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Laptop in use at the School: Perceived Relations in the Student Development as seen by Teachers

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Abstract

This work presents part of a study on the analysis of the use of laptop for educational purposes in Brazilian public Elementary schools, situated in different regions of the country, as participants of the project one Computer per Student - UCA, of the Ministry of Education – MEC. The schools received low-cost laptops, assigning one computer for each student, teacher, principal, pedagogical coordinator and other professionals. The package also included internet connection, Wi-Fi infrastructure, and continued education development focused on the pedagogical use of this technology and on the technological immersion aimed to create the digital culture at the school.

The present study is part of a broader research whose focus is on the integration between technology and curriculum, analyzing the process of development in action and the practices of laptop use in seven public schools of the Brazilian states of São Paulo, Goiás and Tocantins.

The focus of this work is on the school teachers' view as registered in the analysis of the answers given to an online questionnaire with closed format questions. The analyzed questions refer to the improvements pointed out by the teachers regarding the development of their students who use laptops in curricular pedagogical activities. Data analysis is performed through two methodological approaches: conventional descriptive statistics and Implicative Statistical Analysis - ASI with the use of CHIC (Hierarchic, Implicative and Cohesive Classification) to identify the association between the answers provided by the teachers. The replies are displayed in hierarchical trees of similarity, which highlight the most significant levels of inter-relation between the answers in terms of similarity.

Key Words: Laptop at the school, curriculum and technologies, student development, elementary education, software CHIC

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Introduction

This work presents part of a study on the research about the use of laptops for educational purposes in seven Brazilian public Elementary schools, located in the states of Goiás, São Paulo and Tocantins, from the viewpoint of the teachers working in these schools through their replies to an closed-format questionnaire. The analyses focus on issues regarding the improvements noticed by the teachers in the development of students who use laptops on their curricular pedagogical activities. Data was processed using two methods: the classic descriptive statistics and the multidimensional data processing using the software CHIC (Hierarchic, Implicative and Cohesive Classification), which reveals the inter relational patterns of the teachers' answers.

This study is part of a broader research (Almeida et al, 2013), which is funded by two Brazilian academic research agencies (CNPq and CAPES) and the Ministry of Education (MEC). The research encompasses issues related to Brazil's public policies directed to the introduction of technology in Elementary levels, through the project One Computer per Pupil (UCA, in Portuguese). The project has delivered educational laptops for a little over 300 schools, in the ratio of one laptop per (1:1) student, teacher and school management staff, and has also provided a contextualized course for educators' development (both teachers and managers) of these schools. The research, which is linked to the Post-graduate Studies in Education: Curriculum, of PUC-SP (Catholic University of São Paulo), aims to identify - in the laptop-based pedagogical practice - contributions, difficulties and impacts in the curriculum from the viewpoint of school managers, teachers, experts, students and parents, and also the signs of changes, educational innovations, and new teacher development needs.

Since the focus is to identify what teachers say about the development of their students who are using laptops in curricular pedagogical activities, it is important to describe what is meant by integration between information and communication technologies (ICT) and the curriculum.

Curriculum and ICT Integration

The concept of curriculum allows for multiple interpretations and theoretical constructs. Hence, it is relevant to describe the concept adopted in this study both in itself and in the integration between curriculum and ICT.

The etymological meaning of curriculum is given by the Latin word which means path, course, or run, as well as the syllabus of a course or a discipline. As time went by, its meaning evolved to reflect the changes in the world views and in the society.

In the 60's, the concept of curriculum had a technicist tone, but at the end of the 20th century and the beginning of the 21st century, a number of scholars started to consider curriculum as praxis, in line with an educational model that

is not reduced to be a project of cultural socialization (Gimeno Sacristán, 2000).

The approach adopted in this study is based on the notion of curriculum that is reconstructed in the social practice (Goodson, 2001) established between teacher and students. The curriculum construction process takes place in reality's concrete conditions, i.e., in the interaction between subjects and knowledge objects. The process is, hence, a cultural, historical and social construction (Moreira, 1997), which is developed through intentional social practices (Pacheco, 1996), with the participation of teachers and students and their identitary features, in a horizontally-set relation based on dialog aiming to transform (Freire, 1968).

When using the ICT in the social pedagogical practice, it is important to consider that such technologies alter the way we learn, teach and represent thoughts, and also interfere in meaning-making, subjectivities, space, time and interpersonal relations. Under the sociocultural approach (Vygotsky, 1987), technologies are not seen as neutral: they constitute symbolic cultural tools and trigger such deep transformations that they lead many authors to identify the rise of a digital culture Buckingham, 2010), the networked society (Castells, 1999) and the creation of the web-based curricula (Almeida, 2010).

Due to the ICT inherent funcionalities, the pedagogical practice using ICT media involves the combination of a number of resources, people, spaces, time and relations, thus leveraging active learning and the curriculum openness and flexibility (Almeida & Valente, 2011). From this viewpoint, interaction, participation, collaboration, group activities and authorship in the knowledge representation enable the development of a real curriculum, which can be identified through the digital records of processes, products and interactions.
When considering the use of mobile ICT equipped with wireless internet connection, the teaching-learning and the curriculum development spaces are expanded and create opportunities for a new form of mobile work (Koschembahr, 2005), allowed by information mobility and educational actions.

The integration between curriculum and ICT allows for breaking through space and time constraints of the classroom and the school, and for interacting with the different spaces of knowledge production and the daily life events that enter the school and reveals it to the world. Hence, the approach of contents becomes more flexible; the learning context becomes closer to authentic situations; and the curriculum reconstructed in the social practice can be analyzed through the digital records enabled by the ICT.

In the last two decades, the use of portable digital technologies with wireless connection (wireless laptops) has been adopted in education by different countries, or regions within a given country, taking into account the potential immersion it provides, mainly with the 1:1 ratio of one laptop per student. The mobility spreads beyond the workplace or study rooms to external places, out of the classroom and the school, allowing students to get involved in authentic learning situations (Luckin et al, 2005). Many authors have studied

these contexts, such as Warschauer (2008), Bebell & O'Dwyer (2010), Penuel (2006), Vacchieri (2013), Almeida & Prado (2011).

Bebell & O'Dwyer (2010) reported that laptop use in K12 schools in the United States has presented results related to the expanded use of technology by both students and teachers: there was an increase in students' interest and participation, but also only a moderate improvement in students performance. The authors underscore that teacher development is an essential aspect to ensure progress.

Warschauer (2008) analyzes an experiment on the use of laptop in the 1:1 ratio in schools located in California and Maine, in the United States. The author points out results which show how students learned how to access, manage and integrate information in writing and in multimedia presentations, thus revealing digital literacy development, as well as effective investigative skills.

Since the end of last century's 80's, Brazil has been promoting initiatives for the use of ICT in education. A number of programs, projects and reference documents from the Ministry of Education (MEC), and the state and municipal public school networks focused on the introduction of ICT in schools together with corresponding teacher development courses have been developed aiming to promote ICT integration with the curriculum. In recent years, such goals have also encompassed the use of mobile technology with wireless internet connection, like the referred project One Computer per Student (UCA) (BRASIL, 2010).

Study indexes about the initial experiments of the UCA project, performed between 2007 and 2008, show changes in class-hour time, classroom and school managements, and also in student participation and parents' attendance to school-related activities. Studies also point out the progress in digital literacy of both teachers and students (Almeida & Prado, 2011). In its further stage (phase 2), this project was expanded to 300 public schools, both in urban and rural areas, located in all the country's geographical regions.

A study developed for two years in seven schools participating in phase 2 of the UCA project, located in states of three of Brazil's regions (the center-western, north and southeast) analyzed ICT integration to the curriculum and revealed: relevant progress (Almeida, 2013) in the development of students' reading and writing skills, and their ability to express ideas through media-based languages; improvement in both students' and teachers' self-esteem; the involvement of both teachers and students in investigative processes, which involved both in-school and out-school places; and a decrease in students absences and drop-out rates. The study also featured changes in the reorganization of time and space for the pedagogical work at the schools; in teacher-student and student-student relations; in knowledge management; in the ecology of classrooms, the school and its surroundings; and, in the adoption of a digital-culture vocabulary.

The knowledge produced, the founding and results of researches on the use of mobile ICT in schools showed the relevance of investigating the teacher's viewpoint about the relations arising from students' development in curricular

pedagogical activities. To capture such perspective, the methodology chosen for this study has a quali-quantitative basis.

Methodology

This study aims to identify what teachers say about the development of their students who are using laptops in curricular pedagogical activities. It is, hence, important to describe what is meant by integration between information and communication technologies (ICT) and the curriculum. For this, data was collected using an online questionnaire, consisting of closed-format questions which were answered by teachers of UCA project schools.

The questionnaire form was made accessible on Google Docs and went through a two-phase testing. The first phase was performed by the research team members, and aimed to verify the questions adequacy to the research goals. After the cross-checking, the second phase was implemented with the teachers working in the UCA participating schools, but who were not members of the research team. A new cross-checking was run on the questions, and some options for answers suggested by the respondents in this phase were adopted. The respondents found the questionnaire easy to understand.

After this step, the questionnaire was made available for the teachers working at the seven UCA participating schools on a website based on the internet. The answers were entered between May and June of 2013. The answers were stored in a Google Docs database, which was created specifically for this purpose. This database was exported to the Microsoft Office Excel application and went through two types of processing: the classic descriptive statistics and the multidimensional data processing using the software CHIC (Hierarchic, Implicative and Cohesive Classification) version 3.5, whose logic is based on the establishment of relations between the answers.

The use of CHIC in the analysis of the teachers' answers to the questionnaire made it possible to retrieve the inter-relationships between answers (variables) laid in hierarchical similarity trees. The trees group the associated answers in classes, according to the level of inter-relation detected as being the most significant in relation to their similarity or likeness with other levels and classes (Gras & Almouloud, 2002; Almouloud, 1992; Gras, 1992).

For data processing using CHIC, all the answers to the questionnaire were rewritten in binary digits - 0 or 1 - which denote the absence or the presence of an event, meaning, for this study, the proposed option being checked or not by the respondent. This data generated a new worksheet, saved with a *csv* extension, and separated according to the question being analyzed. In the worksheet, columns with cells showing zero value or just a single cell with value 1 (or the opposite, i.e., all cells having a value of 1 and just a single cell showing value zero) were excluded.

The main focus of analysis was the inter-relations with similarity level considered significant by the software data processing, making it visible on a map the existence of people whose answers were close. The software shows

the inter-relation between the respondents' answers who checked the same options in two or more items, rather than the frequency of an isolated answer.

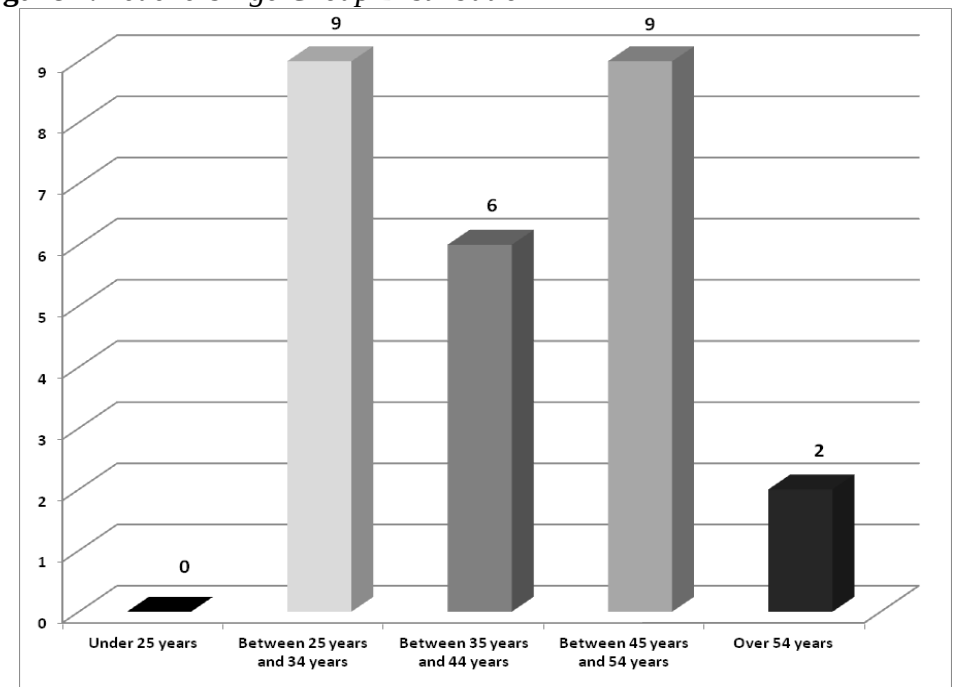
A similarity tree was created by grouping all the answers related to the options reported by the teacher relative to noticeable improvement in the development of students (answers "improved a lot" or "improved significantly") who used the educational laptop in curricular pedagogical activities.

To promote a better understanding of this study, the descriptive analysis was used for the questions referring to the teacher's profile and the laptop resources used, as well as the data processed utilizing CHIC to analyze the question that brings a 17-item topic list on specific aspects about which the teacher could have noticed any improvement in the students using laptops for their curricular pedagogical activities.

Quantitative Analysis of the Teachers' Answers about Improvements Noticed in the Development of Students Using Laptops

There were seven public schools participating in this research: three located in the state of São Paulo (southeast region), two in Goiás (center-western region) and two in Tocantins (north region). Among these seven schools, a total of twenty-six respondent teachers were distributed as follows: thirteen from schools in the state of São Paulo, ten from Tocantins and three from Goiás. A total of twenty-four teachers were regular classroom teachers and the remaining two were substitute teachers.

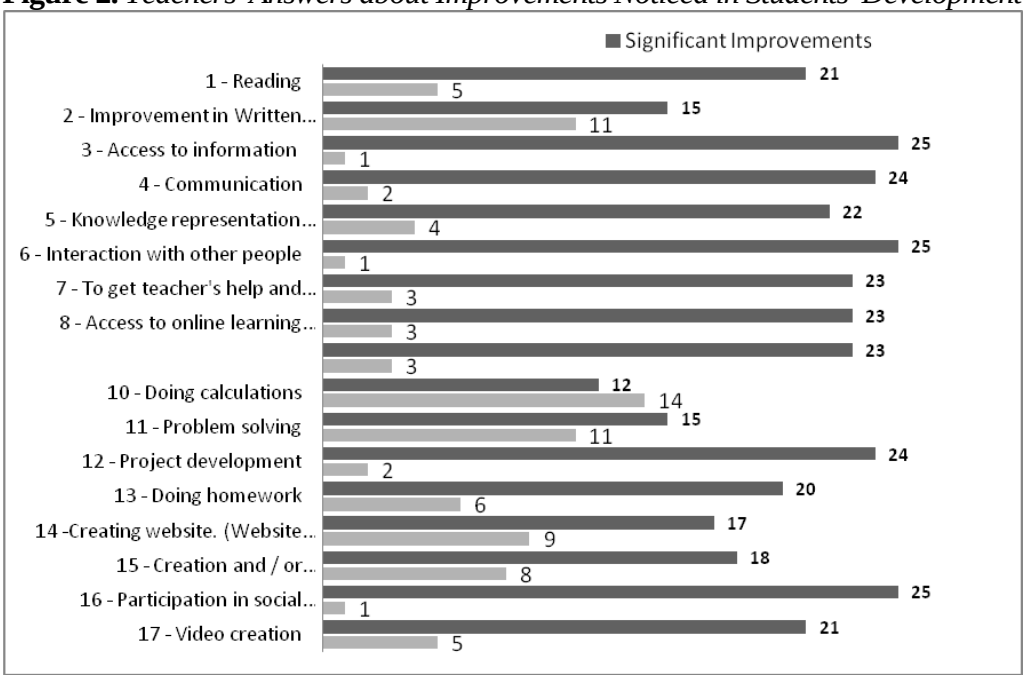
Figure 1. *Teachers Age Group Distribution*



As shown by the graph in Figure 1 "Teachers Age Group" there were nine teachers aged between 25 and 34 and also nine between 45 and 54; six of them were aged between 35 and 44, and only two were older than 54 years. This indicates that the majority of the teachers are either at the beginning, or the middle of their teaching careers.

Regarding the teachers answers about improvements noticed in the students development (Figure 2), the most frequent answers (between 25 and 20 replies) were: access to information, interaction with other people, social networking, communication and project development; seeking teacher's help and feedback, accessing learning materials online, production and presentation of assignments; knowledge representation on different media, reading, video creation; homework. In relation to the aspects which teachers reported as having presented little improvement, the options were: calculations (14 answers); writing skills and problem solving (13); creation of web pages (9); creation and/or writing of newsletters, comics and clips (8).

Figure 2. *Teachers' Answers about Improvements Noticed in Students' Development*



Among the answers about significantly improved skills, we highlight communication aspects, but there are others which might be better understood through an analysis that allows for the establishment of inter-relations between answers.

Analysis of the Inter-relations revealed in the Similarity Trees of Teachers' Answers

In this topic, we analyze the similarity tree which corresponds to the classes that inter-relate the teachers' answers about the improvements noticed in the development of students using laptops.

Figure 3 shows the similarity tree with the inter-related answers listed in Table 1, regarding the "significant improvement." The tree is structured in three independent classes, since there is no inter-relation between them.

Figure.3 *Similarity Tree and Table 1 (corresponding variables*)

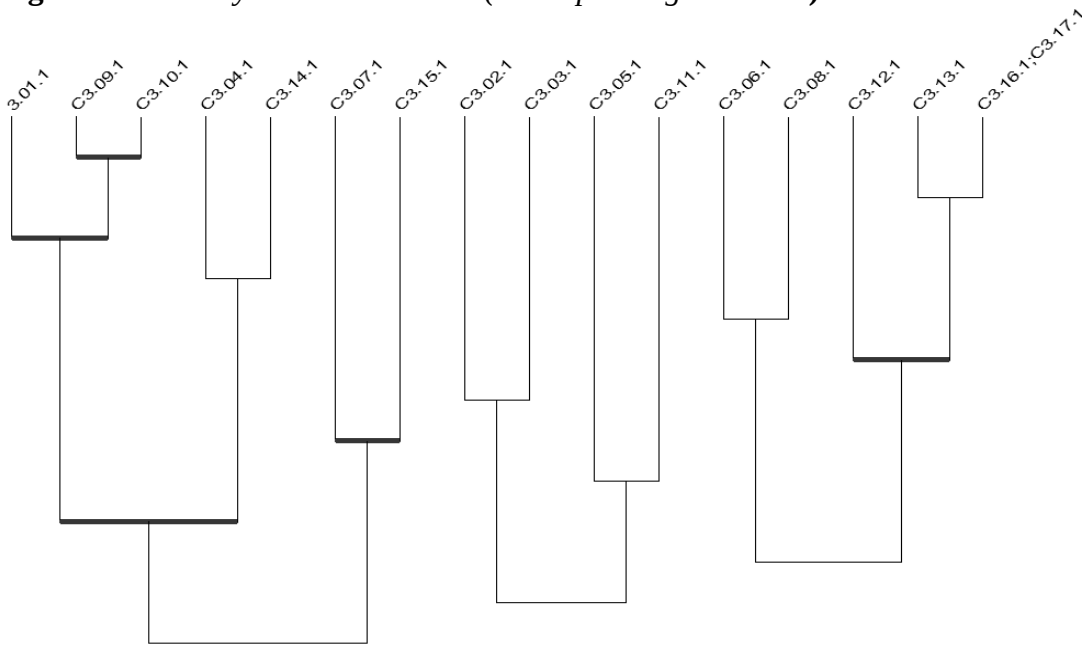


Table 1. *Variables Corresponding to Teachers' Answers about Significant Improvements in Students' Development*

C3.01.1	Reading
C3.09.1	Production and presentation of assignments
C3.10.1	Doing calculations
C3.04.1	Communication
C3.14.1	Creation of webpages
C3.07.1	Seeking teacher's help and feedback
C3.15.1	Creation and/or production of newsletters, comic strips and news clips.
C3.02.1	Written Production
C3.03.1	Access to information
C3.05.1	Knowledge representation using various media
C3.11.1	Problem solving
C3.06.1	Interaction with other people
C3.08.1	Access to online learning materials
C3.12.1	Project development
C3.13.1	Doing homework
C3.16.1	Social networking (Facebook, MSN, Linkedin, etc)
C3.17.1	Video creation

The class located in the middle of the tree, composed by two clusters (C3.02.1, C3.03.1) and (C3.05.1 and C3.11.1) each with a low level of similarity (0.5761 and 0.4936) also shows a relation between them and the low-similarity level (0.1102) and, hence, not significant.

The class located on the left of the tree, however, has various significant clusters (bolded horizontal lines). The strongest tree cluster is formed by variables C3.09.1 and C3.10.1 (similarity index of 0.9731, level 1), thus suggesting there are teachers who pointed as their students' significant improvement using the laptop to create and present assignments and to do calculations. Linked to this cluster, there is variable C3.01.1, which, together with the previous cluster, forms a relevant sub-class (C3.01.1, C3.09.1 and C3.10.1) of level 3 and similarity index 0.8824, thus indicating that there are teachers who point significant improvements of students' activities using the laptop on reading, creation and presentation of assignments, and for calculations. These improvements suggest significant contributions from the use of laptops in students development and the fact that it is a level-3 relation shows that a great number of teachers checked out all these answers.

In this class, there is another cluster (C3.04.1 and C3.14.1), but it shows a low similarity level (8), which indicates there is a group of teachers who checked significant improvement of their students in laptop-activities in communication and web page creation. This cluster has a relation with the previous one (C3.01.1, C3.09.1 and C3.10.1), establishing a new sub-class of level 10. However, it is sill considered significant, both by CHIC and by the contextual characteristics under study. it is interesting to identify a small group of teachers (0.4307 similarity index) who report seeing significant improvements in their students in all these aspects (C3.01.1, C3.09.1,C3.10.1,C3.04.1 and C3.14.1).

The cluster formed by variables C3.07.1 and C3.15.1 is considered a significant level-8 cluster (0.5746 similarity), and it shows that there are teachers who recognize significant improvements in their students' pedagogical activities using laptops in relation to seeking teacher's help and feedback, and the creation of newsletters, comics and clips. This cluster is an evidence of the teachers' effort to get closer to their students and guide their creation assignments, which is in line with a pedagogical praxis in the active learning approach.

The class on the right of the tree has a significant cluster formed by variables (C3.13.1, C3.16.1 and C3.17.1), of level 2, being C3.16.1 and C3.17.1 variables of congruent answers. This three-variable cluster is articulated with C3.12.1, making a level-6 sub-class (0.6427 similarity), showing that there are teachers who notice significant improvements in their students' development regarding video creation, social networking, doing homework and in project development.

The sub-class formed by variables C3.06.1 and C3.08.1 of level 5 is significant; however, its relation with the previous level-6 sub-class is too weak (level 11, 0.1162 similarity). Hence, it is only relevant to analyze sub-classes C3.06.1 and C3.08.1, which offer hints of a group of teachers who notice

improvements in the development of their students using laptops in activities related to interaction with other people and access to teaching material online.

Thus, the class situated to the right of the similarity tree (Figure 3) has two relevant sub-classes. The first relates to students' development in curricular activities that allow them to interact on networks, perform in projects committed to task-performance and the production of videos. This is coherent with cluster level 8, as previously discussed. The second sub-class, represented by cluster C3.06.1 and C3.08.1, associates students' development using educational laptops in curricular activities which explore the interaction with other people and the access to learning materials online.

This analysis shows different stands from teachers regarding the inter-relations of the most significant improvements. At the higher levels of inter-relation there is a group of teachers whose answers-relations report improvements in their students development with the laptop use for curricular activities of reading, production and presentation of assignments and doing calculations. Other relations show another group of teachers that reports significant improvements in students development using laptops in curricular activities of video production, social networking, doing homework and project development.

In the lowest, albeit relevant levels, there are three groups of teachers whose answers articulate with aspects that go through communication aspects. One group of teachers reports significant improvements in their students' pedagogical activities using laptops in relation to seeking teacher's help and feedback, and the creation of newsletters, comics and clips. The second group notices improvements in activities related to interaction with other people and access to learning materials online. Finally, the third group points significant improvements in their students regarding activities that integrate communication and web page creation.

Final Remarks

Having as a goal to identify the improvements pointed by teachers regarding students' development with the use of laptops in curricular pedagogical activities, this study analyzed the answers to an online closed-format questionnaire, given by teachers participating in the UCA project.

Considering that the quantitative treatment of the answers emphasized aspects of communication, and that the knowledge of context indicated other aspects that were not present in such results, a choice was made to apply implicative multi-directional statistical analysis using CHIC to establish the inter-relation between the teachers' answers about the options "evolved a lot" or "improved significantly" in relation to a number of items.

The relations established between the teachers' answers about improvements noticed in their students' development can be affected by the teacher's conceptions, values, experience, and curricular proposals that guide practices at schools belonging to different public networks in the different

regions of Brazil. With the purpose of deepening the understanding about the inter-relations revealed in this study, other researches are under development in the context of the participating schools.

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