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The Computer and Classroom Activities: Some Perspectives on General Basic Education in the Province of Buenos Aires

La computadora y las actividades del aula: Algunas perspectivas en la educación general básica de la provincia de Buenos Aires

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Abstract

The purpose of this investigation is to understand better the limitations and potential offered by the classroom for the pedagogical use of the computer. Initially, it makes a general approach to the problem, mentioning the main reasons that cause such use to be difficult. Then the method and bases of this descriptive study are presented. The paper continues by outlining the pedagogical methods habitually practiced by the teachers; the resources commonly used for these activities; the specific use made of the computer; the activities assigned to students; and finally, the difficulties encountered in students when developing classes for them. Finally, there is made a brief analysis of this information, as well as some interesting points for the integration of activities between the classroom and the computer laboratory.

Keywords: Teaching methods, resources for teaching, students' activities, uses of the computer.

Resumen

El propósito de esta investigación es entender mejor las limitaciones y posibilidades que ofrecen las actividades cotidianas del salón de clases para el uso pedagógico de la computadora. Inicialmente, se hace una aproximación general al problema, y se mencionan las principales razones que dificultan esa utilización. Posteriormente, se exponen el método y los fundamentos de este estudio descriptivo. A continuación, se reseñan los métodos de enseñanza que practican habitualmente los docentes, los recursos de uso corriente para esas actividades, el uso específico que hacen de la computadora, las actividades que encomiendan a sus alumnos, y, finalmente, las dificultades que encuentran en los estudiantes en el momento de desarrollar sus clases. Por último, se hace un breve análisis de esa información, así como de algunos puntos interesantes para la integración de actividades entre el aula y el laboratorio de computación.

Palabras clave: Métodos de enseñanza, recursos para la enseñanza, actividades de los estudiantes, usos de la computadora.

Introduction

Computer and communication technologies are producing changes of such magnitude that virtually all sectors of society have been influenced, directly or indirectly. While one purpose of education is to prepare individuals to face the challenges of their times (Giroux, 1990; Sancho, 1996), in Argentina, the integration of these technologies into basic general education, except for a few exceptions, remains virtually absent, or tends to occupy an isolated and marginal space. Probably we must locate the root cause of this situation in the erratic and discontinuous policies followed by different political and educational administrations. Indeed, a lack of continuity is habitual in the training and advisory plans for teachers, a shortage of equipment and infrastructure in schools, and a

deficiency in support for maintaining them. However, in 2000, there began the construction of a national educational portal (Portal Educ-ar, http://www.educ.ar), whose objective is to interconnect all public schools, and to place at the service of the teacher an ample bank of informatics services. This site is under development. We will have to wait for some time to see what level of impact it will have in the school, and how the multitude of problems associated with this ambitious project will be resolved.

As we observe the situation from a much broader point of view, we can see that one of the most complex problems which must be confronted along with any effort that would entail change is the fact that its actors are trapped by the persistent, imperceptible and persistent presence of a school culture adapted to former situations. The school imposes slow, but tenacious, modes of conduct and thought, as well as the relationships belonging to the institution, which reproduces itself, independently of the radical changes going on around it (Berger and Luckman, 1984, Douglas, 1996). However, there is a dialectical relationship between the culture of the institution and the intentionality of the actors, which allows the school to have a space of relative autonomy (Diaz Barriga, 1994). All the curriculums leave spaces or gaps that keep open the possibility of innovation, i.e. a potential without which both teachers and students, even while living the contradictions and obvious mismatches of dominant scholastic practices, would end up reproducing in immutable form, the routines generated by the school culture (Frigerio, 1991) .

According to Argentina's educational tradition, the school is an institution whose function is to democratize knowledge, enabling individuals to take ownership of the different knowledge and cultural values of their time without irritating distinctions between students from different socioeconomic strata. Within this conceptual framework, the social appropriation of the computer means that, besides knowing its basic operation, the student can integrate it into her[1] daily school activities in a creative manner and according to her own interests (Fichtner, 1999).

Our work area is located in the city of Mar del Plata, which has more than 680,000 inhabitants, and is the largest city in the interior of the province of Buenos Aires. In that environment, we have participated in several teacher-training plans for the use of computers in schools, and have conducted various studies. Thus we have come to know the problems facing teachers. We have found that although teachers express positive attitudes, they clearly encounter serious difficulties when they try to incorporate the computer creatively into their daily activities (Martinez, Astiz, Medina, Montero and Pedrosa, 1998b). In the case of students, the empirical evidence for clearly positive attitudes is encouraging (Martinez, Astiz, Medina, Montero, Pedrosa and Tait, 1999), as is the learners' willingness to work with the computer (Martinez, Astiz, Medina, Montero and Pedrosa, 1998a). As we pointed out above, in a majority of the schools, the computer is part of the equipment; the common denominator is that little time is assigned to the informatics activities, and these are carried out in isolation from other subjects, in an area habitually called 'the computer lab', in charge of a professional or teacher from the informatics area (Martinez, Astiz, Medina, Pedrosa and Tait, 1998c). As a result, there is practically

no link between the 'classroom teachers' and the 'computer teacher'. That observable separation widens because the mainstream classroom and computer labs have radically-different functional structures and working methods, which is no small matter when their possible integration of their activities is being considered (Crook, 1998; Martinez Montero and Pedrosa, in press).

The concepts presented above give support to the claim that the incorporation of informatics resources into the development of different subjects bypasses the integration or connection of the regular classroom activities with the computer lab. Under that premise, we begin with the hypothesis that a natural way to establish an eventual integration between classroom and lab requires, on the one hand, research on the role of the laboratory within the school, its structure, activities that develop in it, and the ways students and teachers behave in that environment. We have researched this theme in a previous work, from which arise indications that allow us to affirm that in our medium of action, there are some spaces through which connections can be established between the laboratory and the classroom, in order to make creative use of the technology in various fields of knowledge (Martinez, Montero and Pedrosa, in press). On the other hand, it requires knowing the ways of working in the classroom, media support for these activities, the tasks assigned to students, and teachers' perceptions concerning the difficulties they encounter in their students and which make learning more difficult. These issues are the object of this study, which attempts to reach a diagnosis concerning the following points:

a) What are the teaching methods habitually practiced by teachers?
b) What are the common resources used for such activities?
c) What is the specific use made of the computer?
d) What are the activities teachers assign their students?
e) What is the teachers' perception concerning the difficulties they encounter in their learners when developing their classes?

Method

- Participants

In this work it is assumed that the possible paths towards the integration of informatics with other subjects must be studied as derived from the conditions currently prevailing in the schools. Based on this definition, it is asserted that the probabilities of success for this transition, considered as a point of continuity between the present situation and future prospects, will be better in schools where there is, however minimally, some experience of integration, real or potential, between the activities of the computer lab and the regular classroom. According to this hypothesis, and the results of two previous investigations (Martinez *et al.* 1998c; Martinez, *et al*., In press), there was effected a preliminary selection of educational institutions feasible for carrying out the study. Of these, ten facilities were selected through a combination of intentional sampling for the selection,

according to type (private schools and public schools), and sampling by quota, considering zones of the city with different socioeconomic characteristics. Once defined the schools, teachers of these establishments were invited to participate in the research. For reasons having to do with downsizing our study, the proposal was limited to teachers working in the last four years of basic general education (students aged 12 to 15 years) in the areas of Natural and Social Sciences. Thirty-nine teachers responded in the affirmative.

- Instruments for collecting the information

The information for this research was collected through the instruments listed below:

a) Informal interviews, short, of a small group of participating teachers in order to define categories to be included in a survey.
b) Auto-administered survey, distributed to all teachers participating in the study, in order to collect the following information: methods used by teachers, elements of teaching support, uses of the computer, activities assigned to the students, and general and particular difficulties observed in their learners.
c) Interviews carried out with a subset of participants in order to clarify or expand some answers emerging in surveys whose wording could be interpreted ambiguously.

- Thematic structure of the survey and response form

In the following paragraphs the components of the survey are analyzed in more detail.

Methods used by teachers. By *teaching methods* is meant the set of teaching procedures the teacher has available for making her functions more effective (Nerici, 1982). On this point, it is necessary to clarify that we were interested in a general description, since the categories used might include different approaches to teaching (Eggen and Kauchak, 1999). As indicated above, to identify the most common methods, a brief study was conducted prior to the survey by interviewing a small group of teachers. The results of those interviews yielded the following categories, which are not mutually exclusive:

a) Statement by the teacher; b) resolution of problems in the classroom; c) tasks in the classroom; d) laboratory work (natural sciences); and e) field trips and field work. To this set was added an open category under the heading of 'other'. Regarding this question, teachers had to point out all the alternatives they use, with the number 1 indicating the most frequent, the number 2 the next most frequent, and so on, successively.

Elements of teaching support. By means of the earlier study reported in the previous section, the following alternatives were established, not excluding those for materials that support the work of teaching most assiduously:

a) Chalk and blackboard, b) books, c) newspapers and magazines, d) video, e) prints, and f) computer. Also added was an open category under the heading of 'other'. In answering this question also, teachers had to mention all the resources they use, with 1 indicating the most frequent, 2 the next most frequent, and so on.

Student activities. By means of the preliminary study mentioned above, the following categories of activities were established, to indicate the work that teachers assign their students most often:

a) Answering practical work guides, b) research tasks, c) software-supported activities, d) construction of concept maps, and e) laboratory practices. As in the previous cases, an open category was added under the heading of 'other'. Similarly, in this question teachers had to mention all the activities they assign, with 1 indicating the most frequent, 2 the next most frequent, and so on.

We should clarify that teachers usually labeled as a 'research paper', a task consisting of searching for information on a given topic, and on that basis, writing a short monograph.

Uses of the computer. Given our interest in knowing in some detail the activities carried out with the computer, no category was proposed. This left open the possibility for the teacher to express herself freely in two dimensions: a) her own use of the computer to prepare teaching resources (see 'educational support elements'); and b) students' use of the computer to perform tasks assigned by the teacher in the classroom (see 'Activities of the students'). Regarding these two dimensions we should indicate: a) concrete activities done with the computer and b) software used.

Specific and general difficulties. The introduction of categories in a survey requires all participants to share definitions and to effect a relatively uniform interpretation of these. This is not easy to achieve when it comes to describing the difficulties, particular and general, which students exhibit and which threaten their learning. Thus, questions concerning those topics of particular interest were written in an open format, bearing in mind that this format allows, on the one hand, the avoidance of conditions or the induction of some type of response; and on the other, having an deeper understanding of one of the important topics of study. Consequently, the teachers could present, in short, free-form phrases, the most important difficulties, specific or general, exhibited by their students.

Interpretative approach

As a step prior to the presentation of results, we will outline the bases on which we have classified the information reported by the surveys and interviews.

- Classification of the information collected

To organize and develop the material collected concerning the difficulties the students show, we have established a classification scheme for organizing the

information. While establishing a taxonomy can fragment the object of study, in our case, we have made it a tool by which to make a reasonable description, and to get an overview of the situation. Generally, the notes made by the teachers were identified as cognitive, metacognitive or motivational problems, and we will take a moment here to look more closely at these points.

Metacognition. Metacognition is a concept referring to higher-order thinking which includes active control over the actual cognitive processes involved in learning (Flavell, 1976). While taxonomies or traditional classifications (Bloom, Gagné, etc.) consider the ability to think about thought itself (area of metacognition) as an intellectual technique included in the cognitive abilities (Reigeluth & Moore, 2000), we are interested in distinguishing, insofar as possible, to what extent and how often students' difficulties stem from the inability to assess the requirements of the problem, for the conscious construction of a plan for resolution, for the conscious selection of an appropriate strategy to control the process toward an established goal, and for modifying the plan when necessary (Mayer & Wittrock, 1996). These general skills have been treated in different content areas, for example, in reading (Garner, 1987), writing (Flower & Hayes, 1980), science (Novak & Gowin, 1988), or mathematics (Schoenfeld, 1992). Although the concept of metacognition is a complex concept (Hacker, 1995), in a first approximation it is understood that the cognitive strategies are those used by the individual when he is 'inside the problem' (action), while metacognitive strategies are used to control the cognitive processes, so as to ensure that the goals pursued are achieved (assessment and control).

The cognitive domain. Although learning acts in multiple dimensions (Gardner, 1983) and the taxonomies of different individuals recognize affective, motivational, volitional and cognitive components (Snow and Corno, 1996), the cognitive domain constitutes one of the dimensions that concentrates the greatest attention in the field of education. In order to establish classificatory schemes, different authors have proposed taxonomies covering different categories. Thus, Bloom establishes categories of 'knowledge', 'comprehension', 'analysis', 'synthesis" and 'evaluation' (Bloom, Engelhart, Furst, Hill and Krathwohl 1971); Gagné, those of 'verbal information', 'intellectual techniques' and 'cognitive strategies' (Gagné, 1987); Ausubel differentiates between 'rote learning' and 'meaningful learning' (Ausubel, Novak and Hanesian, 1983)' Anderson makes a distinction between 'declarative knowledge' and 'procedural knowledge' (Anderson, 1983); Merrill establishes the categories of 'literal memory', 'memory of paraphrase', 'use of a generality' and 'finding a generality' (Merrill, 1983); and Reigeluth discriminate between 'memorizing information,' 'understanding relationships', 'applying techniques' and applying generic techniques' (Reigeluth & Moore, 2000). All these categories are related and organized from low-level learning to higher-order thinking, which allows for certain equivalences between them (Reigeluth & Moore, 2000). For the organization presented in this study, we have used the classification of Bloom as the most influential model for establishing categorizations (Cazden, 1990), and also for being the best known in our environment.

Motivation. The concept of motivation has been approached from different perspectives and at different levels of depth (Rueda and Moll, 1994; Stipek, 1998). According to Graham and Weiner (Graham & Weiner, 1996), motivation has been studied by assuming different constructs that can be classified into two groups: on the one hand, those linked with autoperception; and on the other, those related with achieving goals. In the first group, there can be distinguished: a) interest in self-worth (Covington, 1992), b) expectations regarding one's own performance (Bandura, 1986), and c) the attribution of errors to stable personal failings (Dweck & Goetz, 1978). In the second group, there should be mentioned: a) the relationship between work and personal commitment (Nicholls, 1992), b) intrinsically-regulated motivation and the role of rewards (Deci & Ryan, 1985), and c) the tension between individual and collaborative activities (Ames, 1992). In a first approach, we can understand the concept of motivation as a process of activation and orientation of the action (Huertas, 1997). For this work it will suffice us to outline a general approach. In effect, a way to capture the concept of motivation is to think about a typical action, such as studying for a test or solving a problem in the classroom, and to observe it as a time sequence initiated, sustained, targeted, and finally, completed. Thus, it is of interest to know what the student is doing (choice of activity), how long it took to begin the task (latency of response), how hard the student is working (intensity of behavior) and how long he is willing to go on working (persistence of behavior). In the same way, it is also of interest to know what are the cognitions and emotional reactions that accompany the activity (Graham and Weiner, 1996).

Results of the survey

As we have said already, the first part of the survey was oriented toward identifying the methods predominating in the teachers' work; the support materials they use most often; and the activities they assign their students with greatest frequency. Below are the results of the survey.

- Methods for the development of classes

The three predominant methods in the teaching work are the following: 'problem-solving in the classroom', 'teacher's presentation', and 'discussions in the classroom'. Table I shows the percentage of teachers who consider the methods described, distinguishing the order of frequency of the use of these methods: first, second or third. The remaining methods are used less often.

Table I. Methods for the development of classes

	Problems	**Presentation**	**Discussions**	**Other**
Principal method	59.0 %	35.9 %	0 %	0 %
Second method	30.8 %	30.8 %	20.5 %	17.9 %
Third method	10.2 %	17.9 %	30.8 %	35.9 %

- Elements of teaching support

Similarly, the three resources with greatest frequency in classroom work are: 'chalk and blackboard', 'books', and 'newspapers and magazines'. Table II shows the percentage of teachers who use these resources, distinguishing whether they are used in first, second or third order of frequency.

Table II. Elements of teaching support

	Chalk and blackboard	**Books**	**Newspapers and magazines**	**Other**
Principal resource	79.5 %	17.9 %	0 %	2.7 %
Second resource	15.4 %	66.7 %	7.7 %	5.1 %
Third resource	2.6 %	7.7 %	35.9 %	41.0 %

- Activities assigned to students

Concerning activities which teachers assign most frequently to their students, Table III tells us that the predominating activities are answering 'practical work guides', performing simple 'research tasks' and building 'concept maps'. This table shows the percentage of teachers who assign the tasks, noting also, whether they use them in first, second or third order of frequency.

Table III. Activities assigned to students

	Practical tasks	**Research**	**Concept maps**	**Other**
Principal activity	56.4 %	25.6 %	10.3 %	7.7 %
Second activity	17.9 %	43.6 %	15.4 %	23.1 %
Third activity	7.7 %	15.4 %	35.9 %	25.6 %

- Use of the computer

We recall that, according to the survey format, the computer might appear as an element of support which the teacher used in her classes, or as a resource for the activities assigned to students. As Tables II and III show, the computer is not listed in either of these. This is consistent with our previous studies, which indicated the marginal role this powerful resource plays in the development of the different subjects. However, the information provided by polls and not recorded in the tables above, indicates the following:

a) In 13 cases (33.3% of the total), teachers and students made some use of the computer (usually minimal) both for teaching support and for activities assigned to the students.
b) In seven cases (17.9% of the total), they did so only in one of the two variants cited.
c) Altogether, in 20 cases (51.3% of the total), teachers and their students used the computer, although with little significance.

We will now center our attention on the use made of computers in the cases mentioned in the preceding paragraph. As noted elsewhere in this document, the questions concerning the characteristics of the use given computers were written in open form so as to have a more precise picture. A detailed reading of the corresponding answers shows that the activities carried out are as follows (see Table IV).

Table IV. Uses of the computer

	Percentages of the total number of teachers	**Percentages of teachers who use a computer**
Microsoft Word	43.6 %	85.0 %
Internet Explorer	15.4 %	30.0 %
Searches on CD	7.7 %	15.0 %
Power Point	7.7 %	15.0 %
Excel	5.1 %	10.0 %

A brief description of the use given each of these programs:

a) The most general functions of the *Microsoft Word* word processor were used, for example, in selecting fonts and formats, inserting tables and images in documents and using the spell checker and grammar checker. There was very

little use of hyperlinks, either for referencing segments of the same document or for external documents.

b) Internet Explorer was normally used to enter a search engine such as *AltaVista* or *Yahoo*, as well as to go to a website recommended by the teacher. The Internet was usually accessed to collect information necessary for completing a class assignment. Search on CDs was also located in this profile.
c) *Power Point* was ordinarily used to construct simple presentations on special topics. Special effects for title presentation, transitions between slides, etc., were generally used rather broadly, although in most cases, the presentations had an absolutely linear structure.
d) *Microsoft Excel* was habitually used for making graphs of simple functions and for working with tabulated data, on which were made such simple calculations as summations and averages. It was also common for tables or graphs generated in *Excel* to be exported to documents written in *Word*.

- Students' difficulties

For an analysis of teachers' opinions concerning the difficulties they encounter in their students, contributions by 38 teachers were used. (Out of 39 teachers, one did not contribute an opinion). Once the opinions were collected, uncertainties clarified, and some redundancies eliminated, there remained 179 statements that constituted as many units of analysis. Of that total, 8 units were excluded because they fell outside the proposed classification (this was the case, for example, with statements like 'do not respect their peers', or 'have family problems'). The average gives a value of 4.5 statements per teacher involved.

In accordance with the terms specified above, the analysis process led us to place the difficulties encountered by students (and which limit their learning) in the categories of 'knowledge', 'comprehension' and 'application' (there appeared no units of analysis that might be situated in the categories of 'analysis', 'summary' or 'evaluation') or in those of 'metacognition' and 'motivation'. Each unit of analysis could belong to more than one category. For example, we have found cases in which the teacher stated that students have little ability to establish relationships by studying certain themes ('relating'). Analyzing this claim in more detail, we discovered that it referred both to situations in which the problem lies in 'comprehension' (e.g. relating two concepts to each other); and to failures in 'application' (for example, relating a concept with a concrete situation). An example of another kind: in many cases, statements like "Students do not understand a text" was found to be associated with a lack of vocabulary (knowledge), as well as the lack of metacognitive ability to monitor reading.

The graph in Figure 1 indicates the percentages of teachers who reported various cognitive difficulties.

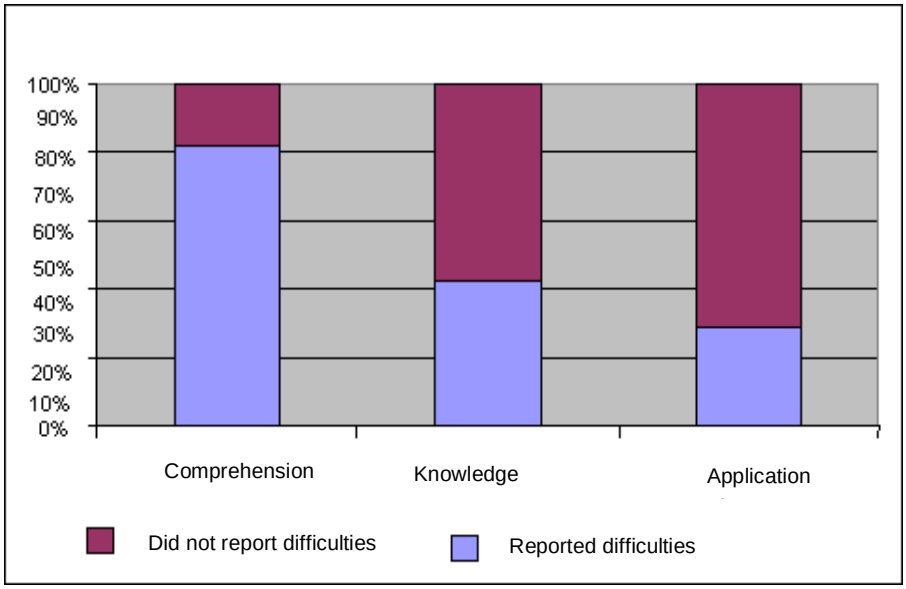

Figure 1. Cognitive difficulties reported by teachers

This figure clearly shows the cognitive difficulties which cause the teachers most concern. As can be seen, the most commonly-reported difficulty reported was that of 'comprehension', it was noted by 31 teachers, or 81.6% of the total. In descending order, appears concern about the lack of 'knowledge', indicated by 16 teachers, representing 42.1% of the total. Finally, we have the problems related to the category 'application', which was mentioned by 11 teachers, i.e. by 28.9% of the total.

Let us turn now to metacognitive difficulties and problems of motivation. In these categories were included teachers' statements such as the following: "The students do not know how to organize the communication of results," or "Students do not know how to study", both in the category of 'meta-cognitive difficulties'. In the category 'motivational problems' were statements like "The students are not interested in studying," or "Students have other priorities".

Figure 2 provides information on these two issues. As we can see, 29 teachers (76.3% of all research participants) reported metacognitive difficulties, while 21 reported problems with motivation—55.3% of the total number consulted.

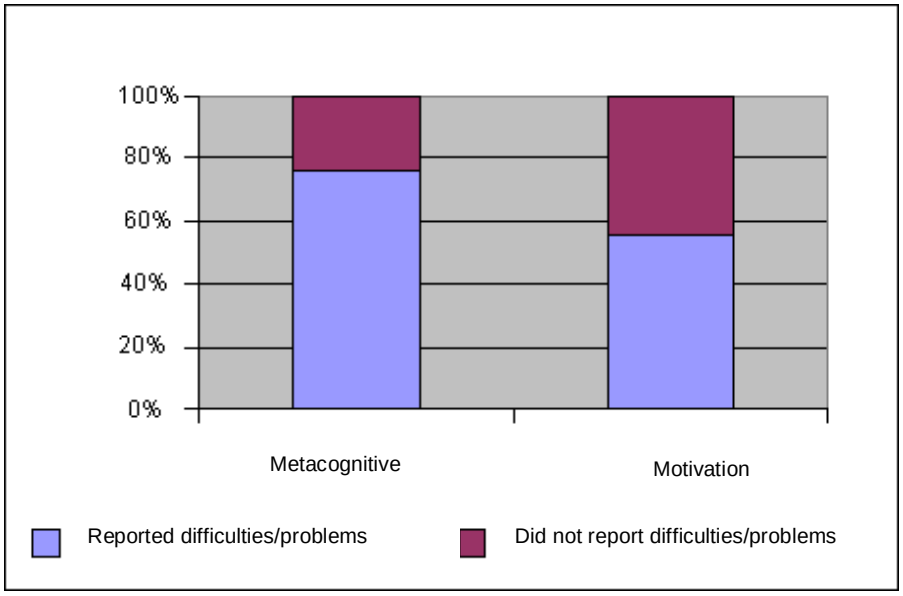

Figure 2. Difficulties of metacognition and motivation reported by the teachers

Discussion and perspectives

First we must consider that the information obtained in this study was limited to teachers working in the last four years of basic general education in the areas of natural sciences and social sciences in a group of schools where there was some experience of integration, real or potential, between the activities of the computer lab and the regular classroom. Therefore, the statements in this work should not go beyond the framework in which they took place.

Looking at the data collected on methods, elements and activities, it is interesting to note that the expression of problems in the classroom has shifted to presentation as the primary method for developing the classes and a to certain inclusion of discussions in classroom practice. With respect to the elements supporting the work of teaching, there appears no issue that merits special attention. Following the tasks assigned to students, it was observed that the construction of concept maps has been incorporated by an interesting number of teachers.

With reference to the information collected about the use of computers, it was observed that either this resource is not used, or in the cases where it is used, it plays a marginal role in development and teaching in students' daily work. As we can see, in no case does there appear the use of specifically-educational software. Activities were focused on the use of the word processor, by and large for the same tasks formerly carried out by other means; in the search for information, electronic support is now added to the traditional printed matter.

Let us go on now to the opinions of teacher on the subject of the difficulties they encounter in their students when developing their classes. The values found in the cognitive categories show no major surprises. Indeed, in this context, 81.6% of teachers reported problems classified as 'comprehension' (indicating low significance of learning); 42.1%, impediments characterized as 'knowledge' (indicating little dedication to study); while 28.9% mentioned difficulties categorized as 'application'. What is noteworthy is that 76.3% of teachers referred to difficulties identified as metacognitive. This is very significant, and is probably associated with the fact that metacognitive skills are not usually taught or practiced deliberately, despite the impact they have, both in different learning activities, and the resolution of problematic situations. Finally, there is a situation repeatedly mentioned in different areas: 55.3% of teachers said their students show a lack of motivation toward study and other scholastic tasks.

This general panorama, succinctly described, works as a backdrop for any company that particularly wants to address the creative linking of classroom activities with the computer lab. It also shows the limitations of the context, as well as the challenges to be overcome; however, it also sets some interesting boundaries for use in setting up an integration proposal, namely:

a) The expression of problematic situations in the classroom as a teaching method. In this way of working it is not unusual for students to discuss and work in small groups, a modality appropriate for the development of collaborative activities in computer labs.
b) The construction of concept maps assigned to students. This activity deserves to be exploited in various dimensions: (1) as a means of externalizing learners' own thoughts, which may lead to the development of metacognitive strategies; (2) as a communicative medium for reflection and discussion; (3) as an alternative for overcoming various problems of concept comprehension; and (4) as a starting point for designing hypertexts or simple presentations on a computer.
c) It is the intention of many teachers to use the computer, even with the limitations noted above.

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[1] Earlier in the twentieth century, English, like Spanish, used the masculine possessive pronoun in generalized statements to indicate both genders of humankind. Since the advent of the feminist movement, however, such usage in English has been considered sexist, is generally avoided, and has been replaced by expressions such as “his and her”, “s/he” etc. (Fennel, Francis, 2002). While these non-sexist devices can be comfortably employed now and then in a work, their constant and continual use becomes awkward. In this work, in order to avoid the annoying repetition of such constructions, we shall at times use the feminine pronoun (she, her, etc.) and at times, the masculine (he, him, his, etc.).