development.

Once this section has been applied to each system or project, reading it may provide criteria for decision-making regarding the domains registering greater or less progress and, therefore, the kind of priorities that could lead the development of new actions.

Definition of development stages is directly related to reasonable expectations for the impact that ICTs have on educational systems, particularly with respect to learning, skills and student competences. It is therefore possible to enter into the table below some examples of the kind of results that can be found in education systems or in project target groups. Analysis of indicators will therefore depend on stage of development.

	<b>Emergency</b>	<b>Application</b>	<b>Integration</b>	<b>Transformation</b>
<b>Practices</b>	Predominance of vertical, expository classes. Classes centered on the teacher and his/her knowledge. ICTs as specific training content for the students. Students have difficulties accessing technologies for use	Teacher-centered classes that sporadically incorporate the use of ICTs into some school activity beginning with its regular curricular planning. Students have regular access to technologies, but very seldom do they connect them with their school experience.	Student-centered classes; the teacher assumes the role of presenter and tutor, actively proposing and accompanying the work of students who use ICTs collaboratively in their school work. This use is rather intensive in the context of the school but substantially low outside of it and the proposed activities.	Lifelong learning environment; teachers and students continually collaborate in the creation and communication of knowledge. Emphasis on investigation and the development of projects, with the increasing autonomy of each actor and abundant use of platforms for communication and collaboration.
<b>Student Involvement</b>	Passive attitude of students regarding learning. Low or moderate expectations regarding the impact of studies on their lives in the future.	Passive attitude of students regarding learning. Moderate expectations regarding the impact of school on their lives in the future generate motivations outside of school.	Active attitude of the students regarding learning. High expectations regarding their learning and personal achievements, though not explicitly connected to their school experience.	Proactive, autonomous attitude throughout entire life. High expectations regarding their future and the role that education plays in it.
<b>Learning Results</b>	None	Low impact	Medium impact	High impact
<b>Skills and Competencies</b>	None	Low impact	Medium impact	High impact

Until now, limited and partial investment in ICTs (implying very small changes in inputs) were rarely expected to involve changes that can quickly translate into new and improved skills and competences in students. Applying this framework has allowed us to recognize that the achievement of significant impacts is the result of a development process that requires a broad vision, comprehensive, integrated implementation and development time in order to exhibit genuine impact.

#### **4. Inputs**

The inputs considered in project design and evaluation include the following:

##### *4.1 Infrastructure*

- a. Physical: Initiatives associated with provision of infrastructure necessary for the use of and access to ICT, e.g. laboratories, libraries and furniture.
- b. Equipment: Devices planned for the project or considered part of the project (even if not conceived as a direct part of the project) includes computers, printers, projectors and the conditions included in the purchase and use of those items, e.g., guarantee and service support.
- c. Connectivity: Access to Internet and networks that allow their use for education purposes. Bandwidth access, connection stability and technologies that facilitate better online traffic and provide privacy protection filters for content accessed by students. In addition to this, implementation of a reliable local network structure that is safe and accessible.
- d. Support: Activities aimed at administration, maintenance and repair of equipment as well as problem-solving related to project activities and technical support for users.

##### *4.2 Contents*

- a. ICT Curriculum: Initiatives linked to the implementation and/or adaptation of curriculum content in ICT or other subjects, (in the use of ICT).
- b. Content: Digital or analog material aimed at teaching and learning with technology tools, e.g., encyclopedias, manuals, textbooks, books, guides, videos and hypertext.
- c. Tools: Software development or support initiatives for development of teaching and learning processes; e.g. productivity applications, virtual simulators and modeling.

- d. Information systems: Aimed at supporting implementation and distribution of management and education information systems at the school, country and regional level, as well as those that allow monitoring of educational projects and their stakeholders, including curriculum, pedagogies and possible models of use.

#### *4.3 Human resources*

- a. Teacher training: Initial and in-service training associated with the adoption, adaptation and updating of curriculum and practices for the integration of ICTs into education.
  - (a) General ICT competencies: training initiatives for acquisition of and/or certification in general skills in the use of ICTs, basic education, and productivity and communications tools.
  - (b) Educational use of ICTs: training and education initiatives associated with the specific use of ICTs with educational purposes and in educational contexts.<sup>8</sup>
  - (c) Pedagogical Support: efforts toward providing pedagogical support and follow-up for participants, providing them guidance or developing in-service tutorships for implementation of the activities proposed.
- b. Community involvement: Actions that promote (and allow for) the active participation of community members and families in the development (and as direct beneficiaries) of the project.
- c. ICT competences: Training activities for the acquisition and/or certification of specific ICT skills, general education, and productivity and communication tools.

#### *4.4 Management*

- a. Administration: Structures and strategies for system and project management and administration for all levels considered (school, province, country, and region) as well as the relationship with other institutional stakeholders associated with the project e.g., strategic allies and donors.
- b. Information dissemination: Activities aimed at providing information about project results, strategies and actions and involving all potential interested stakeholders and beneficiaries of the project.

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<sup>8</sup> Particularly important in this area is UNESCO's development of standards for the educational use of ICTs by educators.



#### *4.5 Policy*

- a. Planning: The project's priority (short or long term) in the context of other initiatives, plans, projects or actions, including visibility (understood as the ownership level with the success and objectives of those leading the project).
- b. Budget: Long-term budget needed for operational continuity and development of complementary initiatives required for the project's success.
- c. Legal Framework: Actions to adjust and adapt the rules and regulations to enhance and improve the impact of the initiative and minimize the risks. Includes measures to improve the safety and security of minors, regulations associated with industries and copyright protection.
- d. Incentives: Plans and programs designed to (positively or negatively) underscore beneficiary commitment and the results of the project expected by its participants.

### **5. Processes and Products**

Processes and products being proposed to allow the framework to support the design, implementation and monitoring of specific projects developed to incorporate the use of ICTs for educational purposes.

For example, listed below are some of the products and processes that may typically be considered as part of these projects and whose observation and monitoring will reveal how each contributes to achieving the expected results.

#### *5.1 Infrastructure*

##### a. Amenities:

Specific references about the technical characteristics of the equipment. Also included here is the connection with other existing equipment indirectly related to the success of the project. Characteristics and conditions of connectivity.

##### b. Implementation process:

Description of project logistics, location and equipment distribution.

Additionally, specifics on the procedure for equipment selection, purchasing, distribution and integration/implementation in projects. Also included are references to the investment made in the context of the project essential to its success, such as classrooms or buildings, as well as calendars and systems in use by equipment users and their availability.

b. Helpdesk:

Describes systems installed to lend support to indirect and direct users in the event of technical and pedagogical difficulties. It will provide the user rate, response time, mechanism used, most common difficulties, the best-rated responses and other indicators describing support available to participants.

*5.2 Resources*

- a. Curriculum development: Work developed to connect curriculum to the learning goals and project objectives associated with ICT4E. Inclusion of ICT into the curriculum at the different levels as a competency or as cross-cutting or vertical content, learning goals specifically proposed by the stakeholders.
- b. Learning organization: Description of how learning activities are structured and organized (didactics), including how the curriculum is developed (integrated or separated from other thematic areas), how often and at what time of day ICTs are integrated into the curriculum, pedagogical approach(es) at the institutional level as well as knowledge management strategies.
- c. Availability of resources: Levels of access to educational resources from direct and indirect beneficiaries; whenever possible underscore relevance and importance with respect to project objectives.
- d. Access and use: The opportunity for and simplicity of access to the information and management systems by the beneficiaries (direct or indirect), whenever possible, provide their relevance to and the quality of the proposed objectives.

*5.3 Human resources*

- a. Teacher performance: Describes teacher background information pertinent to the learning objectives: e.g., performance, planning activities, student: teacher ratio, performance evaluation and incentives.
- c. ICT experience: Previous experience with ICT in educational use, both in and outside the classroom.
- d. Models for educational use: Characteristics of ICT training to stakeholders in order to capitalize on the use of ICTs in educational contexts.
- e. Education Support system: Mechanisms aimed at motivating and lending support to the work of different stakeholders involved in the project, such as tutoring or assistantships for teachers, personal or on line support plans, training resources, mutual communication among peers and guides for families.

- f. Community inclusion: Actions involved in the project's implementation aiming to include the initiative in its development context, introduction of participants (direct or indirect) to the project, communication with those involved in the project who facilitate the project's implementation. Also describe how the project considers the impact on the community, particularly regarding students' families.

#### *5.4 Management*

- a. School organization: The way the project is integrated into the overall institutional scheme of the school, how many hours each teacher spends on it and systems aimed at organizing and supervising the operation regarding the use of ICT.
- b. Management systems: Institutional framework, systems and mechanisms implemented by the school or institution, or that the project modifies and impacts and which allow for follow-up of project activities and learning objectives.
- c. Systems use: Opportunity for and simplicity of access to the information and management systems by the beneficiaries (direct or indirect), whenever possible stating relevance to and quality of the proposed learning objectives.

#### *5.5 Sustainability*

- a. National (local) Plans: Displays the existence or lack of national plans that comprehensively maintain and describe the use of ICTs in education systems, linking them to each other and to the rest of the goals and policies, and to the development strategies as well.
- b. Budget: Different budget sources and procedures that are directly or indirectly involved in the project's operations. Any difficulties with the procedure and future financing plans should be described. The expenses entailed by the project should be noted, specifying one-time purchases as well as recurring purchases that will therefore be part of the project in the future. Mechanisms recommended to secure funding in the future. For long-term implementation, the project's strengths and weaknesses and how the project itself plans to address them.
- c. Priority and Visibility: The position of those responsible for the project as well as project objectives and the promotion of such activities.
- d. Legal framework: Description of regulations associated with project implementation.

- e. Incentives plans: Program or incentive plans associated with the project's beneficiaries and objectives.

## **6. Evaluation**

This Conceptual Framework is not proposed as an evaluation model, nor does it develop specific assessment instruments. It should work as a guide to consider the elements involved in ICT for education projects. The evaluators using the Conceptual Framework should then apply and develop the adequate evaluation models and instruments, depending on the context.

### *6.1 Baseline*

The data that inform the processes and products BEFORE the project's implementation and by which the project impact can be measured.

The baseline is concerned with data that allow for identification of indicator status at the system level upon starting the application or before project implementation. From these initial data (sum zero), system progress or project action impact will be measured, once they are implemented.

The baseline should take into consideration the systems level, a broad set of indicators that facilitates precise analysis of ICT incorporation status. At the project level, you should select those indicators that explicitly impact the project's objectives, including those linked to student learning. Wherever possible, however, the data for all processes should be taken into consideration to facilitate documentation of unforeseen impacts.

### *6.2 Follow-up and monitoring*

When applied at the system level, steady action is required that may be implemented to ascertain changes occurring due to various actions aimed at incorporating ICTs into education systems. Periodic application (annual, biannual or as frequently as possible) aims at determining the developmental status of systems regarding the introduction of ICTs, and shedding light on the decision-making of policy makers.

At the project level, relevant data design in the intermediate steps of the project's implementation will inform progress and steer the project toward its proposed objectives, allowing for early problem detection and correction in learning.

### *6.3 Results and/or impact evaluation*

This process involves comprehensive review of a project, program or system, its achievements, progress and difficulties, and establishes its impact vis-à-vis proposed objectives. Evaluation is conducted at project/program completion or at the end of a given phase of the project's implementation, and its purpose is to measure actions and the strategy proposed against the results obtained, and to monitor its relationship with and impact on system indicators.

Along these lines, impact made on all areas, processes and products must be taken into consideration and not only the ones where the project has implemented actions.

Evaluation is a process that is crucial to every project and should be considered an essential component at the outset of project design. Whenever possible, efforts should be made to have evaluation conducted by an external entity unassociated with the project's direct or indirect executors, to achieve objectivity and impartiality. Whenever possible, experimental evaluation methods should be favored to complement other data sources to produce more solid, reliable results.

## **III. Indicators for ICTs in Education**

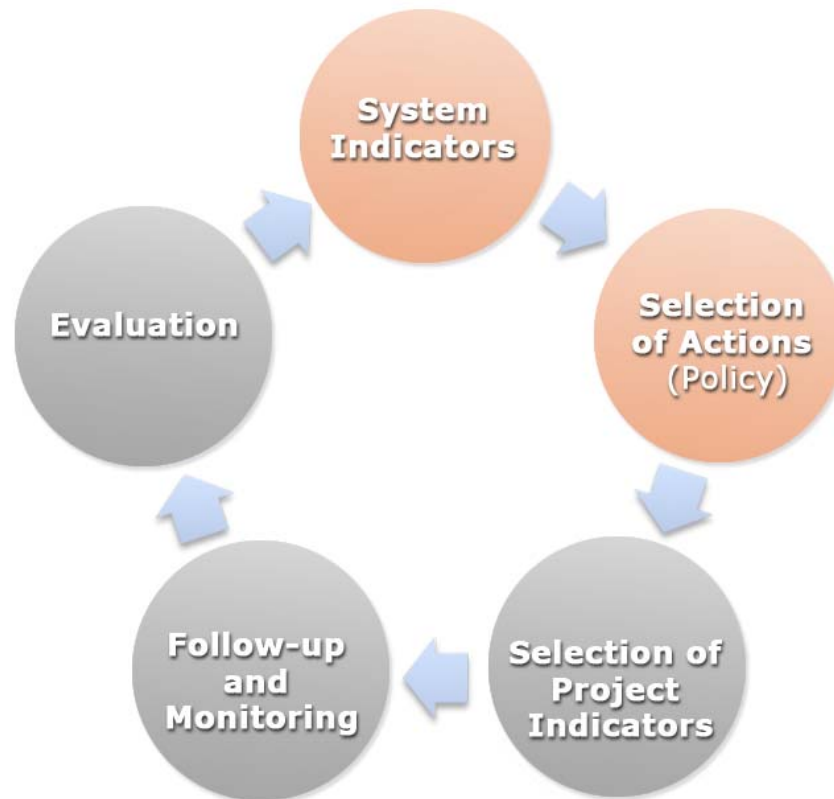
### **1. General Presentation**

Application of the Conceptual Framework on a set of indicators is proposed as an exercise to facilitate a comprehensive view at the system level (local/sub-national, national, regional or global) and at the project level as well.

Regarding use in monitoring systems, we propose creating an index based on a set of indicators to help describe the respective system. When applying indicators at the project level, this set of indicators lends support to and organizes the project evaluation process, but in no case is it completely exhaustive, since this process involves many other variables.

With the aim of organizing the indicators, associating them with the framework proposal, we have considered the need to have Indicators of Inputs and Processes (Input), and Indicators of Results and Impact (Output), depending on the data type to be described and the area involved.

The methodological proposal for applying the indicators in the context of this conceptual framework and its associated indicators is comprised of five instances:



### *1.1 System Indicators*

At the systems level, the IDB proposal is to consider all or the greatest number of indicators possible from among those proposed, In order to achieve the most complete view possible of the development status for the incorporation of ICTs in education.

This set of indicators, to the extent that it is possible to obtain complete, up-to-date information, allows us to create one or more indexes accounting for the progress status in the incorporation of ICTs in education, allowing us to determine the system' phase of development and the areas in which it is more or less advanced.

### *1.2 Selection of Actions (Policy)*

Based on the data provided by the indicators, policy makers can make better informed, more complete decisions that place a high priority on achieving specific impacts.

### *1.3 Selection of Project Indicators*

At the Project level, it will not be feasible for all defined input indicators to be modified by an ICTs for education project. Therefore, at the outset of a project of this type, the first task to undertake would be to establish which of the proposed set of indicators are feasible for this initiative to impact. Furthermore, process indicators are created that will enable follow-up and monitoring of project development.

Aside from the above, the methodological proposal suggests that all input indicators must be measured each time or taken into consideration. This is done for two reasons. The first is because a project may, in practice, produce impacts unforeseen in its original design, and it is valuable to be able to ascertain and quantify them. The second reason has a systemic or public policy aspect to it: becoming acquainted with all of a country's educational indicators will afford a project executor a broader view of the global impact of any country's different education projects and of its status at different points in time.

### *1.4 Follow-up and Monitoring*

According to the methodological proposal at the system level, data gathering is to be carried out periodically at regular intervals, depending on the availability of data at each level:

- Before the project begins: Building the baseline.
- Midterm measurement: Data gathering at the halfway point, while a project is being implemented. Allows you to determine impacts over the medium term and to take steps if necessary.
- End of project measurement: Gathering information upon completion of the intervention. Facilitates quantification of changes in indicators during the project implementation period. At this point, the status of all the input indicators is ascertained. These indicators provide information about the impact attributable to the project and about changes observed in the overall status of the system undergoing intervention.

A fourth instance of data gathering is advisable, whenever possible:

- Follow-up measurement: Gathering information one or two periods after the respective project is completed. This allows for an evaluation of the situation over the medium term, after the project has ended. At this point, changes may be

observed for example in some indicators due to lack of funding for recurring expenses.

Process indicators required for the project to report should also be defined. Reports on these indicators will be of utmost value to the project executor because it facilitates rigorous monitoring of project implementation, provides the opportunity to make suggestions and, if necessary, to propose remedial measures.

At the outset of the project, it is advisable to agree on a timetable for submitting reports on these indicators. Perhaps not all of these indicators will be relevant to all of the processes. This means agreement must be reached among the parties regarding which indicators will be used for each project management plan and what reporting intervals will be observed.

### *1.5 Impact evaluation*

The final evaluation of a project may take into consideration a broad set of tools, models and indicators to report on results. According to the proposal presented herein, we suggest taking into account how project results have enabled modification of indicators of the system where they were introduced, in terms of impact. These indicators were established in the definition of the general indicators and in the selection of specific indicators relevant to project action.

In this way, definition of the indicator allows us to set goals for the project, which under the same terms of the indicator it proposes to change. Therefore, for each relevant indicator, the project impact evaluation presents its respective status before the intervention, the status targeted by the intervention (goal) and the percentage of the goal achieved.

## **2. Proposal for Indicators**

As pointed out by the methodology suggested in the preceding section, this section presents a preliminary proposal of indicators for the design, implementation, follow-up, and evaluation of the impact of an ICT for education project. Consistent with this, indicators are grouped together into two sections, whereby the first deals with the inputs and results and the second deals with the process or management plan of the project.

These indicators were put together based on the indicators defined in the document entitled *“Guide to Measuring Information and Communication Technologies (ICT) in*



*Education (UNESCO UIS, December 2009).*<sup>9</sup> In addition to the fifty indicators proposed by UNESCO (shown in the column with identifiers beginning with “ED”) we added another 70 indicators (with the identifiers beginning with “I”) which together allow us to thoroughly describe the conceptual framework proposed.

In one appendix, available online at the IADB website, there will be detailed descriptions, examples and formulas of each of the proposed indicators.

## 2.1 Input Indicators

Inputs		Input Indicators	Indicator Identifier
<b>Infrastructure</b>			
Physical		Proportion of schools with electricity (for ISCED levels 1-3)	<b>EDR1</b>
		Proportion of schools with a telephone communication facility (for ISCED levels 1-3)	<b>ED3</b>
		Percentage of schools with local area networks (LAN): - wired - wireless	<b>I01</b>
ICT		Percentage of schools with a radio used for educational purposes (for ISCED levels 1-3)	<b>ED1</b>
		Percentage of schools with a TV used for educational purposes (for ISCED levels 1-3)	<b>ED2</b>
		Number of TV sets available in schools per 100 students (ISCED level 1-3)	<b>ED28</b>
		Number of audio-visual materials available in schools per 100 learners (by type and for ISCED level 1-3) - digital projectors - video players and recorders - audio players and recorders - cameras - scanner	<b>ED29</b>
		Learner-to-computer ratio (for ISCED levels 1-3)	<b>ED4</b>
		Proportion of schools with computer assisted instruction (for ISCED levels 1-3)	<b>ED24</b>
		Proportion of schools with Internet assisted instruction (for ISCED levels 1-3)	<b>ED25</b>
		Proportion of available computers for pedagogical purposes that are privately owned (by learners) (ISCED level 4 and levels 5 and 6)	<b>ED34</b>
		Proportion of all computers available for pedagogical purposes (for ISCED levels 1-3, level 4 and levels 5 and 6)	<b>ED35</b>
		Proportion of all computers available for administrative purposes (for ISCED levels 1-3, level 4 and levels 5 and 6)	<b>ED36</b>
		Percentage of all computers in use for teaching for 4 years or less ,	<b>I02</b>
		Total number of technological platforms available and their reach (in number of users): - for learning - for communications	<b>I03</b>
	Connectivity		Proportion of schools with Internet access at school (for ISCED levels 1-3)
		Ratio of student-to-computer connected to Internet (for ISCED levels 1-3)	<b>ED31</b>
		Proportion of high schools with a broadband and average bandwidth	<b>I04</b>

<sup>9</sup> Annex 1 of this document contains tables itemizing the UNESCO indicators included herein. Annex 2 contains a description of the indicators developed by IADB that complement the previous ones.

Inputs	Input Indicators	Indicator Identifier
	connection, by geographical area.	
	Average stability (quality) of the connection at the schools	I05
	Proportion of high schools with a firewall and privacy protection systems as part of their school network	I06
	Average monthly expenditure for broadband internet connection (for average ISCED levels 1-3)	I07
	Percentage of schools offering wireless Internet access: <ul style="list-style-type: none"> <li>- closed or restricted</li> <li>- open to the community</li> </ul>	I08
Support	Percentage of schools according to level of support: <ul style="list-style-type: none"> <li>- teacher or ad-hoc trained administrator</li> <li>- technical support staff</li> <li>- staff for development</li> <li>- external support contract</li> </ul>	I09
	Rate of problems reported compared to total number of computers available for educational use.	I10
	Average response and solution times for reported problems	I11
	Percentage of registered users satisfied or very satisfied with the technical support received.	I12
<b>Contents</b>		
Curricula and ICT	Proportion of grades where basic computer literacy courses are prescribed within the curricula (by nature of training, by type and for ISCED levels 1-3)	ED11
	Proportion of learners enrolled in grades where basic computer literacy courses are taught as prescribed within the curricula (for ISCED levels 1-3)	ED11 bis
	Average number of expected hours per week for usage of ICT in the classroom as prescribed within the curricula (by major subjects and for ISCED levels 1-3): <ul style="list-style-type: none"> <li>- sciences</li> <li>- knowledge of mathematics</li> <li>- basic computer literacy</li> <li>- languages</li> <li>- art</li> </ul>	ED13
	Average number of hours per week for usage of ICT in the classroom as prescribed within the curricula (for ISCED levels 1-3) <ul style="list-style-type: none"> <li>- exercises on computer using educational software</li> <li>- exercises on computer using the internet</li> <li>- radio (interactive radio instruction)</li> <li>- television</li> </ul>	ED14
	Average rate of classes incorporating the instrumental use of ICT for experimentation and building contents, compared to total number of annual classes.	I13
	Percentage of schools with curricular innovations for the use of ICT for educational purposes	I14
Digital Education Resources	Availability of national education portals <ul style="list-style-type: none"> <li>- yes/no</li> <li>- number</li> <li>- target audience <ul style="list-style-type: none"> <li>o teachers</li> <li>o students</li> <li>o administrators</li> <li>o parents and guardians</li> <li>o other</li> </ul> </li> </ul>	I15
	Percentage of registered users participating in the national education portals: <ul style="list-style-type: none"> <li>- schools</li> </ul>	I16

Inputs		Input Indicators	Indicator Identifier
		<ul style="list-style-type: none"> <li>- teachers</li> <li>- students</li> <li>- parents and guardians</li> </ul>	
		Proportion of curricular coverage for digital education or Web resources for the teaching community (Subject/Level)	I17
		Number of digital resources available per subject/level	I18
		Rate of user-created resources, compared to total resources available in the national educational portal.	I19
		Percentage of teachers who develop and share educational content compared to the total number of teachers registered in the national portal.	I20
Platforms, Applications and Services		Percentage of schools with an institutional website (for ISCED levels 1-3)	ED50
		Percentage of schools with an educational website (for ISCED levels 1-3)	I21
		Percentage of schools with a blog page (for ISCED levels 1-3, level 4 and levels 5 and 6)	ED51
		Proportion of educational institutions offering distance education programs (for ISCED levels 5 and 6)	ED54
		Percentage of students and teachers with: <ul style="list-style-type: none"> <li>- e-mail accounts</li> <li>- weblogs</li> <li>- personal webpage</li> <li>- membership in at least one social network (Facebook, Twitter, etc.)</li> </ul>	I22
		Percentage of schools offering services to teachers and/or students to create and share educational content on their Web page or portal	I23
<b>Human Resources</b>			
Teacher Training		Average proportion of the pre-service teacher training curricula devoted to curricular adaptation of ICT	I24
		Proportion of primary and secondary teachers trained to teach any subject using ICT (by mode of training) <ul style="list-style-type: none"> <li>- trained via formal pre-service programs at teacher education institutions</li> <li>- trained via formal in-service (on-the-job) programs at teacher education institutions</li> <li>- trained via informal programs</li> </ul>	ED39
		Percentage of primary and secondary school teachers certified in basic computer literacy.	I25
		Percentage of primary and secondary school teachers certified in education computer literacy.	I26
		Proportion of teachers in primary and secondary schools trained to teach Basic Computer Literacy (for ISCED levels 1-3)	ED8
		Proportion of primary and secondary teachers trained to teach basic computer literacy (by mode of training) <ul style="list-style-type: none"> <li>- trained via formal pre-service programs</li> <li>- trained via formal in-service (on-the-job) programs</li> <li>- trained via informal programs</li> </ul>	ED38
		Average annual hours devoted to the explicit training of students in the use of word processors, spreadsheets, presentations, etc; by level, by geographical area and type of high school	I27
General Competencies in ICT		Percentage of primary and secondary students certified in basic computer literacy.	I28
		Percentage of the adult population trained in basic use of ICT.	I29
		Ratio of learners-to-teacher using ICT to teach (for ISCED levels 1-3)	ED44
		Ratio of learners-to-teachers of Basic Computer Literacy (for ISCED levels 1-3)	ED43
		Number of public initiatives devoted to promoting the use of ICT for educational purposes (contests, meetings, challenges, festivals)	I30

Inputs		Input Indicators	Indicator Identifier
		Percentage of primary and secondary school students that have participated in initiatives promoting the use of ICT for educational purposes (contests, meetings, challenges, festivals)	I31
		Percentage of schools that participated in public initiatives promoting the use of ICT for education (contests, meetings, challenges, festivals)	I32
Pedagogical Support		Percentage of schools with explicit professional pedagogical support to teachers for the incorporation of ICT into the curricula.	I33
		Ratio of school-based ICT Coordinators to the number schools offering any ICT assisted instruction (for ISCED levels 1-3)	ED12
		Percentage of teachers participating in collaboration networks for implementation of ICT into education.	I34
<b>Management</b>			
Administration		Percentage of schools with formal projects for incorporation of ICT into education processes	I35
		Percentage of schools with formal projects for incorporation of ICT into administrative processes	I36
		Percentage of managers certified in basic ICT use	I37
Information Systems		Percentage of schools with human resource management software	I38
		Percentage of schools with financial management software	I39
		Percentage of schools with internal or local (offline) student tracking management software (,record keeping, attendance, promotion)	I40
		Percentage of schools with student tracking software linked (online) on the regional and/or national level.	I41
		Percentage of schools with online student services accessible to parents and guardians	I42
Community involvement		Percentage of schools offering access to ICT equipment on established schedules to their communities (parents and guardians)	I43
		Percentage of schools that offer ICT-related training to their communities (parents and guardians)	I44
		Percentage of parents and guardians trained by the schools in the basic ICT use.	I45
<b>Policies</b>			
Planning		A National Plan in place for the incorporation and development of ICT in education	I46
		Proportion of ISCED levels covered by existing national or sector policies on ICT use in education (for ISCED levels 1-6)	ED9
		Proportion of Grades covered by existing national or sector policies on ICT use in education (for ISCED levels 1-3)	ED9 bis
		Proportion of learners who are in grades where ICT are used to deliver teaching and learning (for ISCED levels 1-3)	ED10
Budget		Proportion of total public expenditure on ICT in education for current expenditure on ICT in education (for ISCED levels 1-3, level 4 and levels 5 and 6)	ED15
		Proportion of total public expenditure on ICT in education for capital expenditure on ICT in education (for ISCED levels 1-3, level 4 and levels 5 and 6)	ED16
		Proportion of total Government (current) expenditure for current expenditure on ICT in education (for ISCED levels 1-3, level 4 and levels 5 and 6)	ED21
		Proportion of total Government (capital) expenditure for capital expenditure on ICT in education (for ISCED levels 1-3, level 4 and levels 5 and 6)	ED22
		Average public (current) expenditure on ICT in education per learner (for ISCED levels 1-3, level 4 and levels 5 and 6)	ED55
		Percentage of public and private spending on ICT in the education system.	I47
Communications		Percentage of official communications from the Ministry of Education	I48

Inputs		Input Indicators	Indicator Identifier
		dealing with plans, programs, and initiatives for the incorporation of ICT into education compared to the total number of official communications.	
		Frequency with which official communications from the Ministry of Education refer to plans, programs and initiatives for incorporation of ICT into education.	I49
Incentives		Percentage of the total expenditure on ICT in education allocated to incentive programs for schools using ICT in their education processes.	I50
		Percentage of the total expenditure on ICT in education allocated to incentive programs for teachers who use ICT in their education processes.	I51
		Percentage of the total expenditure on ICT in education allocated to incentive programs for students who use ICT in their education processes.	I52
		Percentage of the total expenditure on ICT in education allocated to incentive program for the community (parents and guardians) using ICT in its education processes.	I53
Legal Framework		Existence/Absence of legal provisions regulating: <ul style="list-style-type: none"> <li>- copyright and fair use in education</li> <li>- identity protection in digital environments</li> <li>- privacy protection for minors</li> <li>- control of contents and child protection</li> </ul>	I54

## 2.2 Output Indicators

Impacts to measure		Indicators	Instrument	Identifier
<b>Results</b>				
<b>1. Changes in practices</b>	Pedagogical practices	Proportion of trained teachers using ICT facilities for teaching (by gender, by type of institution for ISCED levels 1-3)	Survey	ED40
		Average percentage of classes taught using ICT over the total number of classes, by subject and level.	Survey	S55
		Total average time per week devoted by teacher for use of ICT: <ul style="list-style-type: none"> <li>- on preparation for school work outside the classroom</li> <li>- on school work in the classroom</li> <li>- on school work outside the classroom</li> </ul> By subject and level	Survey	S56
		Average time per level using ICT in work art school by activity type: <ul style="list-style-type: none"> <li>- searching for and selecting information</li> <li>- drafting texts and documents</li> <li>- developing multimedia resources</li> <li>- peer collaboration</li> <li>- publishing and communicating</li> <li>- providing feedback to work</li> </ul>	Survey / Class observation	S57
		By level and subject, average proportion of classroom time by type of pedagogical methodology: <ul style="list-style-type: none"> <li>- expositive</li> <li>- individual without using ICT</li> <li>- group without using ICT</li> <li>- Individual using ICT</li> <li>- group using ICT</li> </ul>	Survey / Class observation	S58
		Proportion of teachers stating ICT to assist in	Survey	S59

Impacts to measure	Indicators	Instrument	Identifier	
	their teaching.			
	Proportion of teachers who use some digital communication media with their students; by geographical area, type of school and grade level.	Survey	S60	
	Study habits	Average percentage of time that students spend on homework assignments and school work, over total time per week using ICT.	Survey	S61
		Average time spent on educational ICT use (by gender and level)	Survey	S62
		Average weekly percentage of homework assignments and school projects prepared with the aid of ICT.	Survey	S63
		Average time per week that students use ICT in work outside of school by activity type: <ul style="list-style-type: none"> <li>- searching for and selecting information</li> <li>- drafting texts and documents</li> <li>- developing multimedia resources</li> <li>- peer collaboration</li> <li>- publishing and communicating</li> <li>- providing feedback to work</li> </ul>	Survey	S64
		Proportion of students stating that ICT help in their studies.	Survey	S65
		Proportion of student users in the project stating that their classes are more interesting since the teacher began using ICT to assist in his/her teaching; by geographical area, type of school and grade level.	Survey	S66
<b>2. Student Involvement</b>	Enrollment	Cohort enrollment rate by gender, level and geographical area.	Official records	S67
		Proportion of learners enrolled by gender at the post-secondary non-tertiary and tertiary level in ICT-related fields (for ISCED level 4 and levels 5 and 6)	Official records	ED7
		Proportion of learners enrolled by gender at the tertiary level in distance education programs (for ISCED level 4 and levels 5 and 6)	Official records	ED45
	Promotion	Proportion of students promoted to the next grade; by geographical area, type of school and grade level.	Official records	S68
		Promotion rate of learners using ICT as pedagogical aid (by gender, by type of institution at grades 4, 8 and 10)	Official records	ED46
		Promotion rate of learners not using ICT as pedagogical aid (by gender, by type of institution at grades 4, 8 and 10)	Official records	ED47
		Index of ICT in education impact (by gender, by type of institution for ISCED levels 1-3)	Official records	ED48 = ED46/ED47
	Retention	Proportion of students who drop out of work per year; by geographical area, type of school and grade level.	Official records	S69

Impacts to measure		Indicators	Instrument	Identifier
		Proportion of learners who graduated last academic year by gender at the tertiary level in ICT-related fields (for ISCED level 4 and levels 5 and 6)	Official records	ED42
	Attendance	Average monthly school attendance rate for students; by geographical area, type of school and grade level.	Official records	S70
	Attitudes and Expectations	Percentage of students who believe that school will have a "High" or "Very High" impact on their lives in the future.	Survey	S71
		Percentage of students stating that the "agree" and "strongly agree" on the importance of: <ul style="list-style-type: none"> <li>- active participation in class</li> <li>- developing autonomy in learning</li> <li>- Lifelong learning</li> </ul>	Survey	S72
<b>Finales</b>				
<b>1. Results in learning</b>	Standardized test scores (curricular framework)	Standardized test results for curricular knowledge comparable over time, by subject and level. Percentage of students who meet the grading standards of this test.	Standardized tests	S73
<b>2. Skills and Competencies</b>	Critical Thinking	Results of standardized test that measures this competency. Percentage of students who achieve "high" and "very high" levels."	Standardized tests	S74
	Problem solving	Results of standardized test that measures this competency. Percentage of students who achieve "high" and "very high" levels."	Standardized tests	S75
	Creativity and innovation	Results of standardized test that measures this competency. Percentage of students who achieve "high" and "very high" levels."	Standardized tests	S76
	Communication	Results of standardized test that measures this competency. Percentage of students who achieve "high" and "very high" levels."	Standardized tests	S77
	Collaboration	Results of standardized test that measures this competency. Percentage of students who achieve "high" and "very high" levels."	Standardized tests	S78
	ICT	Percentage of students certified in the proper operation of ICT by means of a standardized test.	Standardized test	S79

#### IV. Conclusions

The Framework described in this document has been developed considering the empirical evidence available so far, with both the experience we have developed in the Interamerican Development Bank, and that of other experts in the implementation of ICT projects in Education.

Taking into account that each ICT in Education project develops different lines of action, the framework and set of indicators partners are general in nature, allowing the review of the different variables available. Acting like a menu, where those variables where the project will intervene directly or indirectly those that might affect or be affected by it, can be selected.

Regardless of the variables and components that the project develops, this framework aims that the expected final outcome should be associated with improvements in learning. The implementation phase should consider monitoring and evaluation mechanisms associated with these outcomes.

A good evaluation will allow the comparison of results obtained by ICT in education project with other projects, ICT or not, as a way to consider the investments' efficiency.

This document should be considered a first draft of a conceptual framework and indicators that will improve with time with the development and implementation of new projects. It will be constantly updated and improved as part of its nature associated with processes and products that are in constant and rapid change.



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## **VI. Annex**

Following the methodology proposed by UNESCO, we have developed for each proposed indicator an information sheet defining the indicator, the purpose, method of collection, formula and potential data sources.

These annexes are available directly with the Education Division at Inter-American Development Bank.