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# Design of mobile learning strategies through blended learning environments

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## Abstract

The objective of this study was to design the "Competence of Inclusive Practices" which was articulated to the route of the "ICT Competences for Professional Teacher Development," of the Ministry of Education of Colombia (2013), and thus to fully evaluate 30 teachers of an educational institution in the city of Bucaramanga, in order to recognize their individual or collective training needs, and to formulate appropriate interventions. The research was supported theoretically in guidelines offered by the Ministry of Education of Colombia, the Index for Inclusive Education (Booth and Ainscow, 2011), and empirical researches developed in Latin American countries, including Colombia. The research approach was quantitative, with a descriptive design, which allowed to establish that Inclusive Practices Competence integrated pertinently postures of inclusive education and criteria of the functional framework of Information and Communication Technologies (ICT) in education; in addition, it made it possible to know teachers' perception of the level of competence in relation to the competence level they were (placed); they stated to be located at a low level (explorer) in the development of skills for Inclusive Practices Competence.


**Keywords:** ICT skills, inclusive practices, professional development, educational innovation.

## Introduction

Thanks to the advances that the sciences of electronics and microelectronics have suffered over the last decade, and to the effects that these advances have had on information and communication technologies (ICT), society is living through a time of constant, unscheduled transformations, that have generated changes in the way we communicate, work, relate and learn (Castells, 1997, Delanty, 2002, Hargreaves, 2003, Mattelart, 2007, Tedesco, 2000).

Especially, changes that require the development of skills and competencies that allow citizens to: "manipulate and update knowledge, select what is appropriate in a particular context, learn permanently, understand what it is learnt, so it can be adapted to new situations and rapid change" (Tunnig Project, 2003: 8).

In this regard, the governments of Latin American countries are promoting in state education institutions training processes and providing the necessary technological infrastructure, so that these can contribute to the development of the skills needed by future citizens of society.

Under this framework in Colombia, the ICT Incorporation Program is being developed in schools, in the stages of training and delivery of electronic tablets. In August 2012, the Minister of Education María Fernanda Campo announced to the municipality of Fusagasugá the short-term delivery of 2,500 tablets, with which it was aimed to improve the quality of the learning of children and young people in that municipality (MEN, 2012). In total, about 4,700 tablets were delivered in 13 educational centers of this municipality by the President of the Republic of Colombia, Juan Manuel Santos, in April 2013.

These resources allowed the municipality not only to be a pioneer in the use of mobile devices, but also to develop a teacher training plan aimed at incorporating this type of device into the student training process. For this, an inter-institutional agreement was made between the Mayor's Office of Fusagasugá and the research group Technologies for the Academy -Proventus- of the University of La Sabana, which included the design, implementation and investigation of a process of teacher training through a blended learning environment, around the incorporation of mobile devices.

The training process was divided into two phases: the first one was aimed at making a diagnosis in all the teachers of the municipality, the knowledge they had about the use of mobile devices to support the process of training, as well as to identify the level of development that each of them had of their competence in educational informatics.

Based on the results obtained by the teachers in the diagnosis, there were selected 300 teachers to be part of the second phase by the Secretariat of Education of the municipality of Fusagasugá, in which a training process was designed with the objective of promoting the design of mobile learning strategies by the teachers of the municipality.

To achieve this, the teacher training process was divided in the following way: in the face-to-face modality, skills were developed in the use and management of the tablets, as well as the conceptual foundation on mobile learning and the preliminary design of the strategies for mobile learning On the other hand, a virtual modality was designed to guide and accompany teachers in the final design of a mobile learning strategy that could be integrated into their teaching practices.

Before continuing, it is important to clarify what was understood in this research by mobile devices and mobile learning, because although these are elements recognized by the academic community, the diversity of definitions around these topics makes it appropriate to expose in a precise way the position that was taken of these concepts within the investigation.

One of the first definitions found is that mobile devices are devices that combine the characteristics of traditional telephony, text messages, diary and wireless internet connection. (Nordin, Embi and Yunus, 2010) However, for this investigation, it will be understood by mobile device: "A small device, with some processing capabilities, with permanent or intermittent connection to a network, with limited memory, which has been designed for a function, but which can carry out other more general functions "(Baz, Ferreira, Álvarez and García, 2008: 1).

This definition includes a great diversity of electronic devices, such as Personal Digital Assistants (PDA), portable video consoles, audio and video players Global Position System (GPS) navigators, mobile phones, smartphones, tablets and others.

For some authors, mobile learning can be seen as an extension of E-Learning (Caudill, 2007; Georgiev, 2004; Pinkwart, 2003), because it is an E-learning that relies on mobile devices. For other authors, it is seen as a support to classroom processes (Walsh, 2010). However, for this work it goes further, since the design of mobile learning experiences implies, in the first instance, awareness by teachers about the nature of the training process through mobile devices; in the second instance, the recognition of its limitations and multiple benefits; and in the third instance, a reflection on their teaching practice, the learning they want to promote in students, and the relationship between the benefits that they expect to obtain compared to the effort made (Boude Figueredo, and Jiménez, 2013, Boude Figueredo, and Jiménez, 2015, Liu, Li and Carlsson, 2010, Mohammad, Mohammad, Hamdan and AboAli, 2007, Nordin, Embi and Yunus, 2010, Parsons, Ryu and Cranshaw, 2007).

Finally, this article presents the results obtained during the research carried out to this process of permanent teacher training, in which 296 teachers from 13 public institutions of the municipality of Fusagasugá participated. However, because not everyone completed the training process, the results presented in this text correspond to only 245 teachers.

The main results of the study showed that teachers recognized that the integration of mobile learning strategies in their teaching practices allows them to innovate their learning environments, and to promote the interest and active participation of their students, (thus) reinventing their evaluation and feedback processes; as well as the design of 48 mobile learning strategies that can be replicated and implemented by any teacher, in order to transform their teaching practice.

Additionally, when reviewing all of the strategies designed by the teachers, it was possible to identify, within them, 15 different uses that can be given to mobile devices inside and outside the classroom, in order to support the process of student training. However, since publications have already been made in other journals, these uses will only be named in this text.

**Materials and methods**

The general objective of this research was to determine the contribution of a process of teacher training in the design of mobile learning strategies. We used a qualitative design with an exploratory scope, taking into account that in Colombia and Latin America there are few studies about mobile learning; particularly, we used a methodology that allowed us to see a learning environment from all its edges, as well as to understand the practices and imaginaries of the actors involved, their relationships, tensions and transformations. Even if the versions of the worlds are personal; it is estimated within this type of study that the constructions are not completely unrelated, but that they resemble each other, they have points in common. Thus, realities constructed by different people can be compatible (Stake, 1995).

For its development, the project revolved around three different phases: the first one was aimed at sensitizing teachers about the importance of leaving their comfort zone; the second one was aimed at obtaining a diagnosis about their competences in educational informatics and the use of and appropriation of mobile devices; and the last phase was aimed at training teachers through a blended learning environment, and there would be encouraged the design of mobile learning strategies.

The population that participated in the research consisted of 598 teachers belonging to 13 state educational institutions of the municipality of Fusagasugá, in which basic and secondary education programs are developed. With regard to the level of training, 31% completed only their undergraduate programs, 63% have a specialization degree, 5% have a master's degree, and 1% have a doctorate.

However, 296 primary and secondary teachers (70% on secondary and 30% on primary level) participated in the training process, representing 50% of the total number of teachers belonging to the 13 public education institutions of Fusagasugá, which are distributed 80% within the municipality and the remaining 20% in the rural area. With regard to their working hours, these were distributed as follows: 60% work in the morning shift and 40% in the afternoon shift.

For the development of the training process, all the teachers were distributed into 10 groups, as it can be seen in Table 1, of which 296 teachers were trained in the face-to-face process, and only 245 completed the virtual process. For research purposes, these 245 teachers were taken as the sample of the study.

**Table 1**. Distribution of students by group and training process

| Group | Students trained in person | Students active in the virtual process | Desertion |
|---|---|---|---|
| 1 | 21 | 17 | 4 |
| 2 | 24 | 16 | 8 |
| 3 | 30 | 25 | 5 |
| 4 | 33 | 26 | 7 |
| 5 | 20 | 12 | 8 |
| 6 | 22 | 19 | 3 |
| 7 | 38 | 32 | 6 |
| 8 | 34 | 28 | 6 |
| 9 | 36 | 33 | 3 |
| 10 | 38 | 37 | 1 |

Source: self-made

The data collection was carried out between July 2013 and December 2013, through the application of a variety of instruments, such as questionnaires, in order to determine the level of development of the competence in educational informatics and the level of knowledge and conceptions that teachers had on mobile learning. Semi-structured interviews and two focus groups designed to know behaviors, ways of doing, perceptions and conceptions of teachers about the training process. As well as, the different products elaborated by the teachers throughout the course, in order to find information that would allow to identify the evolution process of the teachers during the training course. The quantitative data were analyzed through SPSS 12 and the qualitative data through Atlas ti version 6.2; for this analysis, there were taken into account the designs of mobile learning strategies, the interviews to the focus groups, and the interviews made to the teachers who guided the blended training process.

## Results

With regard to the participation and completion of the training process, it was found that teachers in state education have difficulties in this type of learning environment, since in the face-to-face training phase, 296 teachers delivered the preliminary design of the mobile learning strategies, but only 245 of them culminated the process, after extending the deadlines established for virtual training in almost 50% of additional time.

In this regard, the teachers during the interviews reported that these difficulties were due to: lack of connectivity in their homes to access the virtual process, not having time to carry out this process in their workday so they had to do it in extra time, and the low instrumental skills and digital skills that they had because a part of the population was older than 50 years.

According to the products made during the training process, it was possible to verify that there were made 75 designs of mobile learning strategies, 73% of which were developed individually, and the remaining 27% in a group. It should be noted that this division was not programmed within the process, it was due to the requirements of the participating teachers, who seeing that they were working with colleagues from the same disciplinary areas, asked if it were possible to elaborate group strategies.

However, it is striking that although during the face-to-face training process, the teachers requested on several occasions that they were allowed to work in groups, at the end of the virtual training process most of the works were delivered individually. As well as that the strategies developed in a group form, belonged in 90% to teachers in the areas of social sciences and Spanish, while the ones designed individually belonged to teachers in Science areas.

However, 65% of the strategies designed by teachers were designed for students to work in groups. When asking teachers about it, they indicated that thanks to the portability of the devices, more strategies can be designed where (in which) students work in groups, inside or outside the classroom, either using one-to-one or one-to-many approaches, because what prevails is the possibility of communication and interaction among them.

As a result of this process, 75 mobile learning strategies were designed; however, only those that met the following criteria were taken into account in the analysis process: giving consent for the data to be used in the research, and completing the diagnostic instrument of the competence in educational informatics. As a result of this process, 14 designs were discarded, so only 61 designs of mobile learning strategies were analyzed.

In the same way, from the identification of the products developed by the teachers, we proceeded to determine which of them met the criteria to be considered significant, and that they could be used and reused by the teachers of Fusagasugá and by others of the world academic community. For this, an evaluation was made to each of the mobile learning strategies designed, through an instrument designed for that purpose, as it can be seen in table 2.

**Table 2**. Instrument designed for the assessment of mobile learning strategies.

| Assessing of mobile learning strategies | | | | |
|---|---|---|---|---|
| **Form elements of the strategy** | | | | |
| | Yes | Partly | No | |
| There is a description of the strategy | | | | |
| Learning objectives are identified | | | | |
| There are identified the competences to be developed | | | | |
| There are described the uses given to the device | | | | |
| There are described the resources used | | | | |
| There is indicated the purpose of the resources and services used | | | | |
| The proposed strategy is replicable in other disciplinary areas | | | | |
| The strategy used can be adapted to different contexts. | | | | |
| **Pedagogic quality of the strategy** | | | | |
| | Excellent | Good | Regular | Low | Poor |
| Description of the strategy designed | | | | |
| Learning objectives | | | | |
| Use of device resources | | | | |
| Use of device services | | | | |
| Use of external tools | | | | |
| Relevance of the strategy with the educational context | | | | |
| Other general aspects | | | | |
| | Yes | | No | |
| It has a target population | | | | |
| It is identified the disciplinary area to which it is directed | | | | |
| The strategy depends on connectivity | | | | |

Source: self-made

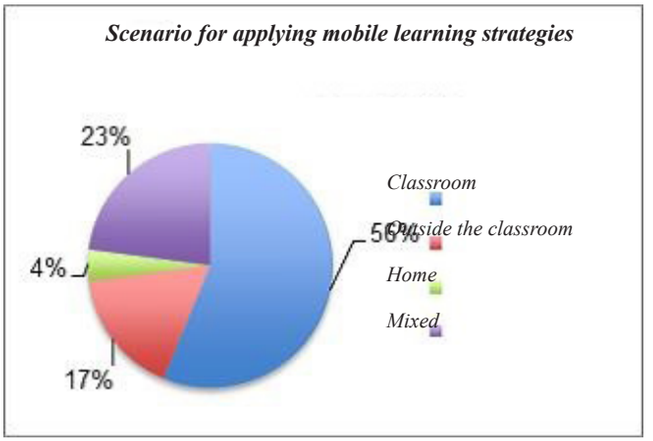
After carrying out the evaluation of the designed strategies, it was possible to determine that only 48 out of the 61 initial proposals might be considered as significant strategies, which could be replicated in different disciplinary areas and adaptable to different educational contexts.

In the same sense, it was possible to determine that the majority of these were oriented to strengthen the development of mathematical competences, in 21%; communicative ones, in 17%; technological ones, in 17%; and social sciences competences, in 15%. However, mobile learning strategies were also designed in areas as diverse as philosophy, ethics and values, and (those) aimed at favoring inclusion processes.

Likewise, it was possible to identify that even though when the use of mobile devices favors the development of activities outside the classroom, most of these proposals propose the classroom as the scenario in which they be developed, which is contrary to the different theoretical proposals on mobile learning that were consulted in the research (Boude Figueredo, and Jiménez, 2013, Boude, 2014, Ebner, Schönhart and Schön, 2014, García and Martínez, 2015, Liu, Li and Carlsson, 2010, Mohammad , Mohammad, Hamdan and AboAli, 2007, Nordin, Embi and Yunus, 2010, Parsons, Ryu and Cranshaw, 2007, Sharples, Taylor and Vavuola, 2005).

However, it is important to note that at least 21% of these were designed to be developed in contexts other than the classroom; and that 23% of these were designed to be developed inside and outside the classroom, as it can be observed in figure 1.

**Figure 1**. Distribution of mobile learning strategies, according to the application scenario.




Source: self-made.

Although this was initially seen as a possible limitation of the study, by performing an analysis of the characteristics of the population, it was possible to conclude that the results obtained are actually very satisfactory, since the majority of the population are digital immigrants with an explorer level, in terms of their teaching ICT competencies, as established by the Ministry of National Education of Colombia (MEN, 2014).

When reviewing the mobile learning strategies, it was possible to identify that within them, there were given different functions to the devices, among which it is worth mentioning that they are used as a source of information in 44% of the cases. Due to its portability and mobility feature, mobile devices can promote, as indicated by Unesco (2013), that the learning process be developed anytime and anywhere, because:

*Mobile learning applications allow to choose between teaching units that can be completed in a few minutes and others that require constant concentration for several hours. Thanks to this flexibility, it is possible to study during a long break or during a short bus ride* (Unesco, 2013: 14).

However, the implication of this goes beyond the possibility of carrying out an activity at any time and place, since for institutions in rural areas or with connectivity difficulties, having the contents within the mobile device allows the teacher to design strategies that take place inside and outside the classroom, or in a pedagogical visit.

The second function proposed by teachers in 31% of the strategies was to use mobile devices to produce knowledge products by students. This is due to the diversity of applications and services they have, allowing teachers to design strategies that range from generating products using applications and tools that depend on connectivity, such as *Drive, Blogger, Youtube, Cmaptools, Mindmap, Educaplay, Powtoon*, etc., until the generation of products that only depend on the use of applications and resources such as video camera, microphone and keyboard for areas without connectivity.

The third function proposed by teachers, in 23% of the strategies, was to use mobile devices to access information. This is due to the possibility of being connected to the internet through wireless networks or the cellular operator service with 3G or 4G. Which, as it has been well indicated by several authors (Boude Figueredo, and Jiménez, 2013, Liu, Li and Carlsson 2008, Mohammad, 2007, Nordin, Embi and Yunus, 2010, Parsons, Ryu and Cranshaw, 2007, Sharples, Taylor and Vavuola, 2005), allows the learning process to be favored, because the teachers can design strategies in which students are the center of the process, becoming an active and pro-active part of the process, which promotes competencies in the management of information that encourage autonomy and peer learning, and to them, become a true guide of the process.

The fourth function proposed by teachers, in 19% of the strategies, was to use mobile devices as support for peer learning. This is possible thanks to the diversity of interconnectivity applications and services they have, allowing students to communicate with each other and with their teachers, at all times and in any place. Even when there is no data channel, it is possible through Bluetooth or wireless servers to be communicated within the educational institution or outside of it in a nearby radius. With which, it is possible to design strategies that allow students to be distributed in work teams, to explore a museum, a library, conduct interviews, videos, knowledge products, etc.

In addition to this, it was possible to identify, as shown in Table 3, at least 15 different uses that can be given to mobile devices within the training process, uses that coincide in their entirety with the policy document of mobile learning published by Unesco at the end of 2013.

**Discussion**

One of the results obtained in this research suggests that it is advisable that the training process around this subject in official basic and secondary education institutions be carried out in situ, and not through blended environments, because most teachers are digital immigrants with low levels of digital skills and ICT teaching skills.

However, it is possible to carry out this type of training process through blended learning environments, provided that a preparatory training process with teachers is carried out during the face-to-face phase, not only to learn how to use the platform and tools, but also to learn how to behave as a virtual student.

It is important to highlight that the findings found in this research suggested that if teachers who want to integrate mobile devices to the training process are oriented, so that they reflect on their teaching practice and identify within this, different scenarios in which the devices mobile can be integrated, it is possible to transform traditional pedagogical practices into innovative scenarios.

Likewise, there were identified different functions that can be given to mobile devices by teachers to support or complement the training process of students, allowing the teacher to become a true counselor of the process, and students in the protagonists of their training.

In the same sense, as it was reported by the teachers, the use of mobile devices facilitates the design of collaborative work strategies, because thanks to the portability of the devices, there can be designed more strategies inside or outside the classroom, either making use of one-to-one or one-to-many approaches, since what prevails is the possibility of communication and interaction among students, which coincides with the approaches found in the research of (De la Torre Cantero, et al., 2015; Ebner, Schönhart and Schön, 2014, García and Martínez, 2015 and Mendoza, Zermeño and Zermeño, 2015).

Likewise, it is very important that teachers from reflection on their practice decide how to integrate mobile devices, and not that this process arises from adapting the practices of others; it is only through reflection on their practice that they will be able to observe the benefits of incorporating this technology into their training processes.

It is (also) important to highlight that, as with other emerging technologies, the incorporation of mobile devices by teachers into the training process must initially be done as a support or complement to the process that has already been designed, and not like a total transformation of their teaching practice, because it is a process in which both teachers and students put into play their conceptions on how the incorporation of mobile devices should be developed within the training process.

These conceptions usually tend to be different, which generates tensions within the training process that are often misinterpreted by the teacher as a bad reception of the process by their students. However, as indicated by (Boude, 2013), this is a normal process that happens every time that teachers and students are in a learning environment mediated by emerging technologies.

**Table 3**. Possible uses of mobile devices in the training process

| Identified uses of mobile devices |
|---|
| Enriching teaching practice |
| Relating theoretical contents with reality |
| Development of strategies that do not depend on |
| Supporting for pedagogical outings |
| Peer learning |
| Training in a second language |
| Development of skills in the development of |
| Development of support digital educational materials |
| Guiding independent work |
| Development of laboratory practices |
| Strengthening skills inside and outside the classroom |
| Supporting for the feedback process |
| Supporting for the evaluation process |
| Development of interdisciplinary processes |
| Promoting processes where the student is the center of the process |

Source: self-made

**Conclusions**

Although the different reports that are generated around the incorporation of ICT to training processes by organizations such as Unesco, OECD, OEI and consortiums such as *Horizon* and *Open University*, they agree that the use of mobile devices in the classroom will be within a year or two a very common practice in educational institutions, this in Colombia is still far from happening. Even though governments have made progress in providing tablets and connectivity infrastructure, this practice is far from common in this process of student training. Even though, the use of the devices is increasingly frequent by these, this use does not respond to a didactic planning by the teacher.

However, it is understandable if one thinks that only until the end of 2013, did Unesco propose to the academic community and government entities the guidelines that each country could follow to draw public policy around mobile learning in its document "Guidelines for policies of mobile learning."

However, when reviewing the literature there is a diversity of works that address this object of study from different points of view, starting from the formulation of frameworks for academic applications (Liu, Li and Carlsson, 2010, Mohammad, Mohammad, Hamdan and AboAli, 2007; Parsons, Ryu and Cranshaw, 2007; Sharples, Taylor and Vavuola, 2005) through the formulation of models for the integration of this type of devices to the training process (Boude Figueredo, and Jiménez, 2013; Boude Figueredo; Jiménez, 2015; Nordin, Embi and Yunus, 2010;) to classroom experiences that report the successes achieved by integrating this type of device into the training process (De la Torre Cantero, Martin-Dorta, Pérez, Carrera and González, 2015; Ebner, Schönhart and Schön, 2014, Frohberg, Göth and Schwabe, 2009, García and Martínez, 2015, Mendoza, Zermeño and Zermeño, 2015).

In spite of this, it is still necessary to develop research processes that like this seek to validate different strategies to train teachers of educational institutions in the design of mobile learning strategies, because it

is not about developing skills in the use of tablets, but skills in the integration of mobile devices as a support or complement to the teaching practice.

Moreover, when governments like the Colombian one since 2012 the Ministry of ICT together with the Ministry of Education, through Computers for Education with its program Tablets to educate has been providing the institutions of basic and media education of tablets to each of the students.

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