



Technologies for Education

Basic Guidelines for Project Evaluation

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TECHNOLOGIES FOR EDUCATION

BASIC GUIDELINES FOR PROJECT EVALUATION

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I. INTRODUCTION

The use of technologies within educational settings has become a priority for governments of developing countries. Investment in Technologies for Education (TEd), which has the goal of improving the quality of education and making it relevant to 21st century realities, has grown steadily during the past decade. However, efforts involving the evaluation of such projects have been inadequate thus far. The evaluation of educational technology projects is critically important, since it allows us to learn from the experience of carrying out such programs while providing vital information on expected results.

The present document is intended for those who design, implement, and make decisions with respect to TEd. Its purpose is to foster the development of increasingly rigorous monitoring and evaluation processes that in turn lead to richer experiences that are more focused, effective, and sustainable.

We will present the basic definitions, conditions and guidelines for carrying out an evaluation of projects involving the use of technologies in education.

In the following section of this document we present the fundamental features and objectives typical of TEd projects, and a description of the central aspects of the action framework developed by the IDB in this regard. In the third chapter, we will discuss what an evaluation is, identify its basic components, and describe the kinds of evaluations currently used. Finally, we will review each step of the evaluation process for these kinds of programs.

II. EVALUATION OF TECHNOLOGIES FOR EDUCATION (TED) – CORE PRINCIPLES AND CONCEPTUAL FRAMEWORK

The purpose of using technologies in education is to maximize the educational results achieved by students. In order to achieve this goal, those who design and implement these kinds of initiatives assume that incorporating technologies for education will help improve educational processes, make them more effective, decrease the costs of certain activities, and enable the development of new practices and innovation that have a positive impact on results.

The core principles and justifications that have been proposed for projects designed to increase technology access in educational settings (Severin and Capota, 2011) include:

- a) Economic rationales: Knowing how to use ICTs is necessary in order for nations to be competitive in a globalized world. In addition, it is necessary to develop skills in within the area of ICTs in order to increase the productivity of technology within productive processes.
- b) Social rationales: These kinds of projects aim to reduce the “digital divide,” which is defined as the difference in use of and access to technology among different population groups—especially between the rich and poor.
- c) Educational rationales: The use of ICTs in education is both a means as well as an end in itself. On one hand, different actors within the educational system must be trained in the use of ICTs in order to be well prepared to meet the real demands of living in the 21st century. On the other hand, the use of these technologies will allow educational systems to optimally adapt to the diversity of interests and skills of their students, and thus offer them a more relevant education.

The evaluation of educational technology projects is of critical importance in order to assure both that the expected results are achieved and to obtain information regarding the optimal combination of inputs and processes that achieves the best possible results. In this way, it will be possible to forge a deliberate process involving both learning and continuous improvement that will allow new initiatives to be more efficient and effective.

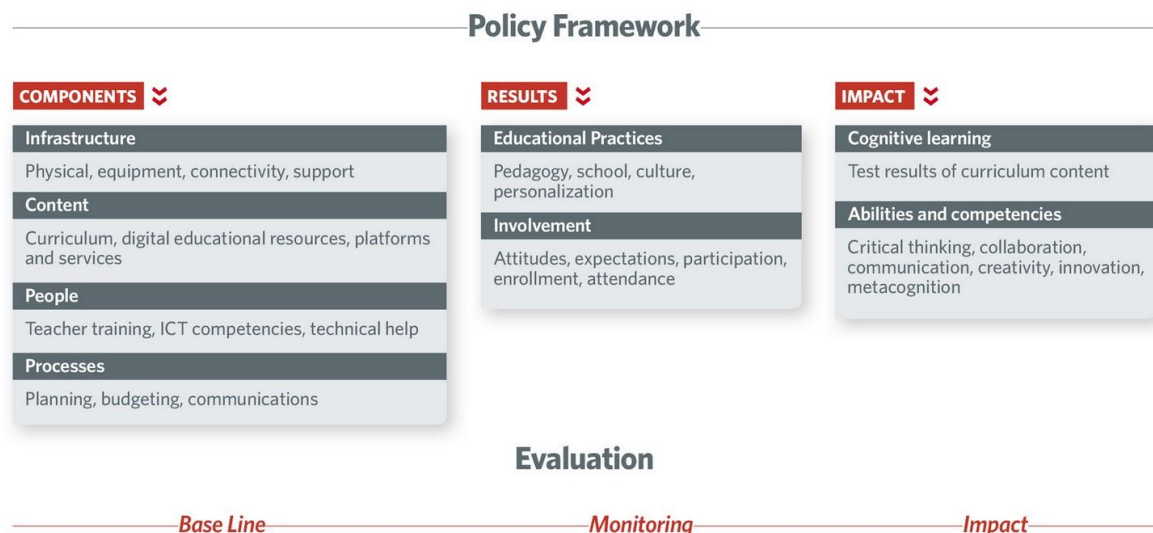
2.1 Conceptual Framework

The IDB has proposed a conceptual framework to support the design, implementation, monitoring, and evaluation of projects aimed at incorporating technologies for the purpose of fostering educational improvements.

The key feature of this framework is an integral project design that prevents such interventions from merely being isolated efforts and instead fosters their systemic incorporation into educational policies for the purpose of achieving excellent results.

The proposed framework identifies four inputs that should at least be considered in each project, as well as in the processes and products resulting from each project. These inputs, while not necessarily forming a direct part of an intervention, could possibly affect, or be affected by, the development of the project. Afterward, various indicators will be proposed for measuring the degree of development and maturation of each project.

Figure 1: Conceptual framework for the design, implementation, monitoring, and evaluation of ICT projects, IDB 2011



The basic premise of this conceptual framework is that the ultimate objective of the educational process is to assure that students achieve learning results and develop competencies and skills. Therefore, the expected results of the interventions are associated with positive changes in both pedagogical practices and study habits, as well as with a greater degree of involvement on the part of educational actors—especially students—in the learning process. The expected long-term impact is a significant improvement in learning, and in the development of the competencies necessary to function in a global world.

It is important to keep in mind that the aspects of a TEd program that need to be evaluated are directly associated with the degree of maturity of the program's development. In terms of this dimension of maturity, the conceptual framework identifies four stages: emergence, application, integration, and transformation. Both the evaluation mechanisms that are implemented as well as the indicators that are utilized must be capable of being applied to each of these stages.

Based on this perspective, it is suggested that the impact that it is reasonable and possible to expect for each initiative will dependent on its developmental stage at the time of evaluation. The expectations relevant to each of the proposed four stages are listed in the following table:

Table 1. Possible expectations based on stage of maturity

	EMERGENCE	APPLICATION	INTEGRATION	TRANSFORMATION
Practices	<ul style="list-style-type: none"> - Dominated by exhibitive and vertical classes. - Classes centered on the teacher and his/her knowledge. - Technologies as a specific subject for students. - Students have difficulties accessing and using technologies. 	<ul style="list-style-type: none"> - Teacher-centered classes that occasionally incorporate technology in classroom activities in the beginning of their regular curricular planning. - Students have regular access to technology, but do not often connect it with their school experience. 	<ul style="list-style-type: none"> - Student-centered classes, teacher assumes a facilitator role, actively proposing and accompanying the work of students and using technology collaboratively in their schoolwork. - Use is relatively intense in the school context, but substantially lower outside of school and in the proposed activities. 	<ul style="list-style-type: none"> - Permanent learning environment, teachers and students collaborate permanently in the creation and communication of knowledge. Emphasis on the inquiry and development of projects, with increasing autonomy of each actor. - Abundant use communication and collaboration platforms.
Students Involved	<ul style="list-style-type: none"> - Passive student attitude with respect to learning. - Low or moderate expectations of the impact of their studies on their future 	<ul style="list-style-type: none"> - Passive student attitude with respect to learning. Moderate expectations of the impact of school on their future lives, motivation for studying outside of school. 	<ul style="list-style-type: none"> - Active student attitude with respect to learning. High expectations with respect to learning and personal goals, although no explicitly connected to their school experience. 	<ul style="list-style-type: none"> - Proactive attitude and autonomous respect for lifelong learning. High expectations with regards to their future and the role that education plays in it.
Learning Results	<ul style="list-style-type: none"> - None 	<ul style="list-style-type: none"> - Low impact 	<ul style="list-style-type: none"> - Medium impact 	<ul style="list-style-type: none"> - High impact
Abilities and Competencies	<ul style="list-style-type: none"> - None 	<ul style="list-style-type: none"> - Low impact 	<ul style="list-style-type: none"> - Medium impact 	<ul style="list-style-type: none"> - High impact

Thus, the availability of a common framework and set of indicators will enable progress in the sector by making available the following elements:

- a) A system of monitoring and control of progress of education and technology initiatives.
- b) Information that will enable impact evaluations of initiatives that take into account baseline, mid-term and long-term results, while controlling for factors associated with teachers, students, and students' families.
- c) Knowledge regarding the relative development of countries with respect to this area (as a result of having comparative information).

On the basis of these definitions, the conceptual framework proposes a set of 122 indicators (90 of inputs and 32 of results and impact) that all together allow a comprehensive view of the process of incorporating technology into education, as well as a result of that incorporation over time.

The greatest advantage of being able to have at one's disposal a broad set of indicators is that it provides information that allows implementation of a formal evaluation process that establishes the baseline or initial conditions of the project, that allows the comprehensive monitoring of the project while it is being implemented, and that is conducive to conducting a mid-term and long-term impact evaluation.

III. EVALUATION: DEFINITION, BASIC COMPONENTS, AND CLASSIFICATION

3.1 Definition

Evaluation is here defined as a systematic, methodical, and neutral process that provides information regarding the effects of an initiative in terms of the goals proposed and the resources utilized.

The evaluation of project is a process that facilitates the identification, gathering, and interpretation of useful data as part of an *accountability* process aimed at planning and defining the distribution of resources and displaying the results. Evaluation also serves as a means of learning from past experience, thus enabling both the improvement of services that are provided in the projects being evaluated and the development of new initiatives. An “impact evaluation” refers specifically to the identification of positive or negative effects generated by a particular project among participants in said project (i.e., in comparison to non-participants).

Some fear the process of project evaluation because they think that its primary purpose is to define the global failure or success of a given project. This is a rather narrow conceptualization of evaluation, given that its fundamental purpose is supporting the development and meeting of the objectives defined by the project, and informing future decision-making.

It is always important to take evaluation into account as a fundamental component of a project. This is critically important in terms of both design and budgetary considerations. Evaluating each component of the project helps to better define project objectives, and to measure the degree to which these objectives are being met during each stage of the project. In terms of budgetary consideration, it is estimated that expenses associated with a rigorous evaluation may comprise between 3% and 10% of the total cost of a program. It is therefore extremely important to consider the costs associated with evaluation when creating a budget for a project.

3.2 Basic components

Once the objectives of an initiative have been defined, the basic components to be taken into account for the purposes of conducting an evaluation are as follows:

- a) Definition of the **objectives and evaluation strategy** that are aligned with the logic and objectives of the initiative being evaluated, the kinds of evaluation necessary, and the appropriate methods for that purpose.
- b) Definition and/or development of the necessary **indicators** for evaluating the objectives of the project.
- c) Definition and/or development of the **instruments** that will allow measurement of the level of compliance with the previously described indicators.
- d) Definition of the **unit of analysis** that will be utilized in relation to each evaluation method that has been selected. For example, in the case of a quantitative evaluation, the sample size necessary for evaluation must be defined. In many instances, both program participants and a control group must be identified. In the case of a qualitative evaluation, the means of selecting program participants must be described.
- e) Definition of **time periods**. Projects normally have short-term, medium-term, and long-term objectives. It is necessary to be clear about what each of these objectives is in order to be able to correctly implement the evaluation plan.
- f) **Application** of evaluation instruments (i.e., for the necessary sample and at appropriate times). It should be kept in mind that, in the case of new instruments that have not previously been used, it is always advisable to conduct a pilot study in order to assure that the instrument in question can capture the information that is desired.
- g) Statistical or interpretive **analysis** of the data derived from the application of evaluation instruments.
- h) System **feedback**.

3.3 Types of evaluation

An evaluation can be defined in terms of a series of dimensions. *Within* each dimension, it should be remembered that different kinds of evaluation are mutually exclusive. *Between* dimensions, however, this is not the case.

Table 1 summarizes the main dimensions that define an evaluation, and the kinds of evaluations associated with these dimensions. A description of each of the different evaluations follows the table, with a special emphasis on process and impact evaluations.

Table 1: Dimensions for classifying types of evaluation

Dimension	Type of evaluation
According to the kinds of indicators and information being analyzed.	Qualitative
	Quantitative
According to the time the evaluation is conducted.	<i>Ex Ante</i>
	<i>Intra</i>
	<i>Ex Post</i>
According to the kinds of indicators in the evaluation.	Process evaluation
	Impact evaluation
According to the use that will be made of the results.	Formative evaluation
	Summative evaluation

3.3.1 According to the kinds of indicators and the information analyzed

a) Qualitative

Qualitative evaluations focus on variables to which no metrics can be applied (i.e., variables that cannot be described in terms of numbers that give an indication of development or results). This kind of analysis is relevant, since it provides information regarding both the value assigned to such variables by program beneficiaries and the processes affecting results, thus fostering greater understanding of the results that have been observed. Qualitative evaluations are critically important for understanding and

incorporating the views of beneficiaries into the evaluation process, and constitute a more appropriate mechanism for understanding and evaluating the social processes involved in implementing a program.

Conducting a qualitative evaluation does not preclude the possibility of also conducting a quantitative evaluation. On the contrary, a qualitative evaluation is an important complement to a quantitative evaluation, since the former can help generate hypotheses or relevant questions that can be further explored via the latter. Such exploration can in turn support the data analysis of the qualitative evaluation.

Among the principle advantages of qualitative evaluations are their flexibility and capacity to quickly collect data and process information. However, their subjective element and lack of a statistical component make it difficult to generalize any conclusions from such evaluations to the population targeted by an intervention.

b) Quantitative

This kind of evaluation focuses on indicators that are variables that can be described in measurable terms, and may utilize one or a combination of statistical methods (from simple comparison of means to highly complex procedures) in order to determine the results of an initiative. Among the distinctive attributes of quantitative studies are objectivity and the possibility of obtaining statistically representative information.

The primary instruments that are used for quantitatively evaluating programs are administrative records, surveys, and standardized tests.

3.3.2 According to the time the evaluation is conducted

a) Ex Ante

Conducted prior to the implementation of a program. Its purpose is to evaluate the context in which a program will be implemented, the needs that have been detected, and inputs. A study of this kind can be used to determine a baseline that can be utilized in future evaluations.

b) Intra (during)

Conducted while a program is in progress, the purpose of such evaluations is to assess process activities while they are being carried out, for the purpose of identifying what is being done correctly, as well as difficulties and errors in implementation.

c) Ex Post

Conducted at the end of a project (or following the conclusion of one phase of a project), the purpose of such evaluations is to determine the results that have been obtained from the intervention.

3.3.3 According to the kinds of indicators in the evaluation

a) Process evaluation

The purpose of a process evaluation is to determine if the project is being properly implemented. This is done by analyzing the input indicators associated with the program whose process is being evaluated. These kinds of evaluation focus on the management and implementation of a project, and their importance lies in the fact that they allow for verification that the conditions of proper implementation of the project are being complied with.

Process evaluations are extremely relevant to program implementation, given that they provide information regarding the most immediate effects of particular program

components on the beneficiary population. This category includes an evaluation of the quality of the goods and services being provided by the program, both at the technical level and in terms of the perception of program users.

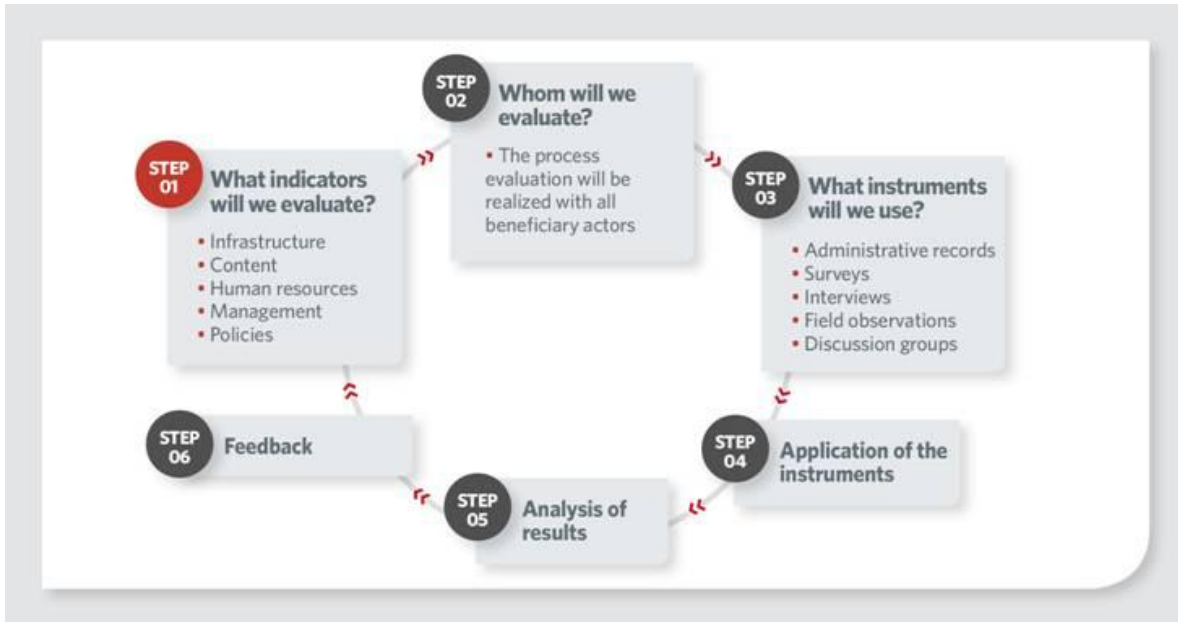
Examples of process evaluations include:

- Comparing the performance of an educational institution to itself (temporal evolution).
- Evaluation in reference to the proposed program's goals (in which case such goals must exist and be well defined).
- Comparing program results with pre-established technical or quality standards (e.g., ISO 9000).

A process evaluation should ideally take place during all stages of project implementation (i.e., before, during, and after). As previously mentioned, an *ex ante* evaluation takes into account those critically important needs that a program needs to meet (and therefore, *ipso facto*, involves the definition of goals to be used to evaluate the program). A process evaluation is especially important while a program is still being implemented. It is only in this way that it is possible to detect errors or difficulties arising from program implementation in a timely fashion.

Depending on the nature of the program to be evaluated, both quantitative and qualitative information can be utilized. The kind of information to be gathered or analyzed is closely related to kind of analysis that one wants to conduct. Thus, if we want to evaluate how beneficiaries perceive a program, in order to see if these perceptions are really related to program objectives, it will be necessary to conduct interviews or form focus groups that provide a platform for beneficiaries to express their perceptions of the program.

Here is a schematic depiction of a process evaluation:



b) Impact evaluation

The purpose of an impact evaluation is to determine if there is a cause-effect relationship between the program, on one hand, and the results obtained on the other. An impact evaluation is generally carried out *ex post* (i.e., after a project, or a phase thereof, has been completed). The kind of impact evaluation that will be discussed here is *quantitative* in nature.

An impact evaluation is based on a *counterfactual scenario*. This refers to evaluating the effects of a program by determining the situation in which beneficiaries would find themselves if they had *not* participated in a program. Given that such a scenario cannot literally be created (i.e., given that beneficiaries are by definition program participants), there are a series of mechanisms that can be employed in order to simulate such a counterfactual situation.

Impact evaluations, which can be conducted in a number of different ways, include the following dimensions:

b.1. How the group to be evaluated is constructed

In order to conduct an impact evaluation, it is necessary to identify and separate the benefits achieved as a consequence of the program intervention from those that would have occurred in the absence thereof (i.e., because of prevailing environmental conditions, other public or private programs, or the mere passage of time). Given that we do not know “what would have happened” in the absence of program implementation, it is necessary to construct a hypothetical situation that allows us to simulate such a counterfactual situation. This is known as a “control group,” which is a group of persons not benefiting from the program, but which is part of the larger group targeted by the program in that it shares social, economic, educational and other relevant characteristics with the beneficiary group.

Impact evaluations are characterized in two different ways, according to how such control groups are constructed:

i) Experimental

Both the sample of beneficiaries as well as that of non-beneficiaries are constructed by randomly assigning representatives of the target population to either the treatment or control group of a particular program. Such random assignment allows the assumption that both groups are statistically equal with respect to all attributes relevant for the project, and thus is conducive to an unbiased evaluation of the program.

This kind of evaluation is very common in certain areas of medicine, but less common within the realm of public policy. This is due to the fact that it is sometimes not politically or ethically viable to exclude individuals in need from a given treatment regimen. Therefore, random assignment is often questioned in terms of general public wellbeing, sometimes for ethical or political reasons, and sometimes because the need for evaluation itself arises only after a program has already been initiated. However, it is still

possible to conduct this kind of evaluation when projects *naturally* create a randomized assignment of beneficiaries and non-beneficiaries (i.e., because of budgetary considerations, implementation stages, geographic restrictions, etc.).

To be implemented, an experimental evaluation must be considered from the time a project is first conceived. This is because there needs to be clarity regarding both sample groups from the very beginning of a project. In addition, a clear and decisive commitment is required to respect the randomization of group assignment. This is important in order to avoid the contamination of treatment and control groups, which would prevent proper attribution of program effects.

ii) Quasi-experimental

In many instances, it simply is not feasible to randomly assign beneficiaries of a program. This is often the case for ethical reasons: in other words, it is sometimes thought unethical to conduct random assignment. In other circumstances, random assignment is impossible because an interest in carrying out an evaluation arises only after a project has already been initiated. In still other cases, the conditions of implementation do not allow for the creation of isolated treatment and control groups. However, it is always necessary to simulate a counterfactual situation in order to conduct an impact evaluation. Quasi-experimental design identifies control groups that have been determined on a basis other than random assignment of subjects.

b.2. How an impact indicator is determined

The way that an impact indicator is determined depends on the group about which we have information (i.e., treatment and/or control groups) and the period of time for which we have information (i.e., before and/or after implementation of the program) as well as the scope of the program (i.e., universal, census-based, or selected according to some specific criterion).

		Beneficiaries	
Stage		SELECTION	CENSUS
DESIGN/ START	<p>Differences in differences Comparison within beneficiaries and non-beneficiaries over time</p>	<p>Comparison of the results of the beneficiaries over time</p>	
IN PROCESS / FINAL	<p>Primary differences Comparison of results between beneficiaries and control group, once the program has finished</p>	<p>No control group and it is not possible to analyze the evolution of the results. The alternative is to find a baseline in standardized tests applied at the national level.</p>	

Based on the combination of these factors, there are three different kinds of analyses that can be conducted.

- i) Analysis of the temporal evolution of the beneficiary group (i.e., pre- and post-project).

This involves comparing the situation of participants at different stages: prior to entering the program, during different program stages, and then at the end of the intervention.

This kind of analysis does not involve a control group (defined either experimental or quasi-experimental). For this reason, it is not possible to correctly establish a cause-effect relationship between the program and the observed effects. This kind of analysis does not allow for the isolation of other factors (i.e., factors other than the program) that might have affected the results being evaluated. For this reason, it is not feasible to attribute differences associated with the temporal evolution of the beneficiary group to the effects of the program alone.

- ii) Comparison between beneficiaries and non-beneficiaries (primary differences)

This consists of comparing the situation of program participants with non-participants in order to evaluate the impact of a program. These kinds of evaluations are conducted once the program has been completed (in other words, they do not utilize temporal evolution data). Analyses of primary differences are typically conducted within the context of quasi-experimental design, in which a decision to conduct an evaluation was taken only after the project was underway (and which therefore lacks a baseline measurement).

This might not seem to pose a problem because, as previously mentioned, the purpose of constructing a control group is to assure that there is a group of individuals who are statistically similar who can serve as a basis for comparison. However, because information regarding both groups *prior to* initiating the program is lacking, any differences found afterward may be due to pre-existing differences that determined program participation (a phenomenon known as “self-selection”). When a group of program beneficiaries has not been randomly assigned, but instead the persons themselves have decided to participate in it, the group of beneficiaries is by definition different from the non-beneficiary group, since the former have certain characteristics that have motivated them to participate.

There are a number of statistical methods that allow for the isolation of these effects and the obtaining of unbiased impact indicators. Among such methods are: i) the natural experimental method; ii) construction of artificial control groups via “matching” procedures; iii) identification of causal effects *by means of instrumental variables*¹ and iv) regression discontinuity designs.

iii) Comparison between beneficiaries and non-beneficiaries over the course of time (“difference in differences”)

This approach involves a combination of the two previously described options, given that it consists of comparing the situation of beneficiaries with that of non-beneficiaries before and after implementing a project. This is the most commonly recommended approach,

¹ See Heckman (1998).

because it allows for more reliable attribution of the causality of changes vis-à-vis the proposed program.

In order to conduct this kind of evaluation a minimum of two different measurements are needed: baselines (i.e., prior to project implementation) and for both groups. This makes it possible to construct what is called a “difference in differences” indicator where first, a change in results of individuals before and after the program (primary differences) and, later, the differences between beneficiary and control groups (secondary differences) are compared.

Among the important considerations in this respect are the following:

- A random experimental design normally utilizes longitudinal information in carrying out an evaluation. Given the fact that such a design is utilized when an evaluation has been planned as part of the program’s development, it is possible to determine a baseline for evaluation purposes. In the case of experimental evaluations, and as long as the treatment and control groups are indeed comparable, determination of a baseline is not strictly necessary, although having it makes it possible to obtain more accurate information. Most importantly, it provides a higher degree of confidence regarding the comparability of the experimental and control groups.
- When quasi-experimental designs are used in order to conduct an impact evaluation, it is less probable that longitudinal information will be available, although using such information can still be feasible. For example, many countries universally apply standardized tests to their students at designated times. In such cases, the measurement obtained can become a baseline for evaluation. In addition, depending on how often an instrument is utilized in these kinds of circumstances, the very same test can be used as a post-program measurement.

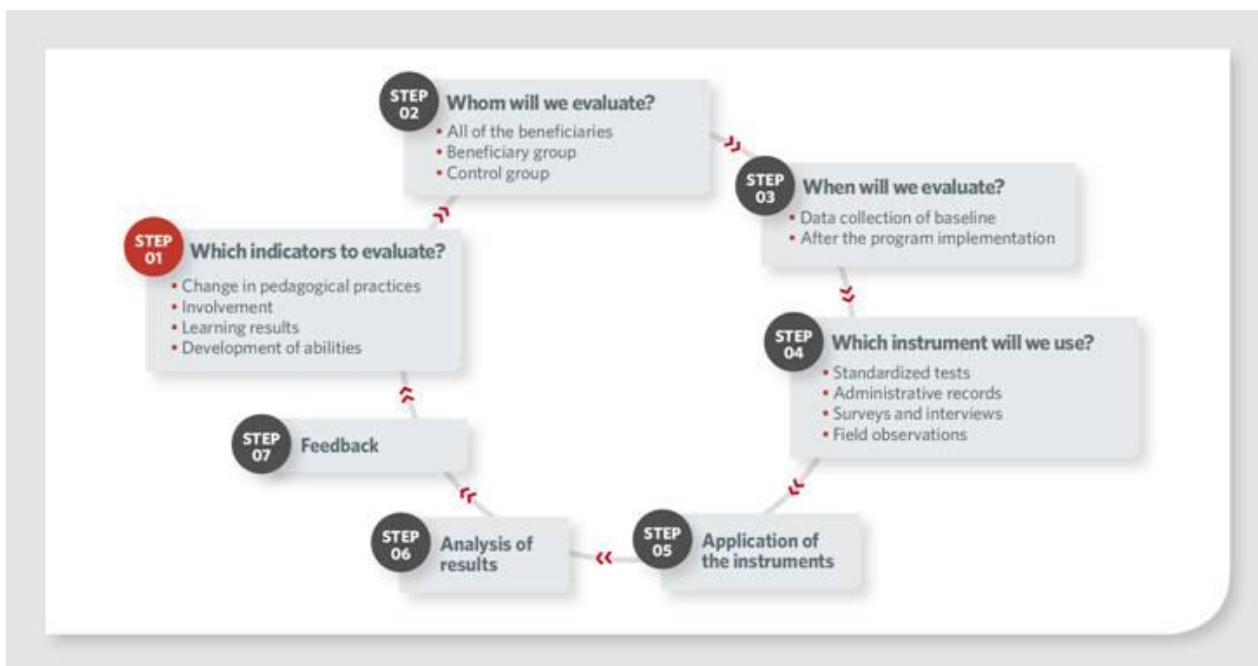
b.3. According to the statistical method used in order to measure impact

A number of statistical methods have been used in order to quantify the impact of programs. The use of these methods mainly depends on the information available, whether or not there is a control group and, if there is a control group, how it has been defined. The following are among the most commonly used techniques:

- i) Difference in differences method: This method is only feasible when there are treatment and control groups with baselines, and only after completion of the program.
- ii) The construction of control groups via statistical “matching” procedures.
- iii) Determination of causality using advanced estimation methodologies such as: two-stage estimation (Heckman), regression discontinuity designs, and instrumental variable models.

It is essential that each stage of the impact evaluation be implemented by a specialist in the procedure who has advanced knowledge of both statistics and econometric models.

Here is a schematic diagram of an impact evaluation:



IV. IMPLEMENTING AN EVALUATION OF A PROJECT INVOLVING TECHNOLOGIES FOR EDUCATION

The ultimate objective of every educational technology should be achieving learning results and engendering competencies and skills among students. In order to achieve such a result, however, a series of processes within the initial input environment need to be implemented with respect to inputs frequently affected by the project's activities. The monitoring and evaluation of these processes is a domain that allows for both the timely reporting to all interested parties of information regarding the progress of a project toward an expected ultimate objective, and for making decisions regarding needed adjustments that have to be made on an ongoing basis.

In the following paragraphs, we describe all of the important activities that should be carried out in order to conduct an evaluation of these kinds of programs, within the context of the previously described conceptual framework.

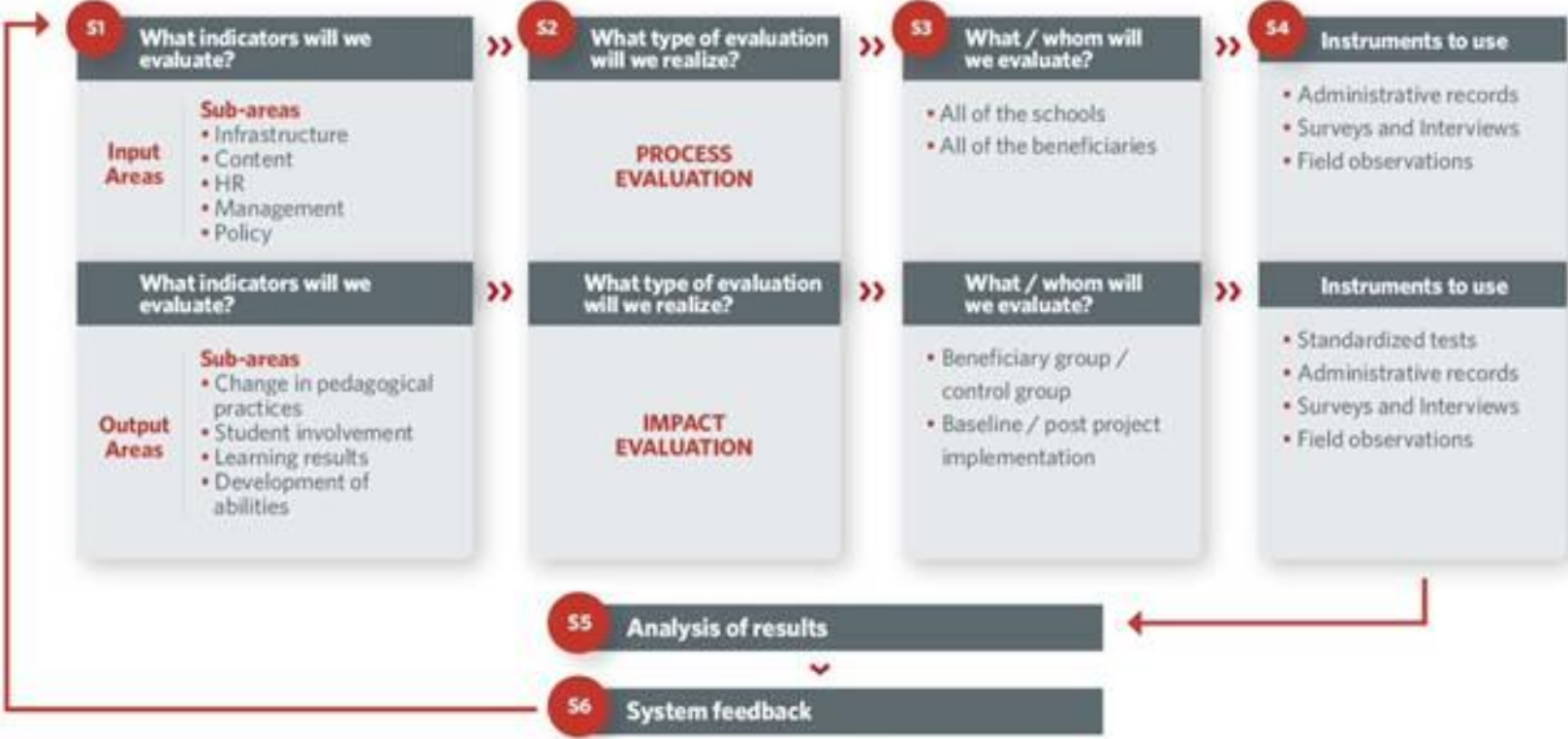
It needs to be emphasized that evaluation is a component that is vitally important to each stage of the project, and should ideally be designed along with the project and not afterward. However, it is also important to remember that there are mechanisms in place for evaluating impact in those cases in which beneficiary and control groups were not identified as part of the program design. In other words, even though both alternatives are viable, it is always preferable (i.e., in terms of the quality of information to be obtained) to develop an evaluation strategy for the project while it is being designed rather than after it is already underway.

The purpose of this section is to provide a step-by-step review of the implementation of an evaluation of a project involving Technologies for Education that considers the indicators to be evaluated, the instruments necessary to conduct the evaluation, and the professionals needed at each stage.

Figure 2 shows the stages associated with the implementation of the evaluation TED project. Even though the diagram depicts a number of successive steps, the reality of the

matter is that steps 1 through 4 involve a great deal of overlap, and must be considered collectively in terms of developing an evaluation.

Figure 2. Implementing the evaluation process



In the following section, we will provide separate descriptions of the process of developing an evaluation of input results indicators.

4.1 Process evaluation: Input indicators

As previously indicated, a process evaluation is critically important for all projects because, among other things, it assures that the conditions for the proper implementation of the project are in place.

i. Indicators

Table 2 presents a series of domains and subdomains defined within the conceptual framework for input indicators. Note that there are five input domains that need to be part of the design and evaluation of any project.

Table 2: Input indicators

Domains	Sub-domains
1. Policies	Planning
	Budget
	Communication
	Incentives
	Legal framework
2. Infrastructure	Physical
	ICTs
	Connectivity
	Technical support
3. Content	Curriculum and ICTs
	Digital educational resources
	Platforms, applications, and services
4. Human resources	Teacher training
	General CIT competencies
	Educational use of ICTs
	Pedagogical support

5. Management	Administration
	Information systems
	Community involvement

Source: ICTs in Education: Conceptual Framework and Indicators - IDB

1. Policies

- a) Planning: Medium- and long-term priority of the project or its context of other initiatives, plans, projects or activities being implemented, including visibility or degree of identification of educational leaders with the achievement of the plan’s objectives.
- b) Budget: Long-term budget needs to take into account include operational continuity and the development of complementary initiatives needed to achieve the expected impact.
- c) Legal framework: Activities aimed at adjusting and adapting the available norms for the purpose of improving and maximizing a project’s impact and minimizing its risk. This includes measures designed to improve the protection and safety of legal minors, the regulations of associated industries, the safeguarding of copyrights, etc.
- d) Incentives: Plans and programs for highlighting (either positively or negatively) both the commitment and the results expected from the project by those participating in it.

2. Infrastructure

- a) Physical: There is a relationship between the provision or availability of the infrastructure necessary for the facilitation of use of a technology system and the assuring of access to that system. The ratio of accessibility to the system can be 1:1 or a lesser figure. Other important elements in this regard are electrical connections (i.e. the need for multiple outlets in classrooms), communication networks, classrooms, furniture, etc.
- b) Equipment: This refers to all of those devices that have been planned for, including computers, projectors, printers, peripherals, and accessories, as well as the

conditions associated with their acquisition and use (warranties, support, service levels, etc.).

- c) **Connectivity:** Internet and Access to the network are of fundamental importance for implementing TEd projects. Other important elements in this regard include bandwidth, connection stability, traffic-optimizing technologies, and the provision of filters that protect confidentiality and that control the content that can be accessed by students, as well as the structuring of solid, secure, and accessible local networks.
- d) **Technical support:** This concerns the administration, maintenance, and repair of the available equipment, as well as activities geared toward resolving problems and technical concerns by those users participating in the project.

3. Content

- a) **ICT curriculum:** Development of curriculum for the implementation and/or adaptation of content regarding ICTs and concerning other materials via the cross-sectional use of ICTs.
- b) **Digital educational resources:** Digital material to be used for teaching and learning with computers must be available. This includes educational software, digital resources, encyclopedias, manuals, textbooks, other books, guides, etc.
- c) **Platforms, applications, and services:** incorporation of software or support initiatives for conducting teaching and learning activities, including productivity applications, simulators, modelers, etc. Also included in this category are means and mechanisms to be used for distributing digital content to different users within the educational system.

4. Human resources

- a) **Teacher training:** Pre-service and in-service training as regards the adoption, adaptation, and continuing use of curricular content and practices involving the integration of computers into the teaching and learning processes.
- b) **General ICT competences:** Training initiatives for acquisition of and/or certification in general skills involving the use of ICTs, basic training, and productivity and communication tools.

- c) Educational use of ICTs: training and educational initiatives associated with the specific use of ICTs in educational contexts and for educational purposes.
- d) Pedagogical support: efforts to provide pedagogical support and monitoring for participants, providing them with orientation and developing ongoing tutorials to facilitate the implementation of the proposed activities.

5. **Management**

- a) Administration: Structures and strategies for the management and administration of systems and projects at all project levels (i.e., nation, region, school, department), as well as the relationship with other institutional actors involved in the project (e.g., those in charge of its financial aspects, strategic allies, etc.).
- b) Information systems: Activities designed to support implementation of educational management and information systems at the level of the school, region, or nation, as well as activities that will track educational projects and their actors. This includes curriculum management and pedagogical management.

It is essential to specifically identify those indicators that are relevant for the evaluation of each TEd project. Not all input indicators defined within the framework will be able to be modified by all of the projects. For this reason, it is critically important to identify and define the set of indicators that are most likely to be affected by each initiative. For example, it is possible to distinguish between those projects that are implemented as part of a national policy from those that target a specific group of the population. Policy indicators would not apply to this latter category.

Specifically, infrastructure, content, and human resource indicators are very important when it comes to implementing a project involving the provision of technology for education, and should constantly be monitored in order to detect possible problems in implementation. For example, it has been observed that, in many One-to-One computer projects that have been carried out in Latin America, there has been an issue of a lack of teacher training in developing pedagogical techniques involving the use of new technologies. Ideally, this is the kind of problem that should be detected in the early stages of a project in order to implement strategies that would provide solutions.

ii. Instruments

In order to conduct an evaluation of processes and managerial control of projects, the information necessary for determining the previously described indicators must be available. Among the instruments enabling access to this information are the following:

- a) Administrative records: This refers to the information collected as part of administrative procedures with which educational units are obliged to comply, whether to manage the educational institution or to fulfill requirements imposed by governmental authorities. Administrative records to be kept by schools include accounting information, enrollment records, and teacher payrolls.
- b) Surveys: The purpose of surveys is to obtain information relevant to the identification of indicators through a set of standardized questions. Surveys may be geared toward particular categories of actors within the educational system: students, teachers, principals, those holding power of attorney, etc. Surveys may be applied to a representative sample of the entirety of the study population in order to ensure the reliability of the statistical data analysis.

The IDB utilizes three different questionnaires that can be accessed through our website, and which are designed for educational establishments, teachers, and students. These instruments capture 41 input indicators and 15 result indicators, collectively totaling 45% of the conceptual framework.

For the evaluation of the program “One Laptop per Child” in Peru, a series of instruments were constructed, among them questionnaires for students, families of students, school principals, and teachers. These instruments are also available through the IDB website.

- c) Interviews: This refers to a set of questions that can be asked of various system actors for the purpose of obtaining more detailed information regarding project activities. The value of the interviews does not reside in their statistical representativeness, but rather in the depth of the information that they collect.

Three different kinds of interviews are normally utilized: 1) structured interviews in which all those interviewed are asked the same questions in the

same way, and in the same order; 2) semi-structured interviews in which the interviewer utilizes a “script” that includes the topics to be addressed, although the order in which the topics are dealt with, as well as the way in which the questions are formulated, are left entirely to the discretion of the interviewer; and 3) unstructured interviews, where not even the general content of questions is pre-determined.

For evaluating programs, it is recommended that structured interviews be used in order to guarantee that each interview has been carried out using the same procedures. This facilitates analysis and assures the comparability of results. Specifically in the case of the evaluation of TEd programs, these in-depth interviews should be conducted with teachers and school administrators in order to obtain in-depth and detailed information regarding program implementation, and also and also regarding the expectations and general attitudes with respect to the program. Conducting interviews with students also tends to yield interesting results that can help determine the specific use of those inputs provided by the program.

- d) Observation/Inspection: By field observation we mainly refer to the observation of classes and schools as a means of recording information regarding the implementation of the project. It is hoped that classroom observation will yield useful information regarding work modality, pedagogical practices, teacher performance, the use of various resources (computers being one of them), activities being carried out, the adaptation of activities to resources being utilized, etc. Classroom observation can be conducted either directly or through viewing video recordings, followed by later analysis. Observers will make use of a reference sheet that will serve as a guideline for observation and evaluation.

Field inspection refers to a technical inspection that seeks to obtain information regarding current infrastructure and technical conditions with respect to implementation of the project. This includes elements such as furniture, electrical connections, internet access, quality of service, etc.

Table 3 contains a list of some of the instruments available for implementing these kinds of evaluations in projects involving technologies for education in general, and 1-on-1 projects in particular. Some of these instruments were especially developed within the context of evaluating CIT programs in education, while others (such as PISA questionnaires) were created for other purposes but enable the gathering of information that is relevant for the identification of indicators (i.e., they can be utilized as inputs for developing other instruments).

Table 3: Some instruments available for process evaluations for projects involving technologies for education

Type	Source	Instrument
Survey	IDB Educativo	Grupo ICT and educational surveys for the administrators of educational institutions
Survey	IDB Educativo	Grupo ICT and educational surveys for teachers
Survey	IDB Educativo	Grupo ICT and educational surveys for students
Survey	IDB-Peru Project	Family questionnaire
Survey	IDB-Peru Project	Principal questionnaire
Survey	IDB-Peru Project	Teacher questionnaire
Survey	IDB-Peru Project	School-course questionnaire
Survey	OECD	PISA institutional questionnaire
Survey	OECD	PISA parent questionnaire
Survey	OECD	PISA student questionnaire
Survey	IDB-Peru Project	Classroom observation guidelines

iii. Work group

The work group is an essential component of all program evaluations. If it is necessary to conduct surveys or interviews, or to carry out inspections on the ground, then trained personnel will be needed to design and use such instruments (i.e., in cases in which pre-existing instruments are not used). In addition, an interdisciplinary team of professional specialists will need to identify indicators, analyze the data, and interpret the results.

Considering the fact that the ultimate purpose of any evaluation is to provide feedback to the system, professional experts in communications must be utilized who are able to properly inform all of the actors, and to provide support for developing strategies to resolve problems that have been identified.

iv. Synthesis

In order to carry out a proper evaluation of TEd projects, it is recommended that the highest possible number of indicators be taken into consideration, and that those indicators be selected that are most relevant for the program and the context in which it is implemented. It is further advised that these indicators be devised for the context of schools benefitting from implementation of the project, given that the main purpose of the process evaluation is to measure the degree of progress in the project, and to identify problems in its implementation, at both the general and the specific level.

In other words, the evaluation of management and processes lays the foundation for assuring that the impact evaluation is carried out for projects with acceptable implementation standards. Thus, if no relationship is found between the project and the expected results, one can be confident that it is due to the ineffectiveness of the project, and not problems in the way it was implemented.

4.2 Impact evaluation: Results

i. Indicators

As previously mentioned, the ultimate objective of TEd projects is achieving a significant improvement in learning, as well as in the competencies necessary for functioning in a global world. All of this is intended to be part of a fundamental change in educational practices, and in the involvement in learning processes on the part of actors within the school system, especially students.

Table 4 below presents domains and subdomains of the results identified within the conceptual framework. A set of results indicators were derived from these results.

Table 4: Result Indicators

Domains	Subdomains
1. Change in practices	Pedagogical practices
	Study practices
2. Involvement	Enrollment
	Grade advancement
	Retention
	Attendance
	Attitudes and expectations
3. Learning results	Standardized test scores
4. Skills and competencies	Critical thinking
	Problem solving
	Creativity and innovation
	Communication
	Collaboration
	ICTs

Source: ICTs in Education: Conceptual Framework and Indicators - IDB

1. Change in practices

The use of TEd implies a reasonable expectation that employing them will lead to a substantial change in pedagogical practices of teachers, as well as of the learning practices of students. The opportunities for accessing and constructing knowledge offered by TEd imply, for their effective and comprehensive utilization, the development of new educational management practices and the deployment of new strategies and pedagogical methodologies.

2. Involvement

One of the fundamental components of educational processes involves the commitment of students. Their participation and continued involvement in the processes is a necessary condition for their success. Furthermore, the motivation of students, and their

enthusiasm for being part of these processes, has a positive impact, not only on the possible results of learning and the development of certain competencies, but on the learning climate in general, on the expectation of the actors involved, and on the successful advancement of students from one grade level to the next.

These processes also generate change dynamics in the motivations and expectations of teachers and families, which in turn are reinforced by the motivations and expectations of students themselves, generating either virtuous or vicious circles vis-à-vis the learning environment.

3. Learning results

The first domains where impact might be expected in these kinds of projects are in: cognitive learning, which is normally associated with the materials and courses into which curriculum content is subdivided; in the learning goals; or in expected competencies.

4. Skills and abilities

It is commonly contended that an impact of the introduction of ICTs on educational processes is found in the development of new and better skills and abilities on the part of students. These competencies have been described as “high-level abilities” or “21st century skills” (Severin 2011b) because of their importance for personal functioning within a society of knowledge.

Information and communication technologies are instruments that are common to an enormous variety of work and development opportunities. Therefore, being adept in the use of these instruments may open doors and lead to personal and professional growth. The added value that a person possessing such instruments can offer can also make a difference in a country’s development.

ii. Who will we evaluate?

As indicated in part I, the group to be evaluated must be specified. There are instances in which we only have information about the beneficiaries of a program. In such instances, the evaluation needs to be conducted on the basis of these data alone. The

ideal, however, is to be able to use a control group (i.e., a group with characteristics similar to the beneficiaries of the program, but who have not themselves participated in the program). As previously explained, a control group can be constructed within both experimental and quasi-experimental designs.

ii.1 Random-assignment

In TEd studies, beneficiary and non-beneficiary groups are constructed by means of random assignment within the larger group eligible for a particular program. In this way, it is assured from the very beginning that there is a control group identical to the beneficiary group.

The following points need to be considered in conducting this kind of evaluation for TEd programs:

- It is only feasible for projects that include an impact evaluation as part of the project planning. In other words, it is not viable to conduct experimental evaluations in programs that are already underway, given that their signature characteristic is random assignment of beneficiaries.
- Given the characteristics of TEd projects, it is not always possible to randomly assign students. This is because, in many cases, the program itself stipulates that all students within a particular grade level have access (or not have access) to a computer. In such instances, randomization can be simulated at the level of educational institution, neighborhood, municipality, or region.
- Even if a TEd program is designed as a national project (i.e., involving all of the teachers and/or students within a country) it is still feasible to incorporate experimental methodology into its design. TEd projects are very expensive in a number of respects (e.g., resources, teacher training, technical training, etc.). It is therefore not realistic to implement these kinds of projects immediately at the national level. Instead, they should be introduced gradually (a method also advisable in terms of providing the opportunity to learn from experience). It is this kind of gradual introduction that will allow the incorporation of the element of random assignment of beneficiaries (at any of the levels identified in the previous point).

ii.2 Quasi-experimental designs

As previously explained, it is not always possible to randomly assign beneficiaries and non-beneficiaries before launching a program. When this is the case, quasi-experimental designs attempt to construct control groups similar to the beneficiary group in terms of those dimensions considered relevant.

The construction of a control group for an *ex post* evaluation for a TEd program requires a group of students similar to the beneficiary group in terms of those characteristics considered relevant for program implementation (e.g., age, gender distribution, socioeconomic level, results of standardized tests, etc.). Being able to do this requires information (ideally, census databases) that allow us to properly construct such control groups.

iii. Analytic methodology

As previously mentioned, the analytic methodology employed will depend on the group about which we have information, the time period for which we have information, and the scope of the program. Taking these factors into account, the following kinds of analyses are possible options:

iii.1 Analysis of the temporal evolution of the beneficiary group

As previously mentioned, when this kind of analysis is conducted, it is difficult to establish a cause-effect relationship between the results and the program being evaluated. This is because there are other factors that may have affected the results—factors for which we are not able to control. For instance, one of the expected results of TEd programs is improved motivation of students, as reflected in an increase in school attendance. If, parallel to a TEd intervention, another program is also being implemented for the purpose of improving school attendance (e.g., a school attendance incentive program) then it will not be possible to know the extent to which each of the programs is responsible for the increase in school attendance.

iii.2 Primary differences

This is the kind of analysis that is conducted when all we have, for both the beneficiary and control group, are measurements taken at the end of a program

When using such a methodology to evaluate a TEd program, it is critically important to assure that the control group of students/institutions is similar to the group that has benefited from the program. In addition, it is important to assure that such control groups have not been involved in other initiatives (i.e., in which the beneficiary group has *not* participated) which may affect the results of the evaluation. Say, for example, we want to evaluate the impact of a TEd program on students' learning of mathematics. We form two groups: schools where the program is implemented and schools where the program is not implemented (the latter being matched with the former in terms of the socioeconomic level of the students, their results on standardized tests, the extent to which it is urban or rural, etc.). In comparing students in the two kinds of schools, we could assume that a simple difference in the average results on math tests between the two groups would be a good indicator of the impact of the TEd program that has been implemented. However, it would also be necessary to assure that the group of non-beneficiaries has not exclusively benefited from some kind of policy or program geared toward improving student results. If the students had derived such a benefit, any differences between the two groups with respect to mathematics could not be solely attributed to the TEd program.

In sum, it is necessary to assure that both the beneficiary group and the non-beneficiary group are similar with respect to those characteristics that are essential for evaluating the program. In addition, it needs to be assured that the non-beneficiary group (i.e., the control group) has not participated (in the absence of participation of the beneficiary group) in programs, or been subject to policies, that could have had an effect on the dimension being assessed (in the present case, math achievement).

iii.3 Difference in differences

As mentioned in Chapter I, in order to conduct this kind of analysis, one must have at one's disposal longitudinal information that would enable the construction of the so-called indicator of differences in differences, which first involves the measurement of the change in student results before and after the program (i.e., the primary difference)

and then compares these measurements with those taken of the control group before and after the program (i.e., secondary differences).

In cases in which a TEd program has followed an experimental design, it is feasible to conduct this kind of analysis. However, it is very important to identify those indicators considered essential for evaluating the program, and to create or identify instruments that allow us to obtain a measurement prior to and following program implementation with respect to those key indicators.

It is also possible to conduct this kind of analysis in quasi-experimental designs. Going back to the example of evaluating the impact on math results of a TEd program, it is possible to calculate an indicator of differences in differences if we have some standardized measurement for both groups of mathematical results prior to implementation of the program. Many countries are making progress in using standardized measurements of the results for all students at periodic intervals, making this kind of measurement feasible.

iv. Instruments

As we have seen, in order to conduct an impact evaluation, a great deal of information is needed for the purpose of constructing control groups and for determining the result indicators.

As previously mentioned, control groups consist of groups of individuals that have, on the average, the same characteristics as the beneficiary group. Among the characteristics that might be considered relevant for constructing a control group for a project involving the use of technologies in education are the following:

- Gender of students
- Age of students
- Household composition
- Parent education level
- Attendance rate
- Grade repetition rate
- Extent to which school is urban/rural

- Student-teacher ratio
- Results on standardized tests

These data can be obtained from various sources of information, mainly administrative records, surveys, and standardized test results. Typically, standardized tests are utilized for parent and teacher questionnaires, and this facilitates an accurate characterization of the family and the school.

A number of instruments need to be used in order to construct result indicators. In order to measure changes in practices, the most commonly recommended instruments are surveys and class observation. Indicators associated with the involvement of students in the program can be constructed by using administrative records such as graduation, attendance, grade repetition, and dropout rates. In addition, surveys are needed that are specially designed to measure motivations and expectations. If the goal is to construct indicators of learning results, then standardized tests (whether national or international) are the instrument of choice. Similarly, the development of skills and competencies should be measured via standardized tests. This represents a big challenge, since it implies the need to specifically define “twenty-first competencies” and to propose instruments to measure them.

Table 2 includes a series of available questionnaires that might prove useful for constructing result indicators in the domains of *changes in practices* and *student involvement* (i.e., in terms of their motivation and expectations). Below, Table 4 includes a list of available tests, as well as their origin and availability. It should be noted that quite a few instruments have been developed in Peru as part of the “One Laptop Per Child” program.

Table 4: Some instruments for evaluating impact in projects involving technologies for education

Source	Areas	Instrument
IDB-Peru Project	Reading *	Reading comprehension tests (grades 2-3, 4-6)
IDB-Peru Project	Mathematics *	Logical-mathematical tests (grades 2-3, 4-6)
IDB-Peru Project	Motivation	Intrinsic motivation inventory (for students)
IDB-Peru Project	Verbal fluency	Verbal fluency test (for students)
IDB-Peru Project	PC Use	Laptop-use test (for teachers)
OECD	Reading, Mathematics, Sciences	Programme for International Student Assessment (PISA)
IES	Mathematics, Sciences	Trends in International Mathematics and Science Study (TIMSS)
UNESCO	Language, Mathematics	Latin American Laboratory for Evaluating Educational Quality (LLECE)
MIDE – UC	Language, Mathematics	System for Evaluating Learning Progress (SEPA)
MIDE- UC	ICT Competencies Information, communication, and ethics	Instrument for measuring twenty-first century ICT competencies
ATC21S	10 twenty-first century competencies	Transforming Education: Assessing and Teaching 21st Century Skills (in progress)

* = Tests based on the Peruvian National Curriculum.

v. Work team

Last but not least, it is necessary to consider the professional requirements associated with the design and implementation of an impact evaluation. What is specifically needed in this regard are professionals who are highly knowledgeable in the areas of sampling, statistics, and econometrics (e.g., statisticians and economists). As in the case of process evaluations, given that the essential purpose of every evaluation is to provide feedback to the system, it is also necessary to utilize a group of professionals who are able to communicate the results of this evaluation to the distinct actors of the educational system in a friendly manner.

V. CONCLUSION

Investment in TEd within educational systems is a recent phenomenon that has increased enormously in recent years. Within this context, an evaluation of both the implementation processes of these programs, as well as their results, is indispensable. Such evaluations are needed in order to identify the optimal conditions and pedagogical resources for incorporating technologies into learning systems, and also to measure the impact of technology on students.

This document has presented the various mechanisms currently available for conducting an evaluation of a program. The choice of one of these mechanisms in preference to the others will for the most part depend on the following factors:

- The kinds of indicators one wants to evaluate
- Time of evaluation (i.e., whether it is being conducted before, during, or after the implementation of the project)
- Scope of the program (census vs. sample)
- Available information

As we have seen, it would be ideal for all TEd projects to be designed in a way that incorporates an evaluation strategy from the very beginning. In other words, the evaluation of a program is something that should be thought of when a project is being planned. Only in this way is it possible to devise a strategy that makes it possible to evaluate all of those indicators that are considered critically important for the implementation of the project. Such an evaluation strategy should take into account not only the theoretical aspects but also the practical aspects of an evaluation (i.e., in terms of considering the most effective way to construct control groups, the existing sources of information that can be utilized in the process, and the professional requirements for conducting the evaluation).

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