

Methods for ICTs integration

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Summary

New information and communications technologies have hugely contributed to improve the quality of life of society as a whole. They are fully integrated, either as work, study, or game tools or simply as a communication means. Schools – as educational institutions – should include them in their curriculum.

This paper presents a contribution to the educational field by proposing the configuration of a method for including ICTs at the basic and the middle levels of the educational system. A self-diagnostics tool indicating usage level of ICTs at schools is proposed, also developing an alerts system that highlights the main weaknesses in the use of ICTs.

After the corresponding diagnosis has been carried out, a method is designed for the inclusion of ICTs in institutional spaces. The different integration areas where the ICTs should be included are defined, courses of action are presented, and implementation alternatives are shown.

Key words

Education. ICTs.

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Introduction

The traditional school is an institution designed for transferring knowledge from one generation to the next and ensuring the protection of the cultural legacy, history, uses, ethics, and morals of a society.

Today, this educational paradigm is going through changes, mainly because we live in a globalized world where knowledge is not only related to known facts, but also to the development of the ability of mastering skills that allow individuals creating new knowledge in this changing and competitive world we live in.

These paradigm changes involve a re-definition of a new educational model, one that is mediated by the New Information and Communication Technologies (NICTs), where some concepts need to be re-defined, such as those related to the use of time and space within the educational system.

Technological progress can be pinpointed at different times throughout history. The first transition is the one that took place between the so-called Industrial Era and the Information Era. We are currently living in what is known as Post-Information Era, where information is distributed in a customized way to each person making use of it. There are interconnected computers with programs that, pre-loaded with information about the preferences of the user, offer services that are specifically relevant for this user.

In this era, the new figure of asynchronous communication emerges; this type of communication occurs between people who are neither at the same place nor at the same time. This is the case of messages sent through electronic mail, which are unlike telephone communication in that the latter is a type of synchronous communication, meaning that participants are required to communicate at the same time. The reason why electronic mail became so popular might be due to the fact that the messages sent are not of an urgent nature, and it allows users to exchange information through the different types of files that are attached to the messages.

Among other technologies, the use of electronic books based on physical devices such as CD-ROMs is starting to spread. Here, a significant change in the way information is accessed can be observed, from the sequential reading we were used to with printed books to hypertextual reading in digital books. Internet is formed by everyone, both people and institutions of the most diverse nature, and each member is after its own interests.

Since the transition from the Industrial Era to the Post-Information Era, a great technology progress was achieved in a short period of time. This progress is defined as the number of times that technology is capable of improving the function or objective that has been assigned to it.

All these phenomena associated to information and communication technologies are incorporated to the different scopes of our society, mainly as a response to a globalization and market economy process. Educational institutions as the main educating entity of younger generations are facing a major challenge, namely, implementing the use of ICTs.

For the ICTs to be properly used within an educational system aiming at an improvement of teaching and learning activities, a method that shows how to incorporate ICTs to the basic and middle levels is presented, indicating the different variables at play and the possible courses of action that can be adopted, as well as the alternatives that allow a greater degree of interaction in education, in accordance with the demands of our present society.

Proposed Development

ICTs integration to schools is not a linear process with a clearly marked beginning, a development stage, and an end. Each school should consider its current situation in terms of ICTs integration and develop a plan based on their position and the priorities that the management team considers relevant.

This paper describes an ICTs integration method formed by a telematic tool that manages the information collected by different basic and middle schools and that allows each educational institution to perform a self-diagnostics process that provides information about the degree of ICTs incorporation achieved by that school.

ICTs offer schools a large number of possibilities, among which the following can be mentioned:

- Expansion of the educational offer by means of virtual teaching/learning environments.
- Automation of administrative work, improving quality of service.
- Increased collaborative work among teachers, students, management and administrative staff.
- Speed-up of communications between schools, coordination entities, and the Ministry.

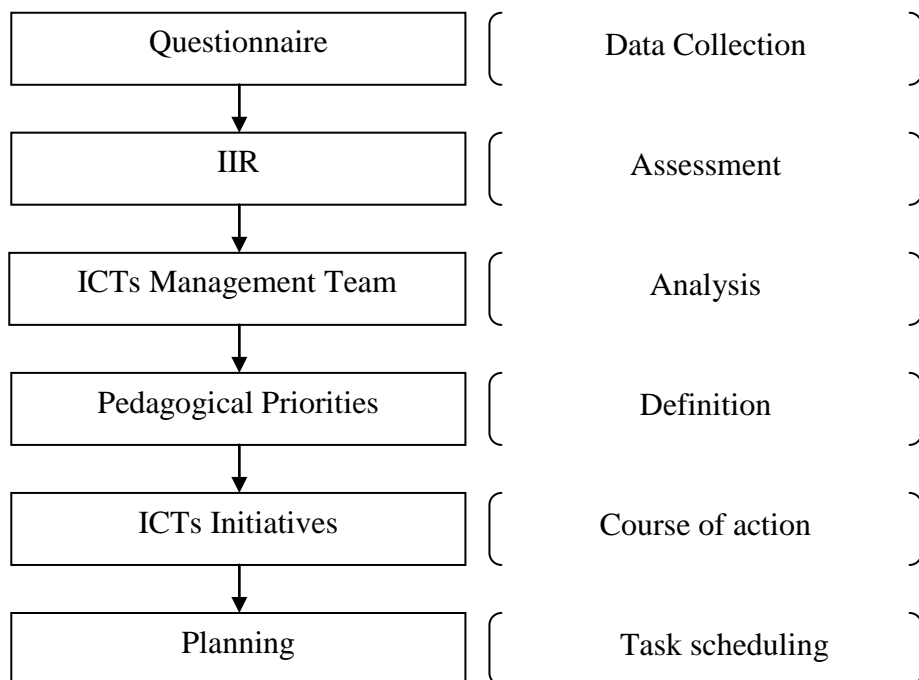
Greater fluency in the relation with students' families.

The incorporation of ICTs to schools in Argentina is mainly framed by the acquisition of technological equipment above the pedagogical level, which can be observed after analyzing the different national programs – PRODYMES (Proyecto de Descentralización y Mejoramiento de la Educación Secundaria, Secondary Education Decentralization and Improvement Project), PROMSE (Programa de Mejoramiento del Sistema Educativo, Education System Improvement Program), – projects that mainly began with the distribution of computer equipment to the schools that were part of these programs. Even though the technological components, including Internet connectivity, are essential, it should be noted that the incorporation of digital educational contents for each of the subjects included in the curriculum is also essential. In addition to this, teacher performance also adds to the equation, in that their digital skills are a determinant factor for classroom implementation, and they act as enablers, guidance counselors and advisors throughout the teaching-learning process.

The tool that we intend to design should assess these factors, the presence of computational equipment, Internet connectivity, digital contents availability, and the abilities of the human resources present at the educational institution.

Product Developed

The effectiveness of the task requires making decisions regarding the sectors that will be analyzed; namely, management team, teachers, administrative staff and students. At a first stage, data are collected through questionnaires. Once this process is finished, the system will assess the information and indicate ICTs incorporation rate, IIR, for each educational institution, as well as a detailed list of the aspects that need improvement. Knowing the ICTs incorporation degree to everyday school activities, an ICTs management group will be formed whose primary objective will be defining the educational priorities for the school regarding the new information and communication technologies. Then, the technological initiatives that can be implemented to achieve the selected priorities will be specified. Finally, the corresponding planning stage takes place. The following illustration presents the steps of the method.



Questionnaire

Information regarding the degree of ICTs incorporation to schools was gathered by means of a questionnaire. This method allows compiling data to carry out an assessment of the digital competence in the different areas of the institutions and the performance of educators, management staff and administrative staff.

Digital competence implies people that:

- a. Can function autonomously using information in different media (oral, written, audiovisual, multimedia, digital)
- b. Are proficient in different languages (textual, iconic, visual, voiced) and use them to communicate
- c. Are critical and thoughtful when assessing information
- d. Observe socially established rules in the use of information and its sources in different media
- e. Regularly use technology resources to efficiently solve situations

The purpose is to develop a tool that allows exploring how ICTs are being implemented in basic and middle educational institutions and, based on the results obtained:

- a. Establish the current utilization level of technology at schools, known as ICTs Incorporation Rate (IIR)
- b. Identify critical issues that need improvement
- c. Reflect upon the conditions that should exist at schools for an optimal implementation of ICTs

The proposed questionnaire is formed by a set of questions grouped in 5 categories:

- Technology (T): questions aimed at assessing the availability of a technology and communications infrastructure at the school
- Personnel (P): questions aimed at establishing the degree of ICTs-related knowledge that the different parties of the institution have
- Communications (C): questions aimed at finding out the use that the school makes of the ICTs in relation to communications, both within the institution and with other institutions
- Education Management (EM): questions aimed at assessing the use of ICTs in the school management process
- Curricular (Cu): questions aimed at finding out the degree of inclusion of ICTs in the curriculum

The questions allow three possible answers:

- Initial (I): anything that is at a preparation stage or is about to begin.
- Medium (M): anything that is being used but has not reached an optimal state.
- Advanced (A): anything that is being used and has reached an optimal state.

IIR - ICTs Incorporation Rate at Schools

The IIR is proposed as the incorporation rate of ICTs reached by schools. It is calculated based on the answers given in the questionnaire. This rate indicates the percentage in which each school has incorporated the use of the different technologies at the institution.

Based on the answers provided, the following can be observed:

- ICTs Incorporation Rate (IIR) reached within each category
- ICTs Incorporation Rate (IIR) reached by the institution
- The aspects that require greater attention for their improvement

To calculate the IIR, the answer to each question is assessed on a 0-2 scale – 0 corresponds to the Initial level (I), 1 to the Medium level (M), and 2 to the Advanced level (A). The average of all questions for each category determines the IIR for that category. The average of the IIR corresponding to all categories determines the IIR for the school.

The following equation is used to calculate the IIR for the school:

$$\text{IIR} = \text{AVERAGE} (\text{IIR.T}, \text{IIR.P}, \text{IIR.C}, \text{IIR.EM}, \text{IIR.Cu})$$

Where:

- IIR.T indicates the ICTs Incorporation Rate reached in the Technology category.
- IIR.P indicates the ICTs Incorporation Rate reached in the Personnel category.
- IIR.C indicates the ICTs Incorporation Rate reached in the Communications category.
- IIR.EM indicates the ICTs Incorporation Rate reached in the Education Management category.
- IIR.Cu indicates the ICTs Incorporation Rate reached in the Curricular category.

ICTs Management Team

With the IIR value corresponding to the school, an ICTs management team formed by teachers of different subjects at the school who are knowledgeable in technology shall be formed. For example, an ICTs management team can include: a. Teachers from different grades and subjects; b. Members of the management team; c. Members from the school cooperative or the parents association; d. Members from other sectors of the local community that are directly related to the school.

The role of the management team will be setting educational priorities for the school, in accordance with the implementation of ICTs. A good starting point to consider is the IIR reached by the school.

Educational Priorities and ICTs

Setting educational priorities in relation to ICTs implies setting objectives to achieve during the school year. In this regard, different considerations should be taken into account:

- a. How can technology help teachers teach more effectively?
- b. How can technology help students learn more effectively?
- c. How can technology provide access to learning and enable the inclusion of students with different learning needs?
- d. How can ICTs facilitate the communication with the educational community in general to enrich teaching and learning experiences?
- e. How can teachers become actively involved and use ICTs in their teaching activities?

There are two main issues that stand out – on the one hand, the teaching/learning process, and on the other, the communication between the school as a whole and the parties involved.

Presentation of ICTs Initiatives

The following technology initiatives are in agreement with the educational priorities that have already been discussed.

- Teaching/learning process
 - Priority 1: Education For All (EFA)
 - Priority 2: Strengthening the educational offer
- Communication between the school and the parties involved
 - Priority 1: Students
 - Priority 2: Teachers
 - Priority 3: Management Team
 - Priority 4: Parents
 - Priority 5: Society

| Priorities | A | | B | | | | |
|--|---|---|---|---|---|---|---|
| | 1 | 2 | 1 | 2 | 3 | 4 | 5 |
| ICTs Initiatives | | | | | | | |
| Incorporating the computer as a regular work tool | | | ✓ | ✓ | ✓ | | |
| Using basic office tools | | | ✓ | ✓ | ✓ | | |
| Creating a school web page to function as a virtual institutional meeting point | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Offering additional virtual training services through the school web page | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Using the school web page as a promotion space for student school activities | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| Creating the teacher's web page with information relevant for the curriculum | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Using Internet to access information available from different government and non-government entities | | ✓ | ✓ | ✓ | ✓ | | |
| Using Internet to create collaborative work spaces (Wikis) | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Creating activities that allow learning through discovery (Webquest) | | ✓ | ✓ | ✓ | | | ✓ |
| Creating discussion spaces in the Web (Blogs) | | ✓ | ✓ | ✓ | ✓ | | |
| Getting to know and exchanging information with other schools through the Web | | ✓ | ✓ | ✓ | ✓ | | |
| Subscribing to newsgroups about educational topics in general | | ✓ | ✓ | ✓ | ✓ | | |
| Improving communication through e-mail, reducing telephone costs | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Streamlining administrative management through a central management system that allows web queries (e.g., academic status of students, activities developed by teachers) | | | ✓ | ✓ | ✓ | ✓ | |
| Using the central management system to allow teachers managing their own personal information | | | | ✓ | | | |
| Developing multimedia content | | | ✓ | ✓ | | | |
| Looking for and using multimedia content available on the Web | | | ✓ | ✓ | | | |
| Participating in technology contests | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Managing internships related to the use of ICTs | | | | | ✓ | | ✓ |

This ICTs initiatives and priorities table shows a detail of different ICTs initiatives based on the priorities that this author considers important and general enough for any school to use.

Planning

Based on the analysis of the IIR reached by the school, the management team should set the priorities that are most relevant for the institution and, among those, select that which is considered to be the most urgent.

Once this priority is selected, ICTs initiatives to effectively fulfill it should be set. Then, activities should be organized, defining the following issues:

- a. Name of the initiative: ICTs initiative to be implemented
- b. Resources: material and human resources required for the implementation
- c. Objective: clear definition of the objectives that the school wishes to achieve with the initiative selected
- d. Start of implementation: date on which work begins to implement the initiative
- e. Implementation duration: time that will be required for the whole process, from the beginning and until the initiative is fully operational
- f. Responsible: person in charge of implementing the initiative

An example

The following example describes a possible application of the method.

1. The school fills in the questionnaires and the system determines the corresponding IIR.
2. The management team is formed and, with information regarding the IIR reached by the school and the school needs, selects a priority among those described in the Priorities and Initiatives Table. The assumption for our example is that the Management Team selects the "Strengthening the educational offer" initiative.
3. ICTs initiatives are observed and listed on a table.

| Initiatives suggested for the "Strengthen the educational offer" priority |
|---|
| 1. Creating a school web page to function as a virtual institutional meeting point |
| 2. Offering additional virtual training services through the school web page |
| 3. Using the school web page as a promotion space for student school activities |
| 4. Creating the teacher's web page with information relevant for the curriculum |
| 5. Using Internet to access information available from different government and non-government entities |
| 6. Using Internet to create collaborative work spaces (Wikis) |
| 7. Creating activities that allow learning through discovery (Webquest) |
| 8. Getting to know and exchanging information with other schools through the Web |
| 9. Subscribing to newsgroups about educational topics in general |
| 10. Participating in technology contests |

Table. Initiatives by Priority

4. Planning activities detailing the name of the initiative selected from the Initiatives by Priority table, resources, objectives, starting date, duration, and responsible. Selection of an initiative and planning of the corresponding project. For this example, the Management Team is assumed to have selected initiative # 1; the planning table would then be:

| | |
|------------|---|
| Initiative | Creating a school web page to function as a virtual institutional meeting point |
| Resources | |
| Objectives | |

| | |
|---------------|--|
| Starting date | |
| Duration | |
| Responsible | |

Table. Planning

Results Obtained

The first result obtained is the creation of a method to include ICTs in elementary and middle level educational institutions, which is achieved based on:

- the study of different actions implemented by the national government to incorporate ICTs into the educational system at a national level,
- the analysis of numerous research works carried out by renowned authors in the field, and
- the analysis of bibliography by nationally and internationally renowned authors.

This method was defined in this paper and is intended to be the governing format for the assessment activities that will be carried out at elementary and middle level institutions.

There is currently work being done to design a data transmission tool that is accessible through the Web to allow carrying out these school assessments remotely. Thus, each institution interested in participating in the project would only need to visit this web page and fill in the method according to its current situation.

Currently, the development of the Web site is at a final testing stage and it is expected to be up and running by the time this article is published. After the corresponding registration of the institution, the school will be able to go through the different phases proposed here; starting with the first stage (self-diagnosis), which the system uses to determine the ICTs incorporation rate (IIR) reached by the school and to give the institution information about its initial situation through the indicators that define its situation.

Conclusions

The authors consider that the incorporation of ICTs to schools offers new teaching and learning possibilities that are currently not being exploited to their maximum potential. The methodology implemented by educational institutions implies treating ICTs as an additional subject, not merely resorting to them as a support tool for the other subjects included in the curriculum.

The method proposed is devised to assist in bridging the existing gap. Knowing that the success of an idea does not depend exclusively on the idea itself, it is crucial that a set of factors interacting with the method in an effective way be considered. Different agents that may positively or negatively affect the implantation process of the method in particular are presented:

- technology architecture,
- willingness of the educational environment,
- digital competence of the parties involved,
- communication fluency,
- need to improve the current status.

By incorporating ICTs to schools, the objective of a flexible educational environment that can quickly adapt to the constant changes in society, make participation in educational experiences possible through virtual

communities, improve the quality of practical activities by means of collaborative learning, and foster virtual discussion and debate spaces is sought.

In as much as these aspects are objectively combined, a continuous improvement will be achieved through the effective incorporation of ICTs in elementary and middle level educational institutions.

Future activities

Future activities will, during a first stage, focus on testing the Web site developed, as well as the method itself. Based on pilot tests, the method proposed will be adjusted, if necessary.

To this end, several elementary institutions of the city of General Pico, La Pampa, have been invited to participate. There are a few that have expressed their interest in collaborating, and we are currently working in the formalization of participation agreements.

Finally, it is crucial to gather data and analyze all changes after the method is applied. This will basically be useful for two immediate tasks: 1) assessing the validity of the method proposed, and 2) strengthening the method by allowing the inclusion of more institutions (not only at a local level, but also at a provincial and possibly national level) so as to allow the incorporation of ICTs to the teaching/learning process.

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