

ICT4E Framework

v. 0.5α

Conceptual Framework Projects for the use of Information and Communication Technologies in Education

**Eugenio Severin
Education Specialist
1300 New York Avenue NW, Washington DC 20577
Inter-American Development Bank
eugenios@iadb.org**

**Working Paper
PLEASE DO NOT CITE
Washington DC, June 2009**

The Inter-American Development Bank Technical Notes encompass a wide range of best practices, project evaluations, lessons learned, case studies, methodological notes, and other documents of a technical nature that are not official documents of the Bank. The information and opinions presented in these publications are entirely those of the author(s), and no endorsement by the Inter-American Development Bank, its Board of Executive Directors, or the countries they represent is expressed or implied.

Table of contents

I. Introduction	4
II. Conceptual Framework definition.....	6
III. Students’ learning	7
IV. Impacts.....	7
4.1 Intermediate impact	7
4.1.2 Change in practices	7
4.1.3 Student involvement	8
4.2 Final Impact	8
4.2.1. Student achievements.....	8
4.2.2. Student skills.....	9
V. Development stages	10
VI. Inputs	10
6.1 Infrastructure.....	10
6.2 Resources	11
6.3 Training.....	11
6.4 Support.....	11
6.5 Management.....	12
6.6 Sustainability.....	12
VII. Products and Processes.....	12
7.1. Infrastructure.....	12
7.2. Resources	13
7.3. Training.....	13
7.4. Support.....	14
7.5. Management.....	14
7.6. Sustainability.....	14
VIII. Evaluation	15
8.1 Baseline.....	15
8.2 Monitoring	15
8.3 Final Evaluation	16
IX. Sources of information	16
9.1 Qualitative.....	16
9.2 Quantitative.....	17
9.3 Analysis.....	17

I. Introduction

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.

One of the main challenges in the use of ICT in education is the lack of indicators that offer clear criteria and objective information to allow policy-makers to make the proper decisions. Projects have not always considered rigorous evaluation processes and in those instances where they have, ICT impact on learning has not been the focus. Lastly, the project offering is so vast that there is no common framework that can be both flexible and broad enough that would include the diverse nature, contexts and different stages of projects.

The main hypothesis of the Framework is that the goal of all education projects is to improve student learning regardless of whether they are children or adults. The expected outcome should then be the impact(s) on learning, and the conditions required to enable such learning.

By putting children in the center of learning process, learning outcomes can be broad enough to consider improvements in students' involvement and compromise in learning as intermediate impact. This plays a direct role in the curricular learning improvement and can be seen through the student's participation and permanence in the learning process, as well as with the improvement in teacher practices and learning processes. The development of either general or "XXI Century Skills" including an understanding of ICT skills acquisition and overall improvement in the promise and involvement of students in the learning process is reflected in their participation in the process.

The Framework includes the identification of components for each specific project (inputs), its planning processes and products, and those processes that, although not directly involved, can be affected by the development of the project.

Monitoring and evaluation processes must be incorporated as an integral part of the process itself. The revision of key information before (baseline), during the process (monitoring) and at the end of the project (final evaluation), are fundamental in the proposed Framework.

Using diverse quantitative and qualitative methodologies for data collection and observation will inform the processes and products and at the same time it will allow for an adequate evaluation to be conducted. This evaluation will measure the project's efficiency by those carrying out the project and other stakeholders, making it easier to determine best practices and promote the development of new initiatives in the use of ICT in education areas.

This Framework has been developed taking into account empirical information available from past Inter American Development Bank experience and other experts in the implementation of ICT projects in education.

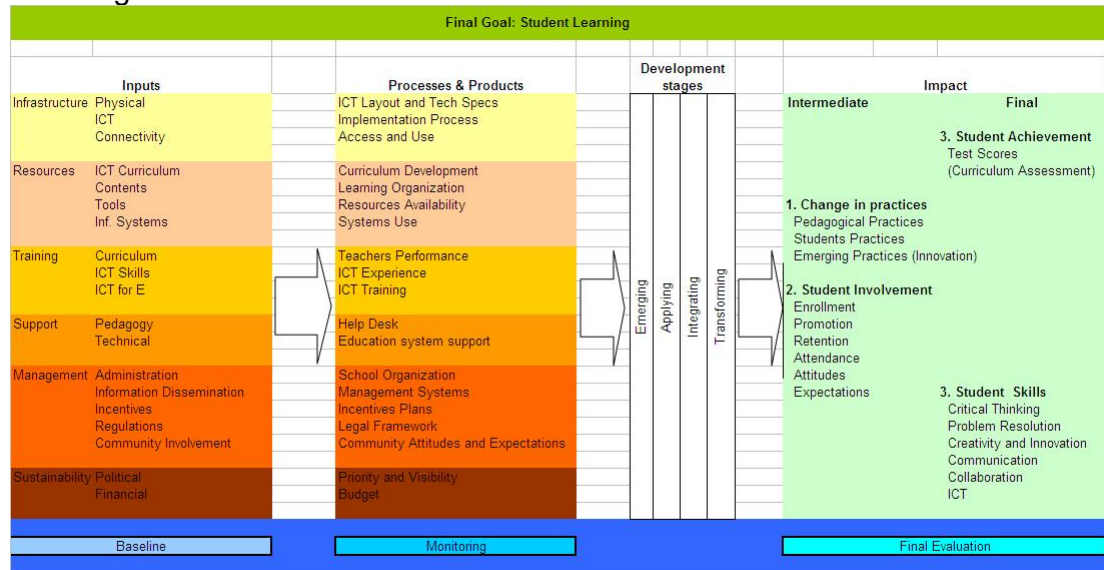
Taking into account that every “ICT in education” project includes different lines of action, the Framework is broad in nature, allowing for different variables to be reviewed and selected, like a roadmap, where the different variables can be selected depending on the direct or indirect involvement in the project and how they could be affected by it.

Regardless of the variables and components that the project includes, the goal (and objectives) should be linked to the improvement of learning and its implementation should take into account monitoring and evaluation mechanisms linked to the objectives. A good evaluation will allow results from one ICT education project to be compared to other projects (ICT related or not) in order to evaluate the efficiency of the investment.

This document should be considered a working paper of the conceptual framework, which will be improved through the development of new products and updated due to the constantly-changing nature of the ICT-education processes and products.

II. Conceptual Framework definition

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



Eugenio Severin (2009)

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 ICT4E initiative, regardless if they are children or adults.
- The **Inputs** refer not only to project lines of action but also those factors that could be affected by its implementation.
- The **Processes and Products** are those elements that will be modified by the project and should show 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:

III. Students' learning

Once the goals and purpose have been established for each project and students have been recognized as direct beneficiaries the expected results will be linked to those learning processes (impacted directly or indirectly by the project actions).

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

The link between the expected and actual outcome will define success in each specific initiative.

IV. Impacts

4.1 Intermediate impact

4.1.2 Change in practices

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

ICT offer a unique opportunity for access and knowledge construction. In order to have an effective and integral ICT use in education development of new learning practices, strategies and methodologies have to be put in place. The literature review indicates that in those examples where ICT has been incorporated as an additional tool to 'keep doing the same as always', the educational impacts are small or non existent.

This is an important field for innovation, where ICT4E play 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 impact.

4.1.3 Student involvement

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

The data for attendance, repetition, promotion and drop-out rates are usually available and allow for the creation of a straightforward impact analysis. Measuring motivation requires other instruments, which when applied correctly, can provide important information about the effects of ICT4E projects.

4.2 Final Impact

4.2.1. Student achievements

A country's education curriculum determines the knowledge and skills that students should achieve for each grade as well as the tasks for teachers and schools.

The first area where impact is evident in Information Communication Technologies in education - ICT4E -projects is in the learning associated with a specific school subject or topic, or how the curriculum content is divided according to the learning aims or expected competencies for each student.

Typically, this impact has been evaluated in subjects like language, mathematics and science, since these are the subjects evaluated in most standardized tests (focus groups or by census) and therefore, there are available data in many countries (e.g.: standardized tests like TIMMS and PISA). Currently, studies have found positive but moderate correlations between ICT projects and test results.

There are some challenges in those countries that do not apply or participate in international standardized tests. In the case of these countries, the project could develop ad-hoc standardized tests to be applied before and after the project implementation (baseline and evaluation) or between groups that do or do not participate in the project (control and compare groups).

The lack of rigorous studies in this area has made it harder to prove the reasonable expectation that countries' investment in ICT projects can improve learning in different subjects. Therefore it remains to be seen if this impact is significant and, if so, in which subjects.

This task is especially complex because the introduction of ICT in education processes is often accompanied by modifications in teaching methodologies. In fact, this is what is intended; with the introduction of ICT, old methodologies could have no or little impact.

What is evident is that the reasonable expectations of both people and governments are that the use of ICT in education usually a complex and expensive process should improve students' learning, which needs to be proven empirically,

4.2.2. Student skills

It is fairly common to point out that ICT use in education has an impact on students' development of new skills and competencies. These competencies have often been described as "21st century competencies" due to their importance in a knowledge society age.

There is extensive literature describing these competencies and is therefore easy to consolidate a group of general competencies required by the students and that eventually will develop fully with the use of ICT, they have been grouped in 3 major areas: critical thinking and problem solving; creativity and innovation; and communication and collaboration.

This is exactly what is being considered in the projects: how much do ICT influence the development of these skills and competencies?

Until now, the evaluation has not been rather exact and has been mostly done through interviews or perception surveys that collect the information/data on students' vision, or through structured observation exercises. Nevertheless, with time, more objective tools will be developed that will allow more strict evaluation exercises.

One of the components of the OECD New Millennium Learners Project is developing ICT competencies for a working definition framework and tools for evaluation the other initiative working towards similar objectives is the alliance between CISCO, Intel and Microsoft with OECD and UNESCO: Transforming Education Assessing and Teaching 21st Century Skills.

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

ICT skills and competencies are a clear objective in any project involving the use of ICT in education and is therefore necessary to evaluate the effectiveness of each project. For these tasks, standardized tests will be used alongside IDB's own validated test to evaluate students ICT skills before, during and after the implementation of activities.

V. Development stages

It is evident that the type of projects to develop and evaluate as well as the expected impacts will depend on the different stages of development in the use of ICT in and the educational context where each project will be applied.

Following Morel's Matrix (2001) ¹ four project stages are described, which are vital in the design, implementation, follow-up and evaluation steps.

Therefore by analyzing the indicators described in "Processes and Products" column one will be able to determine the projects' development stage (emerging, applying, integrating, and transforming) and inform the expected outcome with the results indicators.

VI. Inputs

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

6.1 Infrastructure

- a. **Physical:** Initiatives associated with the provision of infrastructure linked to the use and access to ICT, e.g. laboratories, libraries and furniture.

¹ Named after Professor Raymond Morel from Switzerland <http://www2.unescobkk.org/elib/publications/ICTindicators/ICTinEDchap43.pdf>

b. ICT: equipment for the project or considered as part of the project (even if it was not conceived as a direct part of the project) includes: computers, printers, projectors and the conditions included with 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 those technologies that permit better online traffic and provide privacy protection filters for content accessed by students. As well as putting in place a reliable local network structure that is safe and accessible.

6.2 Resources

a. ICT Curriculum: Initiatives linked to the implementation and/or adaptation of the 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 the development of teaching and learning processes; e.g. productivity applications, virtual simulators and modeling.

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

6.3 Training

a. Curriculum: Training related to adaptation and update of curriculum content for ICT implementation.

b. ICT skills: Training activities for the acquisition and/or certification of specific ICT skills, general education, and productivity and communication tools.

c. ICT Education: Training initiatives for the specific use of ICT in educational contexts. Particularly important here is UNESCO's work in the development of the use of ICT in education and its standards for teachers.

6.4 Support

a. Pedagogy: Those efforts aimed at providing pedagogical support and follow up for those participating in the project, guiding students or developing in-service tutoring for the implementation of planned activities.

b. Technical: Activities oriented at administration, maintenance and repair of equipment as well as problem-solving related to project activities and technical support for users.

6.5 Management

a. Administration: structures and strategies for project management and administration for all levels considered (school, province, country, and region) as well as the relationship with other institutional stakeholders related to the project e.g.: strategic allies and donors.

b. Information dissemination: activities aimed at providing information about project results, strategies and actions and involve all potential interested stakeholders and beneficiaries of the project.

c. Incentives: Plans and programs to highlight (negative or positive) expected outcomes and participant involvement in the project.

d. Regulations: actions destined to adjust and modify existing regulations and norms aimed at improving and promoting impact and minimizing risks. Includes those measures aimed at improving security for underage children, regulation of other industries in the field and the protection of copyright laws.

e. 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.

6.6 Sustainability

a. Political: The project's priority 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. Financial: Long-term budget needed for the operational continuity and the development of complementary initiatives required for the success of the project.

VII. Products and Processes

The products and processes considered in the Conceptual Framework are those that can be observed in order to understand the success of the project.

7.1. Infrastructure

a. ICT layout and technical specifications:

Specific references about the technical characteristics of the equipment. Relationship between the product characteristics and the reasons why the equipment was selected, distribution and the final characteristics of the equipment as it is implemented. As well, the link with other existing equipment indirectly related to the success of the project. Characteristics and conditions of connectivity.

b. Implementation process:

Description of logistics, location and equipment distribution of the project. As well as specifics on the procedure for how equipment was selected, purchased, distributed and integrated/implemented into the projects. Includes also reference to the investment made in the project context and which is necessary for its success like: classrooms or buildings (even when they have not been a project specific component). Both calendars and systems that are in use by ICT users as well as their availability.

c. Access and Use

Determines the time, forms, and conduct of access and educational the different stakeholders (direct and/or indirect) give to the equipment and resources.

7.2. Resources

a. Curriculum development

Work developed to connect curriculum to the learning goals and the those projects objective related to ICT4E. Includes the inclusion of ICT in the curriculum at different levels, as a competency, as transversal or vertical content or as those learning goals set specifically by the stakeholders.

b. Learning organization

Description of how learning activities are structured and organized, including how the curriculum is developed (integrated or separated from other thematic areas), how often and at what time of day ICT are integrated into the curriculum, pedagogical approximations at the institutional level as well as strategies for knowledge management.

c. Resources availability

Levels of access to educational resources from direct and indirect beneficiaries; when possible they will highlight relevance and importance with project objectives.

d. Systems use

The opportunity and simplicity to access the information and management systems by the beneficiaries (direct or indirect), when possible provide their pertinence and quality to the proposed objectives.

7.3. Training

a. Teacher performance

Describes teacher background information that is pertinent to the project: e.g. performance, planning activities, student-teacher ratio, performance evaluation and incentives.

b. ICT experience

Previous experience with ICT in educational use, both in the classroom and outside.

c. ICT training

Characteristics of ICT training to stakeholders in order to take advantage of ICT use in educational contexts.

7.4. Support

a. Helpdesk

Describes those systems put in place to support indirect and direct project beneficiaries in case 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 that describe the support for the participants.

b. Education system support

Those mechanisms envisioned to motivate and support the work of different stakeholders involved in the project such as tutoring sessions, individual curriculum plans, training, partner work and guides for families.

7.5. Management

a. School organization

The way the project is included in the overall institutional scheme of the school, how many hours each teacher spends on it and those systems aimed at organizing and supervising the project's functioning.

b. Management systems

Institutional framework, those systems and mechanisms put in place by the project, or that the project modifies and impacts and that allow for the follow-up of project activities and objectives.

c. Incentives plans

Those program or incentive plans are associated with the project's beneficiaries and objectives

e. Legal framework

Description of regulation associated with the project's implementation.

f. Community attitudes and expectations

Those actions involved in the projects' implementation that aim at including the initiative in its development context, participants introduction to the project (direct or indirect), communication with those involved in the project that facilitate the project's implementation. It also describes how the project considers the impact on the community, particularly in relationship with students' families.

7.6. Sustainability

a. Priority and Visibility

The position of those responsible for the project as well as project objectives and the promotion of such activities.

b. Budget

Different budget sources and procedures that are directly or indirectly involved with the project's operations. Any difficulties with the procedure should be described as well as future financing plans. The expenses that the project entails should be noted, specifying one-time purchases as well as those that are recurring and will therefore be part of the project in the future. The mechanisms that should be used to secure funding in the

future. For a long term implementation, the project's strengths and weaknesses and how the project itself plans to address them. It will include the total ownership cost as proposed by GESCI².

VIII. Evaluation

The proposed Conceptual Framework is not an evaluation framework nor should it be used to explicitly develop specific evaluation instruments. It will function as a guide with elements to be considered which evaluators will apply and use to develop evaluation models and or instruments appropriate for each context.

8.1 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 should consider at least that information that impacts the project's objectives explicitly, including, those linked to student learning. It is advised, though, that where possible the information process is considered because this will allow unforeseen impacts to be documented.

One reason why it has been hard to evaluate impact of ICT projects in the past is the lack of reliable data related to education projects. For this reason it is vital that future projects' baseline information is correctly collected. For those projects that have already started or are already finished, the conditions before the project implementation will be reconstructed where possible with available data.

The effort to set a baseline in place before the project's implementation is highly desirable and should be a condition for new project design, but not essential. Where unavailable it will be "reconstructed" with ex -post information.

8.2 Monitoring

Relevant data design, in the intermediate steps of the project's implementation, will inform progress and guide the project towards objectives, allowing for early problem detection and correction in learning.

Technically precise periods can be defined for the development of the monitoring phase, according to the specific project characteristics e.g.: monthly, quarterly, bi-annually but also technological models can be established that promote permanent feedback to project administrators with pertinent information for control and decision-making.

² Global e-school and communities initiative <http://www.gesci.org/>

8.3 Final Evaluation

The projects' integral review process, including: its achievements, progress, challenges and the identification of its impact in relation to the previously established objectives. Impact should be considered broadly, including all processes and products.

Evaluation is a key aspect of the project. It should be taken into account from the beginning of the design process as a fundamental component and where possible it should be designed by an external entity to assure impartiality and objectivity. Where possible, experimental evaluation methods should be used in order to complement other sources of information so results are more solid and trustworthy.

IX. Sources of information

9.1 Qualitative

An important characteristic of the evaluation will be its contribution to determining the role of ICT in education and the conditions where its implementation adds value to teacher practices, students, schools and communities.

Because of the heterogeneous nature of the countries in the region and the ICT4E projects, a qualitative approach will complement data contributed by the quantitative approach with available data, with the aim of determining the impact and conditions, which explain project results.

This approach also includes individual, semi-structured interviews, focus groups, structured observations in classrooms or other aspects of the project, surveys of those involved in the project directly or indirectly and a review of studies and reports concerning the projects components.

In this context, access is important (through interviews and surveys) in order to collect participants' opinions and perceptions. The self-evaluation and self-perception processes are an important part of the ICT4E projects' possible impact.

The qualitative analysis should contribute contextual information and document the change or impact rendered by the project that cannot be scrutinized with qualitative data such as changes in practices, processes and attitudes, which occurred due to the project.

9.2 Quantitative

The quantitative analysis relies on comparable and objective information stemming from existing sources of data. Usually this kind of analysis includes challenges of isolating variables in a way that the data does not ‘contaminate’ other factors on being able to access clear results to determine the impact produced by the project. The success of this task is strongly determined by the range and depth of the available data for analysis. Clearly more specific data allows for more options in the analysis and for more reliable conclusions.

The construction of control groups (experimental) or comparison (quasi – experimental) are an important part of the search for relevant information. It would be ideal to have longitudinal data at the individual student level as well as at the institutional levels in schools as this could be useful to frequently explore the implementation processes of these types of projects.

9.3 Analysis

Once qualitative and quantitative data have been collected and structured, it is essential to carry out rigorous analysis which will establish linkages between the gathered data and possible contradictions, recognize significant differences and trends, and describe in detail the observable impact and the expected results of the projects, which is described in the following section.

The analysis serves mostly to obtain lessons learned which will put into practice future changes and adjustments in order to improve, as well as to obtain important and comparable data that helps policy and decision-makers in other contexts.