Learning mediated by technologies of information and communication at the basic, secondary and high-level education institutes

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Abstract. The implementation of academic activities that involve new technologies of information and communication, it generates in the digital native (individual who has grown up immersed in digital technology) a significant academic perspective in the development of their skills; what leads to a learning mediated by technologies of information and communication, where these are tools used in the classroom that can contain digital documents, multimedia and even the use of reality increases; what has made the present project has a titanic impact on this educational transversality, where this type of learning leaves a mark impregnated with knowledge in each of the students. In addition, the activities implemented in the classroom means that students are interested in each subject taught and that knowledge flows spontaneously, achieving in this way the significant assimilation of knowledge and skills in any area of knowledge.

1. Introduction
The technology performs a fundamental role in the Educational Institutions; according to the United Nations Educational, Scientific and Cultural Organization (UNESCO), “the diverse forms in which technology can facilitate universal access to education, reduce differences in learning, support the development of teachers, thus improving the quality and relevance of learning”[1]; is what the objective of the present project deserves.

In this context, every day many students begin their teaching-learning processes to transform their lives and achieve their goals; where little by little they nourish themselves with bases and substantial knowledge to be later applied in their higher education. However, a certain number of students at the level of the “Departamento del Cesar, Colombia” according to the “Instituto Colombiano para el Fomento de la Educación Superior (ICFES)” (2017-2018) [2], have difficulties in acquiring academic skills in various areas of knowledge. In this instance intervene the information and communication technology (ICT); “where when applied in the teaching and learning of the student, these develop many skills such as: group communication, participation in classes, creativity, innovation, raise self-esteem and feel more motivated in learning”[3]. These environments in the which the student is integrated, give rise to learning mediated by ICT where: “the teacher generates proposals of activities for the reflection, supports their resolution, suggests alternative sources of information, offers explanations, favors the comprehensive processes; that is, guides, orients, offers scaffolding, and in it consists his teaching”[4]. Inside of the tools that cover the ICT in this project is the augmented reality (AR) [5],
which has positioned itself as one of the technological strategies that will have a strong impact in the near future.

The educational possibilities offered by this technology are multiple and varied and mainly attend to the learning objectives that the teacher has proposed beforehand. “Findings from current studies indicate that AR applications increase the academic performance of students in the learning process compared to the use of traditional learning methods” [6].

2. Surveys and statistics

With the final of delimit the population, is done a virtual survey, for identify which educational institutions at the basic, secondary and high level education of the urban area of the municipality of Aguachica, Cesar, Colombia, would be interested in linking to this new educational environment; also it does delivery physical of a letter of formal invitation to five (5) of them, where the results of this virtual survey show that three (3) educational institutions completed their enrollment; giving a percentage of acceptance of the 60%, while two (2) didn't sign up; obtaining a result of denial of the 40%. It is worth mentioning that additionally, two (2) Institutions in the rural area also wanted to participate in the project because they received information related to it, these rural educational institutions are: “Guillermo León Valencia” School from “Barranca Lebrija” and “Promoción Social” school from municipality of Gamarra, Colombia. and the educational institutions from the Urban Zone of Aguachica are: “Laureano Gomez Castro” school, “Guillermo León Valencia” school and “San Miguel” school. Within the subjects and themes chosen by teachers to implement activities in an ICT mediated learning environment, are found: physical, electronics, physical education, specialization in ICT, exploratory curricula, computer science, language and mathematics, with the latter acquiring the highest percentage of voting with the 33%, followed by language with a 17%.

2.1. Analysis of the student results

The following is a descriptive analysis of the data obtained from a questionnaire carried out by students belonging to different grades within the educational institutions of the urban area of Aguachica, Cesar, Colombia, mentioned above and based on the question whether the student body is satisfied with the methodology provided by some of its teachers, the 68.8% manifests itself positively in contrast to the 31.3% who considers the opposite.

Additionally, as a support to the previous incognita, the question is asked about the need to apply a change in the way of giving classes; which reflected a difference of 6.3% in which those who supported the first question moved to this as support for their livelihoods. It should be noted that there are more students with a 62.5% who were inclined towards accepting that change. Now, regarding the premise that: if it considers important the use of technological tools in the development of classes, the 87% of the students surveyed responded positively with the acceptance in the use of this type of tools and the 13% refuses to adopt him. Due to the importance of knowing the subjects for which the activities will later be carried out in an environment of learning mediated by ICT (in addition, because they are common in the different academic grades 3, 5 and 9), it is worth mentioning that for all data analyses in this report, the database of the ICFES (system access file transfer protocol (FTP)) [7]; by recognizing average test results by municipality in 2017 (where the highest score is equivalent to 500 points) [8], of the third, fifth and ninth grades in the “Departamento del Cesar, Colombia” the level of academic deficiency that Aguachica presents is compared with some municipalities such as González, Gamarra, Río de Oro, San Alberto, (selected for their geographical proximity) in addition to Valledupar for the fact that it is the capital of the “Departamento del Cesar, Colombia”.

The Figure 1 reveals that Aguachica is below other municipalities such as Río de Oro, Valledupar and González, with respect to the academic performance of their students with a regular performance; showing that there are shortcomings that affect the learning of the students in their educational institutions. By contrast, according to the statistics, the tests “Saber” of the eleventh grade (11°), around everything related to the primary grades (3° and 5°) and high school (9°).
3

Figure 1. Average results of the third, fifth and ninth grades of the language and mathematics subjects of the municipalities, in the respective order: Aguachica (1), Río de Oro (2), San Alberto (3), Valledupar (4), Gamarra (5) and González (6).

In Figure 2, averaging the scores obtained in the tests “Saber 11, 2018-2”, it is observed that there is a deficit on the part of the students since on average it does not reach the national average that according to the ICFES is of 249.34 [7].

Figure 2. Average results tests “Saber 11” of the municipalities Aguachica, Río de Oro, San Alberto, Valledupar, Gamarra and González from “Departamento del Cesar, Colombia”.

In Figure 3, is show the average of the scores per area is made to the students from Aguachica, Cesar, Colombia, who presented the Test "Saber 11", of ICFES, 2018-2. Accordingly, it is can be concluded that social sciences, natural sciences, and mathematics are the areas where learners are most deficient, which gives a focus for the implementation of activities in these areas using ICT tools.

Figure 3. Average results test saber 11 by subject in the municipality of Aguachica, Colombia.

2.2. Analysis of the results of institutions

According to the “Test Sáber 11, 2018-II”, the educational institutions registered to the project both in the urban and rural area and three (3) additional educational institutions of an unofficial nature such as they are: “Bilingüe Los Ángeles School, Teresiano Reina del Carmelo School, Francisco José de Caldas” school; they are taken as a reference, in order to make a comparison of the academic level of the learners in the municipality of Aguachica, Cesar, Colombia, which according to Table 1, shows that the educational level of the learners according to the Tests “Sáber 11” of ICFES, tends to be higher in institutions with an unofficial nature, which occupy the first places; but emphasis should be placed on the San Miguel School, which has an average similar to the “Guillermo León Valencia” school from
“Barranca Lebrija” and “Promoción Social” school (Gamarra), data to be taken into account for the implementation of activities and their impact in the near future.

Table 1. Average by subject according to Tests Saber 11 registered institutions.

| Educational Institutions                                      | Score  |
|----------------------------------------------------------------|--------|
| “Colegio Bilingüe Los Ángeles”                                 | 62.349 |
| “Colegio Teresiano Reina del Carmelo”                          | 58.874 |
| “Instituto Francisco José de Caldas”                           | 58.101 |
| “Institución Educativa Guillermo León Valencia”                 | 53.421 |
| “Institución Educativa Laureano Gómez Castro”                   | 47.255 |
| “Institución Educativa Promoción Social (Gamarra)”              | 45.882 |
| “Institución Educativa San Miguel”                              | 45.322 |
| “Institución Educativa Guillermo León Valencia de Barranca Lebrija” | 45.172 |

3. Methodology

The present study is carried out in Educational Institutions with basic, secondary and middle education of Aguachica, Cesar, Colombia, is of descriptive type, by means of which the facts will be represented as they are observed, allowing to detail the phenomenon studied basically through the measurement of one or more of its attributes; as they are the data handled daily, delimiting this way the situations that conform the problem of investigation.

3.1. Software development methodologies

Because of we want to obtain two products of development in this research, which they are: a training web platform and an App; it is intended to link to two software development methodologies defined below.

3.1.1. Methodology mobile-d. It consists of different phases [9]:

- Exploration phase: dedicated to the establishment of a project plan and basic concepts, therefore, it can be separated from the main development cycle (although it should not be overlooked). The authors of the methodology also pay special attention to the participation of clients in this phase.
- Initialization phase: During the initialization phase, developers prepare and identify all necessary resources. Plans are prepared for the next phases and the technical environment is established (including training of the development team).
- Production phase: The programming (work-release planning) is repeated iteratively until all functionalities are implemented. First you plan the work iteration in terms of requirements and tasks to be performed. Iteration tests are prepared beforehand. Tasks will be carried out during the working day.
- System test and repair phase: Aims at the availability of a stable and fully functional version of the system. The finished and integrated product is tested to customer requirements and all defects found are eliminated [10].

3.1.2. Web engineering. It focuses on the creation of high-quality web applications and systems, based on scientific engineering principles. These applications make it possible to access from remote computers [11]. The following are the seven phases of the web engineering (Iweb) methodology.

- Formulation: the objectives, goals are identified, the scope of the application is established and its first delivery.
- Planning: to estimate the general cost of the project to be carried out and to evaluate the risks associated with the development of the application.
• Analysis: establish the design and technical requirements, also analyze the content of this, its iteration, functionality and configuration.
• Engineering: to achieve the integration of architectural design, navigation and interface. This is why it is divided into content design, production, architectural design, navigation design, and interface design.
• Page generation: the designs of the previous stage are integrated through tools such as programming languages and labeling that serve as the basis for the construction of the web application.
• Tests: the business logic applied in the system is checked, and the inputs and outputs of data are verified in order to discover errors of functionality, behavior or performance.
• Customer evaluation: it allows to correct errors thanks to the iterations carried out in order to polish the application compared to previous iterations.

4. System architecture
The architecture is based on a model view controller (MVC) pattern, which is a guide for the design of application architectures that offer strong interactivity with users. This pattern organizes the application in three separate models, the first is a model that represents the application data and its business rules, the second is a set of views that represents the input and output forms of information, the third is a set of controllers that processes user requests and controls the flow of execution of the system[12].

• Model: A model represents a single data object. This can be a row in a database table or an input form per user. Each field of the data object is represented by an attribute in the model. The attribute has a label and this can be validated against a set of rules[13].
• View: This is the information presented to the user. In a view, we will normally see a web page, but it can also be a fragment of a page, such as a header or a footer. From another perspective, is the part where you interact with the user and specify things like: forms, data position and how they will be displayed on the screen.
• Controller: Listens to events triggered by sight (or other external source) and executes the appropriate reaction to these events. In most cases, the reaction is to call a model method. Since the view and the template are connected through a notification mechanism, the result of this action will be automatically reflected in the view.

5. Development and implementation of information and communications technology mediated learning in classrooms
The project has a web platform and an App (under construction) in which it will promote activities applying augmented reality, as well as multimedia content such as games, interactive videos, among others, in order to improve learning in students in grades 3°, 5°, 9° and 11° in registered educational institutions and thus promote ICT mediated learning. Upon entering the website, the brand and various sections such as login, registration and contact information become visible. Detailed information on the different tools used to promote ICT mediated activities, see Figure 4.

The areas that the platform will focus on and how the way of learning can change in each of them are: mathematics, English, social sciences, language, natural sciences and critical reading.

6. Technology
MYSQL [14] database management system used to manage data of students of educational institutions, PHP [15] server language used for client requests, BOOTSTRAP [16] framework of CSS used for the structure of the website, AJAX [17] a set of techniques for exchanging data with the server and updating parts of web pages without having to reload it in its entirety, UNITY [18] software used for the creation of activities in augmented reality, VUFORIA [19] and SDK [20] used for the detection of models found in targets, C# [21] programming language used for the interaction and functionality of the activities,
JAVA [22] programming language used for the interaction and functionality of the activities, additional tools were used such as Javascript, HTML, CSS, among others.

![LludIC](image.png)

**Figure 4.** Screenshot of technology tool login with AR.

7. Conclusion

According to surveys carried out to several students, teachers and educational institutions of the municipality of Aguachica was found that there is currently a deficit of student performance in the development of their academic activities. The importance of the implementation of technological tools within classrooms, by surveys of students and teachers belonging to educational institutions in the municipality of Aguachica, Cesar, Colombia results were analyzed. Likewise, it allowed us to obtain information to measure their degree of satisfaction, level of interest, collaboration and difficulties encountered in their academic environments. In consequence, it is necessary to take advantage of and implement new strategies in the educational institutions of the municipality with the intention of seeking solutions to this problem and that Aguachica can narrow the digital divide. Therefore, the use, use and application of ICT-mediated learning in institutions promotes that the student unites with great interest and willingness to participate and integrate into the different modules that are taught in each of their subjects, thus emerging from the traditionalist monotony in which urban and rural educational institutions are immersed in the municipality of Aguachica, Cesar, Colombia.

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