

Influence of digital tablets on the students' learning within a program aimed at strengthening the teachers' technical and pedagogical practices

Abstract—An institutional accompaniment and a strengthening of the teachers' technical and pedagogical practices were developed, based on the integration of tablets. The intervention was carried out in 223 educational institutions of Cundinamarca, Colombia and the impact on the professional development of teachers, students, and educational institutions was measured. From the variables related to the impact on the students learning, two logistic regression models were designed, that suggest that the results where the students are more active and participatory in class relate to the teachers who embraced new methodological strategies, the teachers who use new technological resources and the teachers that improved positively the way they interact with their students. Additionally, those results where the students improved their commitment to other subjects relate to the teachers that strengthened their participation in teachers groups; the interest on integrating electronic devices from the institutional management, and the teachers that understood better the curricular elements of their area. The results of this initial analysis enable anticipating conclusions that will provide evidences to the statements that support the urge of including technology in education environments, along with teachers' pedagogical strengthening strategies particularly for tablets in Colombian context. On the other hand, this will contribute understanding the impact that these kind of implementations have on students' learning by showing how technology mainly affects factors associated to learning.

Keywords— *Educational use of Digital Tablets; mobile learning; class projects; students' learning; institutional accompaniment*

I. INTRODUCTION

In order to improve education quality in Public Educational Institutions, the Colombian State, the Cundinamarca Government and the National University of Colombia developed the program "Cundinamarca Clase T". About 30,000 tablets were distributed in 223 schools that also received an intervention intended to strengthen teachers' management, technical and pedagogical competences; additionally, the program included an introductory component for the students and the community surrounding schools.

A common concern of the studies on the use of technology in education is to set its impact on students' learning, particularly, according to their competences development. Previous studies have concluded that technology provisioning or technical training for teachers on the use of devices are factors that does not explain exclusively or independently the effects on students' learning. Instead, the international evidences suggest that the change on the methodology and teacher qualification, along with a proper educational management of technology, are factors with a higher influence on fostering learning.

II. FRAMEWORK

In order to analyze the impact the use of Digital Tablets has on the classes within the institutions, this study focused on the effects that this new resource may have on aspects related to the student, such as motivation, active participation and commitment to autonomous work. These aspects were selected based on the existing literature regarding the expectancies of the impact the mobile devices may have as educational resources.

In this regard, when mentioning aspects related to students, multiple researches [1], [2], [3] suggest one of the factors the mobile devices impact the most is how the activities and topics proposed motivate the students. In fact, Pintrich and De Groot [4] suggest three categories that are significant to motivation within education environments: the students' assumptions regarding their competence to perform a task; the self-perceptions regarding the importance and interest in the task; and the affective-emotional consequences resulting from performing a task. Usually, this relates to mobile devices since the concepts can be introduced in a dynamic and interactive way through animations, simulations; collaborative and cooperative learning foster their participation; the teacher pedagogical and technological domain can be correlated so that the student learning experience within the class is more significant. However, Passey [5] state the mobile devices incidence is not enough to succeed motivation. Their usage require the teacher to lead proper learning tasks and guidances [6].

Furthermore, it is very important to foster the students' competences and higher cognitive processes under the integration of mobile devices and the implementation of teaching-learning methodologies. To this extent, the mediating role of the teachers is crucial, since through active pedagogy they leverage students who have power over their own knowledge and participate proactively in their learning process. Similarly, it is addressed the positive influence that the approval and acknowledgement by the teacher, regarding the actions and behaviors of their students, has on their involvement and usage of mobile devices [7].

Finally, in relation to self-learning, the tasks that are considered autonomous are those that involve solving exercises by themselves, propounding new problems, conducting researches and proposing out-of-class activities [8]. This includes thinking processes such as identifying and self-evaluating own learning needs, determining learning objectives and managing the strategies that enable the achievement of such objectives [9]. In general, the importance of self-learning is constantly mentioned in virtual learning environments. This, especially due to the purpose of educational processes is to

teach students about responsibility and make them develop different competences from significant learning.

III. METHOD

A. Participants

During the project development a set of indicators for the class processes development was collected, as well as the measurements the teachers conducted regarding the results and impact of the project. From all the information collected, the research captured in total 245 questionnaires, filled in by the students, from which a sample of 102 questionnaires about the development and results of the class projects was analyzed; these latter were developed based on a set of pedagogical guidelines provided by the program in the training activities.

B. Instrument

The class project was a methodological option aimed at making learning significant through intentional productions by the students. Precisely, when concluding the class project, the teacher realized at what level the students developed the competences, in terms of the percentage of students that achieved the expected learning goals; on the other hand, they assessed the impact the use of Digital Tablets and the project-based methodology had on factors related to learning, such as motivation, active participation and commitment to autonomous work.

C. Procedure and design

The processing of the information collected is based on a descriptive analysis of the three aspects the teachers reported: professional development of teachers, students and the educational institution-community. Three logistic regression models were obtained during a second analysis stage, in order to assess how the project evaluation, related to the teachers and the conditions of the educational institutions-community, affected the probability of measuring positively the impacts on the variables related to the students. The dependent variables of the dichotomous logistic regression models, assessed as Yes (1) or No (0), are: the students are more active and participatory in class, the students leverage proactively the new technological resources, and the students increased their commitment to the subject out of class. The independent regressor variables are Yes (1) or No (0) dichotomous variables related to the teachers and the educational institutions-community. The variables regarding teachers are: the teacher employs new resources and ICT tools to improve the students' learning, the teacher embraced new methodological strategies to strengthen students' learning, the teacher improved positively the way to interact with students, the teacher started participating or strengthening their participation in teachers groups, and the teacher understand better the curricular elements of their area. The variables regarding educational institutions-community are: the educational institution supported the class project, it was projected the continuity of the experience for the next years, it was developed an interest in integrating ICT from the management dimension, the students' family members report a better appraisal, and the students' family members are interested in learning about ICT.

IV. RESULTS

First, the measurement of the class projects showed that the students are more active and participatory in class when the tablets are used (87.3 %), and there is a good leverage of technological resources (86.3 %). It is worth noticing that the students did not increase significantly their commitment to subjects out of class (53.9%). (Table I)

TABLE I. PERCENTAGE IN THE AESSMENT OF THE CLASS PROJECT IMPACTS

Assessment of the impact the project had on the students			
	Frequency	Percent	Valid Percent
They are more active and participatory in class	89	87.3	87.3
They leverage proactively the new technological resources	88	86.3	86.3
They increased their commitment to the subject out of class.	55	53.9	53.9

Second, when considering the measurement of the impacts of the project on the professional development of the teachers, first of all the teachers reported using new technological resources (87.3%), followed by embracing methodological strategies (85.3%), and perceiving the improvement in the interaction with their students (72.5%). 46.1 % considers they started participating in teachers groups and 35.3% considers they understand better the curricular elements of their area. Third, it is worth notice that the measurement of the impacts of the project on the educational institution and community were nor as positive as the results found in students and teachers. In general, the most positive measurement is the one related to the support provided by the educational institution (73.5%) and the consideration of continuing the experience the next years (64.7%). Unfortunately, only 34.3 % of the students' family members reported a better appraisal or are interested in learning (33.3 %).

For the next stage, the data analysis, the Logistic Regression Models were statistically significant for the measurements in which the students were more active and participatory in class $\chi^2 = 25.50$, $p < 0.0005$ and for those where they increased their commitment to the subject out of class $\chi^2 = 29.45$, $p < 0.0005$. The model is not statistically significant in the questionnaires in which the students leverage proactively the new technological resources. Measurements of the class projects in which the students were more active and participatory

A. Measurements of the class projects in which the students were more active and participatory

The model explained 41.8% (Nagelkerke R^2) of the variance in the dependent variable and classified correctly 88% of the cases. The model (Table II) shows that the teachers that embraced new methodological strategies to foster their students learning are 8.8 more likely to have more active and participatory students. The same happens to the employment of new resources and ICT tools to improve students learning (4.9 more likely) and the significant improvement of their knowledge and way to interact with the students (5.6 more

likely). The support provided by the educational institution to the project is not statistically significant in the model.

TABLE II. INCIDENCES FOR THE MEASUREMENTS OF THE CLASS PROJECTS IN WHICH THE STUDENTS WERE MORE ACTIVE AND PARTICIPATORY

Logistic Regression Model with dependent variable: the students are more active and participatory in class					
	<i>B</i>	<i>S.S.</i>	<i>Wald</i>	<i>Sig.</i>	<i>Exp(B)</i>
The teacher embraced new methodological strategies	2.2	0.8	7.2	0.00	8.8
The teacher employed new resources and ICT tools	1.6	0.8	3.8	0.05	4.9
The teacher improved positively the way to interact with their students	1.7	0.7	5.5	0.01	5.7
The educational institution supported the class project	1.4	0.7	3.7	0.05	4.1
Constant	-2.8	1.1	5.95	0.01	0.06

B. Measurements of the class projects in which the students increased their commitment to the subjects out of class

Finally, regarding the model showed, 34% (Nagelkerke R^2) of the variance in the dependent variable was explained and 73% of the cases were classified correctly. The variable of the teachers that reported understanding better the curricular elements of their area was 3.7 more likely to occur if the students increased their commitment to the subjects out of class (Table III); likewise, the variables of teachers that said they started to strengthen their participation in teacher teams (3.7 more likely) and the educational institutions that interested in integrating ICT from the management dimension (3.3 more likely).

TABLE III. INCIDENCES FOR THE ASSESSMENTS IN WHICH THE STUDENTS INCREASED THEIR COMMITMENT TO THE SUBJECTS OUT OF CLASS

Logistic Regression Model with dependent variable: The students increased their commitment to the subjects out of class					
	<i>B</i>	<i>S.S.</i>	<i>Wald</i>	<i>Sig.</i>	<i>Exp(B)</i>
The teacher understood better the curricular elements of their area	1.3	0.5	6.4	0.011	3.7
The teacher started strengthening their participation in teachers work teams	1.3	0.5	7.7	0.005	3.7
The educational institutions are interested in integrating ICT in the management dimension	1.2	0.5	6.6	0.01	3.3
Constant	-1.3	0.4	12.25	0	0.25

V. CONCLUSIONS

Measuring the class projects, in which the students who play more active and participatory roles counted on teachers who

embraced new methodological strategies, provides evidence to the arguments that support the necessity of accompanying the implementation of technology in education environments with pedagogical strengthening strategies for teachers. Furthermore, it strengthens the arguments that support that the teachers who adopt mobile devices and use them continuously in the future have positive attitudes regarding the integration of technological resources in class [7]. Similarly, it emphasize the significant learning evidences from the affective dimension [10], in which the group integration is favored by the social bonding to the group.

On the other hand, in the measurements of the class projects where it becomes relevant that the students increased their commitment to the subjects out of class, the arguments in which the teacher plays a relevant role in the construction of self-learning strategies are supported. Not only strengthening the curricular elements is important, but also integrating the educational community through institutional conditions that provide the teachers of different disciplines the opportunity of using mobile devices with their students, by providing a proper availability of technological resources and quality of access [6].

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