

ICT CURRICULUM INTEGRATION IN THE CONTEXT OF THE LEARNING OUTCOMES PROJECT IN PORTUGAL

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Abstract

The purpose of this paper is to discuss tangible and effective ways to integrate Information and Communication Technologies (ICT) into school curricula. In order to do so, we make use of several years of thoughtful consideration about this issue and, more specifically, of the work that we have recently developed in the context of the “Learning Outcomes” project hosted by the Portuguese Ministry of Education in 2010.

The “Learning Outcomes” project is about developing tools and materials to help schools and teachers make informed choices concerning the national curriculum aims, and thus decide which learning experiences suit them the best. Advocating a decentralised curriculum development, these resources are to be used voluntarily and freely by schools as part of their pedagogical autonomy. One of the tools developed and already available is the set of learning outcomes for preschool, primary and middle school students (ages 3-14) covering all subject areas. Moreover, examples of teaching and evaluation strategies were provided for every subject area, so as to help teachers gain a better understanding of how the learning outcomes can be put into practice.

In order to explain and share the work done regarding ICT, this paper presents and discusses the rationale that supported an ICT Learning Outcomes Framework based on four main competence domains: Information, Communication, Production and Security. After clarifying the concept of teaching and evaluation strategies used in the project, we discuss the implications these examples may have in teachers’ decisions about selecting content, pedagogy, resources and evaluation methods. This discussion seems even more necessary when it comes to ICT, as it is a domain which clearly benefits from open and flexible pedagogical processes that enforce a regular partnership between different subject areas.

We believe that the underlying principles of the work presented here, as well as the products of such work, may contribute to a better understanding of the challenges schools and teachers face once they have decided that ICT use in teaching and learning is more than just a tool to serve different subject areas. It is undoubtedly an opportunity to implement strategies focusing on the cognitive and social development of learners. Nevertheless, we conclude that we need to continue to broaden and deepen our knowledge regarding the challenges and demands of this proposal because, in contrast to a mono-disciplinary approach, it means the school culture must change into a cooperative culture based on partnerships formed by everyone operating within school. This is, according to us, the way to successfully provide experiences that foster a complete and balanced development of the young people in today's society.

Keywords: Learning Outcomes, ICT, School curriculum, Innovation, Portugal.

1 INTRODUCTION

The lengthening of compulsory schooling from nine to twelve years, up to eighteen years of age, is one of the most recent and important education policy measures in Portuguese society, approved in a Council of Ministers on 23 April 2009 [1]. In order to overcome the challenges facing schools and teachers resulting from this measure, the Portuguese education system has attempted to diversify its solutions and tools to improve the conditions of school autonomy, management and leadership so that schools can locally build the best educational solutions. Therefore, aimed at attaining high-quality education and the best academic results at the different educational levels, the Ministry of Education (ME) outlined a global strategy for the development of a primary and secondary school National Syllabus, which encompasses the Learning Outcomes Project (PMA), following up the processes of curricular change that begun in 2001.

The starting point of the PMA involved recognising the need to produce a document clarifying and setting forth the study plans, guidelines and existing programmes. The core idea was to offer a common framework of outcomes to be achieved by the pupils, which could guide and support the teachers' work and help bring about successful learning. This common framework is translated into the identification of the specific performances expected of the pupils in each area or subject, at the end of each cycle and school level. Although it is not a regulatory curricular document, the intention is that it will be used effectively because its practical utility is recognised by the teachers, pupils and families. It can be adjusted within the framework of the autonomy of each school or school group.

The first PMA phase comprised the drawing up of learning outcomes for preschool and primary school education. Nine teams of experts, coordinated by higher education teachers, came up with nine reference syllabuses geared towards primary teaching and one geared towards preschool education, which were sent to several professional teaching associations and scientific societies for their opinion. The final versions of the learning targets for each subject or subject area were drawn up after analysis of the contributions received. They were publicly disclosed in October 2010 in the form of a database, made available online (<http://www.metasdeaprendizagem.min-edu.pt>) by the Directorate-General of Innovation and Curricular Development (DGIDC), belonging to the Ministry of Education (ME).

A second phase involved the drawing up of strategic teaching and evaluation examples that would contribute towards the pupils achieving a given learning outcome or outcomes in each subject or subject area. An attempt was made, basically, to illustrate some didactic procedures that were suitable to achieve the desired learning, without however exhausting the range of possibilities existing for the effective attainment of a given learning outcome. These examples are destined only to support the autonomous analysis and decisions of the teachers in organising the teaching and learning processes.

In order to explain and share the work done regarding ICT, this paper presents and discusses the rationale that supported an ICT Learning Outcomes Framework based on four main competence domains: Information, Communication, Production and Security. After clarifying the concept of teaching and evaluation strategies used in the project, we discuss the implications these examples may have in teachers' decisions about selecting content, pedagogy, resources and evaluation methods.

2 ICT LEARNING OUTCOMES

Taking into account the diversity of the concepts, goals and purposes that have been attributed to the technologies in an educational context over the years, the establishment and adoption of a reference framework has become crucial in order to carry out coherent and consistent actions to promote and improve the pupils' learning. In this background, the work carried out with the scope of the PMA comprised an excellent opportunity to outline an integrated vision concerning the use of the technologies in education, with a view to bringing about the integral development of the individuals [2][3][4].

Keeping sight of the attempt to bring about innovation and transformation of the curricular practices, as well as recognising the need to acquire and develop the basic digital skills, the idea is above all to work on and mobilise the potential of the technologies for the development of a curricular organisation strategy with a transversal focus on becoming a reference framework and a platform of articulation and integration of the ICT for the rest of the subjects or subject areas [5]. In other words, more than an autonomous curriculum, the definition of learning targets in the ICT area aimed to build a "framework of competences to be included by each teacher in his/her specific area, from the viewpoint of the overall development of the pupil, enabling the teacher to understand and decide, on solid grounds, what materials, for what purposes and how the ICT can be pertinently and appropriately used" [2][5].

The proposal began with the identification and reflection on the dimensions of human conduct and on the specific scientific content in which the technologies can add value, but also followed a set of presuppositions that reflected the team's vision as regards the place ICT should occupy in the school today. Consideration was taken, firstly, of the ICT as a cross-subject educational area, whereby it was also assumed that the acquisition and development of digital competences should be present throughout the whole of schooling. Secondly, the acquisition of ICT competences was considered an absolute necessity in school at the start of the 21st century, in response to the challenges of the job market and society in general, constituting essential preparation to equip oneself to exercise full citizenship. Finally, and in close articulation with the first two presuppositions, the ICT would be attributed not only an instrumental role at the service of other areas of knowledge, but above all would

be an opportunity as a strategy for intellectual and social development of individuals, given that the younger generation's natural affinity with the digital technologies leads to greater motivation and inducement of their development [2].

In order to better clarify the scope of this proposal, it will be useful to remind ourselves of the four core competences around which it was possible to systematically outline and define the ICT learning that the pupils must acquire and develop throughout their primary education, including the preschool education period [5]:

- Information - Ability to search for and process information in line with specific goals: research, selection, analysis and summary of the data.
- Communication - Ability to communicate, interact and collaborate using network communication tools and environments as an individual learning strategy and to contribute to the learning of others.
- Production - Ability to systematise knowledge based on work processes that use the digital resources available and develop innovative products and practices.
- Security - Ability to use digital resources in compliance with security regulations

Taking the notion of competency to mean the integrated development of skills and attitudes that pave the way for the use of knowledge in several situations, which the pupils may be familiar with to a greater or lesser extent, we have tried to follow a curricular philosophy based above all on the development of "lasting knowledge" or high-level goals, which Philippe Perrenoud defines as "resources to understand, judge, anticipate, decide and act with discernment." [6] With the understanding and discussion that is intended to be stimulated around the final proposal, table 1 shows how the ICT learning outcomes for primary education are implemented, making reference only to the end-of-cycle outcomes. A visit to the aforementioned DGIDC-ME site (www.metasdeaprendizagem.min-edu.pt) will enable more in-depth analysis of the learning outcomes proposed in the ICT area, where as well as the final goals outlined here, the reader will also have access to the intermediate outcomes defined for basic education and the outcomes proposed for preschool education.

Table 1: ICT learning outcomes for primary education.

	1 st cycle (4 th school year)	2 nd cycle (6 th school year)	3 rd cycle (9 th school year)
Information	The pupil uses on-line and off-line digital resources to search for, select and process information, in line with the defined aims and instructions supplied by the teacher.	The pupil uses on-line and off-line digital resources to search for, select and process information in line with specific objectives and criteria of quality and pertinence, aided by the teacher.	The pupil uses on-line and off-line digital resources to search for, select and process information in line with specific objectives, arising from previously identified questions and problems and with criteria of quality and pertinence.
Communication	The pupil communicates and interacts with other people, with the teacher helping him/her to use synchronous and asynchronous communication tools, observing the underlying rules of conduct.	The pupil communicates, interacts and collaborates with other people, using network communication tools and environments, selected with the aid of the teacher, as a strategy for individual and collective learning.	The pupil communicates, interacts and collaborates using network communication tools and environments, selected in line with their respective potential and constraints, as a strategy for individual and collective learning.
Production	With support and guidance from the teacher, the pupil does school work using the digital tools supplied, to represent knowledge, ideas and feelings.	With support and guidance from the teacher, the pupil designs and does school work using the different digital tools, to express and represent knowledge, ideas and feelings.	The pupil designs and does school work using the different digital tools, and creates original documents that express and represent knowledge, ideas and feelings.

Security	The pupil adopts basic security behaviours in using the digital tools supplied, respecting copyright.	The pupil adopts secure behaviours, respects copyright and intellectual property, and complies with the rules of behaviour for using on-line digital environments.	The pupil adopts secure behaviours, respects copyright and intellectual property, and complies with the rules of behaviour for using on-line digital environments.
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As well as the above mentioned aspects, it is important to point out that the names chosen to represent each of the core competences (Information, Communication, Production and Security) come from the application of a set of criteria that highlight precisely the *integrative approach* that underlies the proposal presented. As we mentioned earlier [4], one of the essential criteria in drawing up the proposal, the *criterion of meaning*, involved the use of terms that could represent the core competences to be worked on in the ICT area, in other words, the “key concepts” that can simultaneously reflect the learning considered essential in this area and possess a logical and relevant meaning to structure and organise the learning. Closely linked to the previous criterion, the application of the *criterion of transferability* allows aspects with greater “instructive transfer” power to be highlighted, in other words, the competences (knowledge, skills and attitudes) considered beneficial for the acquisition of “general learning applicable to the different situations from that in which it is learned”. Finally, the application of the *criterion of connection* underlines the presence of a philosophy of connection and interaction between the core competences defined in ICT, but also between the ICT and the different curricular areas.

The set of these principles is shown in figure 1, where the letters “I” (Information), “C” (Communication), “P” (Production) and “S” (Security) represent precisely the four core competences around which the learning targets are defined. The ICT are represented by the number “1”, while the rest show the diversity of areas/subjects that comprise the school syllabus.

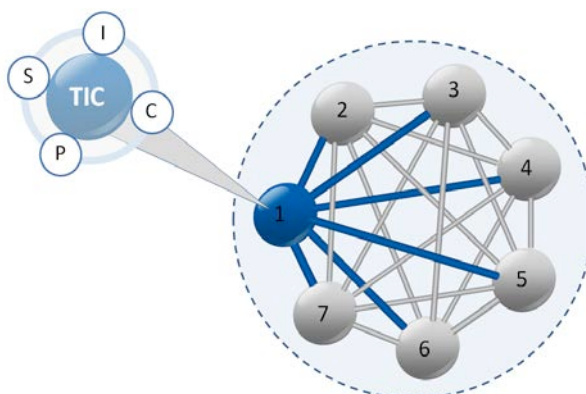


Figure 1: Integrative approach.

Considering the aforementioned open nature of the learning outcomes framework, understood as a curricular document able to be adjusted in line with the specific needs of each context, it is important to note that this model is also compatible with the idea that any intentional learning requires an effective plan of action that is coherent with the teaching goals. It is not, therefore, a question of drawing up a prescriptive and uniform plan of action, but rather a plan whereby each school, within the scope of its autonomy, can implement it according to the specific context in which the goals are considered, as we shall see in the following point.

3 ICT TEACHING AND EVALUATION STRATEGIES

The term ‘strategy’ has been used in numerous contexts, realities and with a huge variety of meanings. In the field of education it is often linked to terms such as approach, model, technique, method [7], cognitive activity [8] and metacognition [9][10][11]. Notwithstanding the wide range of terms associated to it, with several authors using this term in the broad sense [12], within the scope of the Learning Outcomes Project the phrase ‘teaching and evaluation strategy’ refers to a sequence of educational actions or activities, outlining the resources and social forms of work organised so as to bring about certain learning in pupils [13].

The term implies that an intentional plan of action shall channel the education towards the clear and explicit goal of facilitating the acquisition of the respective curricular content. From this perspective, and as part of the sequence of activities outlined in a given strategy, it is important to include strategies of evaluation aimed at supporting the pupils in the learning process (educational dimension) and making sure that the outcomes are achieved (summative dimension).

Also in the background of the Learning Outcomes Project, the drawing up of the teaching and evaluation strategies is justified within the framework of the pedagogical autonomy of the teachers in the way they organise their teaching. However, in order to contribute to the building of a framework that provides teachers with a basis for a richer questioning more in accordance with today's curricular demands, it was necessary to establish a set of guiding principles common to all the areas, among which the following are highlighted:

1. Focus on the pupils' learning.
2. Logical and pedagogical-didactic articulation of activities and/or tasks in relation to the learning mapped out in the strategy.
3. Demanding challenges and intellectual effort needed in the activities and/or tasks.
4. Visibility of the content (concepts, processes...) to be acquired by the pupils in the different activities/tasks.
5. Diversity of the working methods and cognitive processes to be stimulated.
6. Clarity in the definition of the activities and/or tasks.
7. Selection of the key items of the strategy instead of exhaustive details.
8. Visibility of possibilities for differentiation inside the strategy.
9. Use of wide-ranging didactic procedures.
10. Evidence of connections to other areas of the curriculum and development of transversal competences.

Likewise, in terms of organisation, the teaching and evaluation strategies drawn up by the different curricular departments fitted into a common structure including the outlining of the following aspects: the outcome or outcomes aimed at; the expected learning/outcome objective(s); the overall strategy (including the articulated organisation of the activities that make up the strategy); expected time; the evaluation of the results (including the performance indicators, criteria and levels, as well as the kind of tools used and their justification); the bibliography used; and the authors.

Without wanting to exhaustively cover all the didactic procedures that are suitable to achieve a given outcome, the purpose of the teaching and evaluation strategies is only to map out a provisional working sketch aimed at attaining a given outcome, which shall be appropriated following a philosophy of articulation in line with the needs of the learners' contexts. Considering the differentiated nature of the learning, the use of the strategies will naturally depend on several factors such as the nature and specificities of the content to be worked on, the teaching and learning perspectives, the roles of the teacher and the pupil, as well as the resources available in a classroom context.

We now present one of the teaching and evaluation strategies drawn up by the ICT team, which shows in greater detail the application of the principles that was used in its preparation. It is pointed out that this strategy should not be read as a recipe in itself, but rather recreated and used in line with the interests and needs of a given learning context.

3.1 A strategy example: "My family now and before"

"My family now and before" teaching and evaluation strategy, designed for working with 2nd school year pupils, is one of the examples that brings to the fore, among several principles, the focus on the learning, the diversity of the working methods and the cognitive processes to be stimulated, as well as the possibility of establishing connections between different curricular areas. Aimed at creating the right conditions for the pupils to take advantage of the digital technologies so that they can understand how some changes in society are linked to an evolutionary process, in addition to the learning in the ICT area, this strategy attempts to develop the learning defined in two other curricular areas integrated into this educational level in tandem and in articulated form; specifically the fields of the Study of the Environment and the Portuguese Language.

In terms of work organisation, as we shall see in more detail, the students start by discussing what certain facets of society (school, transportation, etc) were like when their parents/grandparents were children. Furthermore, at home they ask for information and images exemplifying this time from older family members. Having gathered these items, the pupils will search today's digital encyclopaedias for information about the objects they brought from home, lay out the pairs of images in an electronic presentation and write small explanatory texts of the changes found. Finally, the pupils shall verbally present their results, seeking to encourage their classmates to actively take part in the discussion.

The box below provides more details, outlining the outcomes of each of the curricular areas, the expected learning objectives, the sequences of tasks proposed, the expected time it will take and the evaluation strategies, including the respective performance indicators, criteria and levels, as well as the tools used and adapted for the learning in question.

Learning outcomes

Information and Communication Technologies

- The pupil uses on-line and off-line digital resources to search for, select and process information, in accordance with the defined objectives and instructions supplied by the teacher [TIC010]
- With the support and guidance of the teacher the pupil does academic work using the digital tools supplied to represent knowledge, ideas and feelings [TIC016]
- The pupil adopts basic secure behaviour when using the digital tools supplied, respecting copyright [TIC019]

Study of the Environment

- The pupils identify changes and things that have remained the same throughout personal, local and national time, recognising different rhythms (gradual change or a break) and directions (progress, cycle, permanence, simultaneousness) [ESM005]

Portuguese Language

- The pupils contribute to the discussion in pairs or in small groups to achieve the common goal (e.g. planning of tasks; delegation of roles) [POT014]
- The pupil makes requests, gives orders and discloses information, taking into account the situation of the person he/she is talking to [POT015]
- The pupil interacts verbally in an assertive manner, and takes part in the discussion in pairs or in a small group [POT013]
- The pupil uses a wide range of vocabulary, namely connectors [POT168]
- The pupil uses clauses to structure the ideas in the paragraphs [POT171]

Learning goals

- Use the information and communication technologies to support the search and production processes.
- Identify and analyse, through comparison with images from different epochs, the changes and/or things that remained the same in some aspects of society.
- Actively take part in the discussions in pairs or in groups, presenting their ideas and results in an assertive manner.

Activities

1. The teacher introduces this strategy by tackling some aspects of society that have evolved over time – transportation, clothing, housing, toys, etc. – and asks the pupils to describe them, as they are nowadays. The teacher then asks the pupils what they think these objects were like when their grandparents were young/children.

2. To broaden the topic, the teacher tells the pupils that they are going to research into the subjects tackled by interviewing their parents or other older family members. To do so, they draw up a small interview script in a group, which includes a set of topics and questions that allow them to obtain relevant data and information. The pupils shall write down the answers and ask for photographs and/or images (preferably digital) depicting some of these aspects.

Note: as an alternative and/or complement, the teacher can ask for one or two teachers / staff members / collaborators of the school, who are of a similar age to the pupils' grandparents, to attend the lessons so that the pupils can question them. In this case, the teacher should prepare, together with their guests, this participation, especially to make sure some images are provided (preferably digital ones).

3. When the pupils have their images and brief descriptions of the researched topics ready, the teacher splits the class into groups of 3/4 pupils. Initially the pupils of the group check which aspects are tackled, compare the information they have among one another and systematise the main ideas with the aid of the teacher.
4. Next, the teacher explains that to better compare "the before" and "the now", the pupils will search for current images about the topics under analysis. Given the age of the pupils, it is recommended that the teacher points them in the direction of on-line or off-line encyclopaedias (e.g. Infopédia; Wikipedia; Diciopédia, etc.). The pupils should copy the images selected for an electronic presentation, placing one image per slide. While the pupils carry out this task, it is important that the teacher gives some instructions regarding the most specific words to aid the research (e.g. at school – desks, school bags, exercise books, blackboard, etc.) and, in tandem, draws attention to questions related to the authorship of the information.
5. When they have gathered the current-day images corresponding to the older images, the pupils should insert the latter into the corresponding slide. If the pupils do not have all the images in a digital format, the teacher can scan them or photograph them with a digital camera so that the pupils can use them.
6. At the end of their presentation, with the two images referring to the two different epochs per slide, the pupils shall write a small essay in their textbook explaining the changes and/or things that have remained the same as portrayed in the images.
7. Each group shall give a presentation to the class, asking their classmates to identify "the before" and "the now" and to try and explain the changes that can be seen. Whenever necessary, one of the members of the group making its presentation shall complement the explanation with texts they have written.
8. To finish this activity, a small self-evaluation questionnaire is suggested that allows the gathering of information both about each pupil's contribution to the task carried out and about the use of the digital tools involved throughout the learning process.

Expected time

Given that the strategy outlined here articulates knowledge from different areas and fields, it should be implemented and carried out in an integrated and balanced way and in accordance with the pupils' needs. It is expected that six 45-minute classes are required to carry it out.

Evaluation of the results

Indicators and criteria of performance quality

A. Participation in the activities

- Interest and endeavour in carrying out the tasks.
- Cooperation in the working group.

B. Use of digital tools

- Interest and endeavour in carrying out the tasks.
- Cooperation in the working group.
- Knowledge of the main functionalities of the digital tools used.

- Proficiency in the use of the digital tools.

C. Presentation of the results.

- Correctness and clarity in the use of the Portuguese language.
- Confidence shown in discussion of the results.
- Understanding and application of the concepts involved.

Performance quality levels

Very good – The pupil carries out the tasks set showing interest and endeavour. Actively takes part in the group work, often contributing with suggestions and always respecting other people's ideas. Shows very good aptitude in the main functions of the tools selected to help the search and document production processes. Uses the digital tools selected for each task proficiently, almost always understanding and applying the teacher's instructions. Uses the correct vocabulary for the situation, clearly presenting the results of the task set. Shows confidence when discussing the results attained, presenting and communicating his/her ideas assertively. Understands and correctly applies most of the concepts involved in the topic.

Good – The pupil carries out the tasks set showing interest and endeavour. Actively takes part in the group work, contributing with suggestions and almost always respecting other people's ideas. Shows aptitude in the main functionalities of the tools selected to help the search and document production processes. Uses the digital tools selected for each task proficiently, almost always understanding and applying the teacher's instructions. Most of the time uses the correct vocabulary for the situation, clearly presenting the results of the task set. Shows confidence when discussing the results attained, although sporadically asks for support from the teacher and/or classmates. Understands and correctly applies most of the concepts involved in the topic.

Satisfactory - The pupil carries out the tasks set showing interest and endeavour. Makes suggestions to improve the quality of the group work, but does not always collaborate in the best way with classmates. Shows aptitude in most of the main functionalities of the tools selected to help the search and document production processes. Uses the digital tools selected for each task in a satisfactory manner, but shows some difficulties in applying the teacher's instructions. Uses suitable vocabulary for the situation, but makes some mistakes that result in the work becoming unclear. Able to present his/her work and ideas in a satisfactory manner, but often asks for help from his/her teacher and/or classmates. Understands most of the concepts involved, but has some difficulty in applying them.

Unsatisfactory – The pupil carries out only some of the tasks set with interest. Makes few or no suggestions about how to improve the quality of the group work, refusing to take part or hindering the collaboration. He/she does not know most of the main functionalities of the tools selected to aid the research and production of documents. Uses few of the digital tools selected for each task, and needs constant help from the teacher to carry out the tasks. Uses a restricted and limited vocabulary in presenting his/her results, and makes several mistakes that hinder the clarity of the work. Shows difficulty in remembering the concepts involved in the topic, rarely applying them in context.

Taking into account the nature of the strategy, the following *evaluation tools* are suggested:

- Self-evaluation questionnaire (participation in the activities and use of the tools)
- Observation chart of the pupils' performances, to be filled in by the teacher throughout the undertaking of the tasks and which can be compared against the results.

Considering the relative value of any evaluation tool, in some situations it may be useful to complement the information collected by recording the critical incidents, especially when the information is compiled specifically to individually support some pupils.

Although this strategy was drawn up to work with pupils in their 2nd school year, the same can be implemented with pupils in the subsequent years, taking into account the targets defined for the respective curricular areas, as well as the intended learning goals.

4 FINAL REFLECTION

As can be seen, the ICT learning outcomes framework outlined above, in contrast to an additional philosophy, constitutes a reference point not only in terms of expectations relative to the acquisition of

ICT skills by pupils, but also as regards the need for work that enhances the possible articulations among the different curricular areas. In a background of curricular change and innovation, this is a framework that undoubtedly paves the way for the opportunity to produce a kind of amalgamation between school and the social community in an integrated and common project [14].

Although different subjects are put into the network, progressively dealing with different transversal competences within the framework of a global education project of the individual, the ICT integration model described herein entails risks and difficulties [4]. Compared to the traditional organisation of school work, a sequence of activities involving two or more subjects contributes to a better integration of knowledge, as recommended in the national and international guidelines on teaching missions. This obviously demands the development of a culture of collaboration among the teachers and between the school and the community.

However, as well as the challenges raised in relation to the teacher training models, which in general follow a practical line of thinking, the research carried out has shown that the characteristics of dispersion and fragmentation of our school network do not favour the existence of a teaching community, whose interactions allow the construction of solid projects based on an attitude of collaborative work. Adding the vast array of reasons pointed out in the literature concerning the resistance to the use of technologies in the educational context [15][16], we can easily see that the success of the proposal presented is not limited to recognition of the opportunities for change and innovation that the ICT learning outcomes framework provides.

To ensure the successful implementation of this curricular framework, particularly as regards breaking away from individual working philosophies to usher in attitudes and opportunities that invite the teachers to collectively draw up plans of action adapted to the desired outcomes, it is absolutely necessary to guarantee close collaboration among the teachers, insofar as by starting with their real concerns it will be possible to develop constant interactions between the theoretical and practical applications. As well as the important role played by the institutional decision makers to provide a set of conditions to bring this about, we believe that much of the path ahead will take place within the scope of the institutions that supply teacher training, striving to increase awareness about the possible synergies relative to notions or processes that can be worked on based on the different viewpoints of the different subjects.

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