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Research Article

PHYSICAL SCIENCE TEACHING IN COLLEGE: PEDAGOGICAL PRACTICES

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ABSTRACT

Educational practices are of great importance in the teaching-learning process and form a basis for, among other things, the failure or success of any training action. Thus, in this study, we tried to approach the quality of these practices carried out by teachers of the physical sciences of the colleges of two delegations Settat and Berrechid (Morocco). To do this, we used the paper-pencil (questionnaire) task for these teachers and their students.

The study showed that the teaching methods adopted were varied: expositive, interrogative, problem situation and investigation. The interrogative method and the problem situation dominate in frequency and preference. The expositive method seems to be still used, whereas, the method by project, the teachers admit never to use it. Thus, it is not easy for teachers to use different methods in class. However, each of them remains nevertheless present in their practices. The use of varied methods maintains the interest of the learners stimulates active participation and improves learning. It is from the right articulation between these teaching methods that the students derive the greatest benefit. On the other hand, the Insufficient time, the amount of content to be seen, the lack of autonomy to act on the content of the courses, the excessive number of learners, Insufficient teaching materials, the lack of training and Insufficient Pedagogical support (supervision) are obstacles braking the use of these active methods.

INTRODUCTION

The teaching of the physical sciences consists in transmitting a learned knowledge based on Natural physical phenomena or artificially induced. In the act of teaching, one often uses a certain tooling generally include notions, concepts, methods and / or theories. Various combinations of these tools are needed to transmit a given knowledge. In a classroom situation, the teacher adopts pedagogical approaches, the implications of which may prove beneficial or harmful for the learner.

Despite the implementation of competency-based approaches, several teachers college practices are still focused on the paradigm centered on teaching where training is considered as a transmission of knowledge and where the teacher is the expert and principal of that Transmission (Langevin, 2007; St-Pierre, 2012). However, according to Romainville (2004) and Cullen *et al* (2004), the linear transmission of knowledge is increasingly incomplete. Traditional methods are mainly criticized for being limited to the transmission of knowledge to passive and unmotivated students (learners) (Bertrand, 1998; Leduc *et al*, 2014). At the opposite, several educational reforms are based on current theories and aim to apply the principles of the paradigm centered learning where training is seen as a device used to facilitate learning (Meirieu, 2009).

In Morocco, and according to the educational guidelines of the Ministry of National Education (Ministry of National Education, 2015), the methodology adopted in the teaching of physical sciences at the college is based on: the progression of concepts through the deepening of the knowledge acquired in the Primary and the introduction of new concepts preparing the pupil for the qualifying cycle; The diversity of forms of didactic work through the adoption of a variety of teaching methods (investigation, problem situation, project ...) and the use of ICT as an aid in the teaching / learning of the physical sciences.

Studies that seek to evaluate the effect of various pedagogical approaches to science education in the world are much rarer than those devoted to reading or mathematics. For example, on

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the What Works Clearing House website of the US Department of Education, 77 "interventions" (curriculum, pedagogical practice, educational policy) relate to learning to read and write, 39 mathematics and only 5 the sciences (Barron and Darling-Hammond, 2008; Bruder and Prescott, 2013 Kirschner, 2006; Ergül, 2011).

Thus, in this article, we first present an update on the pedagogical practices of teachers of the physical sciences of the Moroccan college and how to evaluate the effectiveness of their practices in class. Subsequently, we present the causes that inhibit the use of active methods. Finally, we conclude by presenting their students' views on teaching practices and their difficulties in learning the physical sciences.

Theoretical framework

Physical Science Programs at Moroccan colleges

The teaching of the physical sciences to the Moroccan colleges, according to the pedagogical orientations (Ministry of National Education, 2015), aims to:

- To contribute to the acquisition of a scientific and technological culture in order to build a first global, coherent and rational representation of the world, emphasizing the universality of the laws that structure it;
- To reinforce, through programs, the correlation with other scientific disciplines, showing the specificities and contributions of chemistry and physics.

The implementation of the college program is carried out in 6 semesters at the rate of two semesters per level (1st year, 2nd year and 3rd year). The content of the physical sciences is distributed in a balanced way between physics and chemistry, each of which occupies 50% of the teaching time. The college students acquire the foundations of a scientific culture in different fields of physics and chemistry: matter and environment, light and image, electricity and mechanics.

Teaching methods

In the epistemological sense, the method is a path, a path, a path, a path to follow in order to reach a goal, an objective and a destination. Speaking of education, it would be "all the principles, means, steps, rules of the educational or pedagogical action, to achieve the goals, objectives, purposes it sets itself " as Leif and Rustin (1970) correctly writes. It is the way or the way to proceed to instruct children in the best and most effective conditions. This is why De Ligny and Rousselot (2016) says of the method that it is "the surest and safest way to discover the truth or to communicate it when it is discovered".

The method avoids groping, simplifies the teaching by dispensing him with unnecessary detours in his approach to the objective and coordinates it by ordering, arranging all actions in such a way that everything (tool, gesture, steps …) concurs to the desired result. There are two main types of classification of methods (Leif and Rustin, 1970; De Ligny and Rousselot, 2016).

- A first type which classifies them according to the reasoning used to achieve the production or communication of knowledge and which distinguishes inductive methods from deductive methods, such as the didactic or dogmatic method, the expositive or masterful method, Demonstrative method, deductive method, historical method etc;
- A second type that takes into account the interrelations between learners (students), the teacher and the object of knowledge (content) taught that distinguishes active (or new) methods, such as the interrogative method, The method of discovery (project or project pedagogy), the experimental method, also known as the problem-solving method, the method of observation, the method of investigation, etc.) of the so-called traditional passive methods.

Efficiency of teaching practices

In terms of learning and know-how, can the teacher make a difference? If so, to what extent? And what are the characteristics of an effective teacher? These questions are not new. But it is only recently that we begin to bring reliable answers. Studies of the effectiveness of teaching practices in the United States, initially some fifty years ago, in Europe and in France, show that student performance is not unrelated to the practices of professors. Indeed, some teaching practices, sometimes referred to as "master effect" or "teacher effect", are more effective and equitable than others. Studies identified by the authors indicate that between 7 and 21% of Variance of student achievement would be attributable to the teacher (Bianco and Bressoux, 2009; Cusset, 2011; Cusset, 2014; Kahn, 2012). It should be noted that this effect is greater than that of the effect of establishment (production of school attendance on pupil performance) or effect of class (impact of attendance of such class or such class on student achievement). Bianco and Bressoux (2009) and Cusset (2011) have attempted to isolate "a master effect" by questioning the characteristics of good professors. Ineffective teachers have low educational expectations and take a negative view of student levels and learning abilities. Thus, the weakest students are treated differently: teachers wait less time for answers when they question them, criticize them more often, congratulate them less, interact less with them and ask them simpler questions; In the end, the professors expose the weak students "to a poorer curriculum" (Jarlégan *et al*, 2010). On the other hand, effective teachers value their students (through speech, smiles, looks) and develop a constant attitude towards low achievement by accepting, for example, that a pupil does not understand without being "bad" (Duru-Bellat, 2001). The judgment of the teachers thus weighs on the success of the students, their representations also. Nevertheless, the effectiveness of teachers is also due to the system of interactions in the classroom. For Bresseaux (2006) the "master effect" must be analyzed as "the product of a master student interaction" because the teacher is not omnipotent, "it is sometimes very difficult, whatever the teacher, to make progress to the same extent of students very variously prepared to play the school game ". In the short term, the progression of a pupil depends rather strongly on the teacher to whom he is assigned.

This result of the above-mentioned studies, strong, invites to address the question of the possible effect of an increase in the pedagogical effectiveness of teachers. This can be done to identify effective practices that affect the quality and quantity of student learning, or seek to understand how teachers practice.

METHODOLOGY

This study is carried out in two provincial delegations of the national education in Morocco (Settat and Berrechid) during the year 2013-2014. The target population is made up of 100 teachers (50 from Settat and 50 from Berrechid) and 400 students (200 from Settat and 200 from Berrechid) from college secondary education.

Teachers involved in this study have between 5 and 20 years experience in physical science teaching, working an average of 22 hours per week. Data collection was conducted using an anonymous questionnaire. The questions formulated relate to each of the parts of the problematic of the study:

- Inventory of teaching practices in the teaching-learning process of high school students in the physical sciences;
- Impact of teachers' methods on student learning;
- Factors influencing teachers' choice of teaching method.

RESULTS

Fig 1 below shows teachers' responses on the methods used in their teaching. We can see that the interrogative method comes first with 75.86% of the teachers who say they still use it. The problem situation method, cooperative learning and investigative approach follow with averages of 41.37%, 17.24% and 13.79% who claim to use them always or occasionally. The expository or masterful method seems to be still used occasionally by teachers (36.36%). It should also be noted that more than 90% of teachers admit that they never use the project method.

Table 1 Levels of investigation

	Source of scientific questions	Methods of data collection	Results interpretation
Level 0: verification	Data by the teacher	Data by the teacher	Data by the teacher
Level 1: structured investigation	Data by the teacher	Data by the teacher	Left to students
Level 2: guided investigation	Left to students	Left to students	Left to students
Level 3: open investigation	Left to students	Left to students	Left to students

The results (Fig 2) showed that most teachers can work effectively with their students only at level 0 (92% of teachers surveyed) and level 1 (8% of teachers interviewed) of the method of learning by investigation. For the other 2 levels (guided and open investigations), it seems that they are very difficult to apply by teachers.

To evaluate the effectiveness of teaching methods, researchers use a variety of methodologies. This choice is often constrained by practical considerations of cost, opportunity, time available or acceptability on the part of parents and teachers. The answers of the teachers collected, on how to evaluate the effectiveness of their teaching practices (Fig 3) on student learning, can be summarized in four points: reducing the gaps between weak and strong students (85 %), Inspection reports (94%), student performance (80%), motivation (65%).

For the use of active teaching methods, teachers mention a number of reasons: the insufficient of time (83% of the teachers surveyed), the amount of teaching content (80%), the lack of autonomy to act on the content of the courses (78%), the excessive number of learners (88%), insufficient teaching

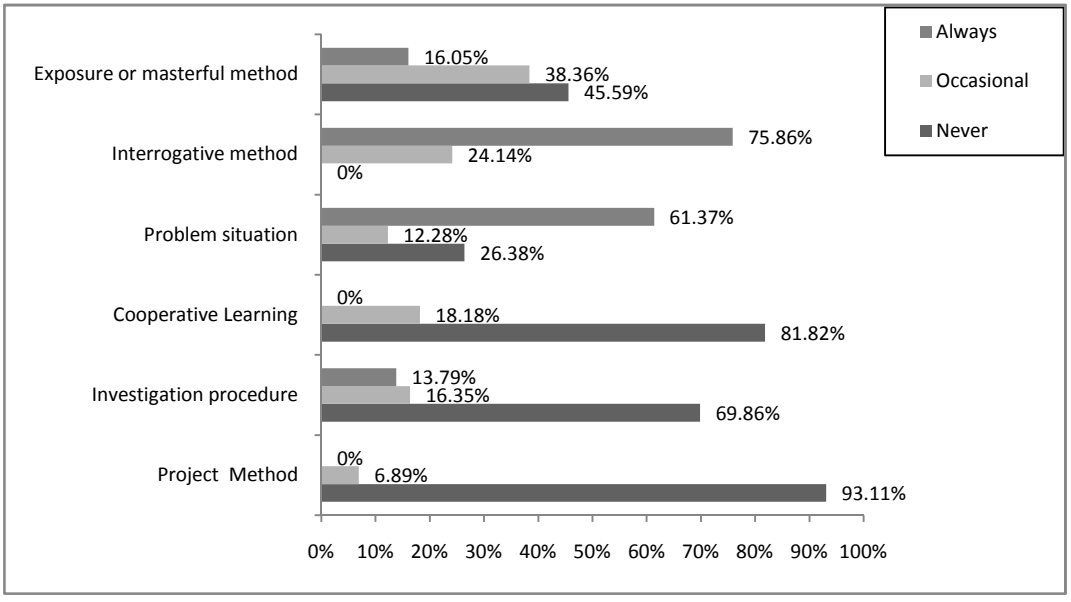

Figure 1 Methods used by teachers

To clarify the debate on investigative learning, we asked teachers what level of inquiry they could use during a class session with their students, according to the latitude left to the students in the choice of the questions to be treated and the methods to be mobilized. These levels, tired from Blanchard *et al* (2010) are summarized in Table 1.

Pedagogical support (supervision) with a percentage of 90% (Fig 4).

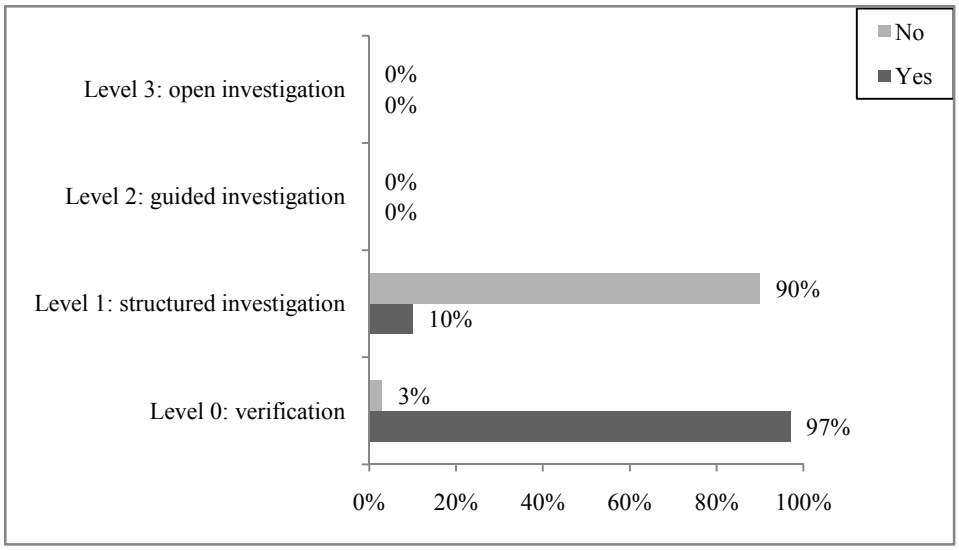

Figure 2 Levels of investigation and teachers' practices

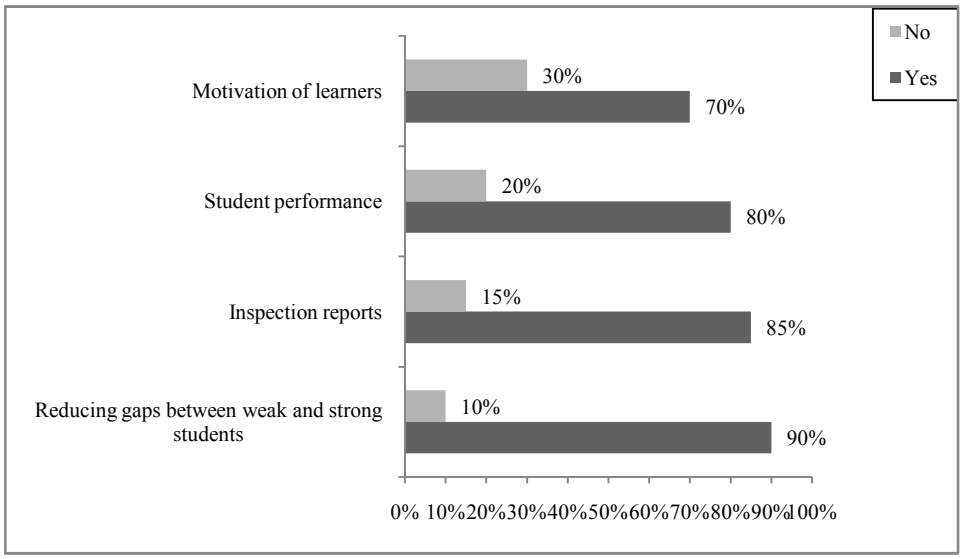

Figure 3 Evaluation of the effectiveness of teaching practices

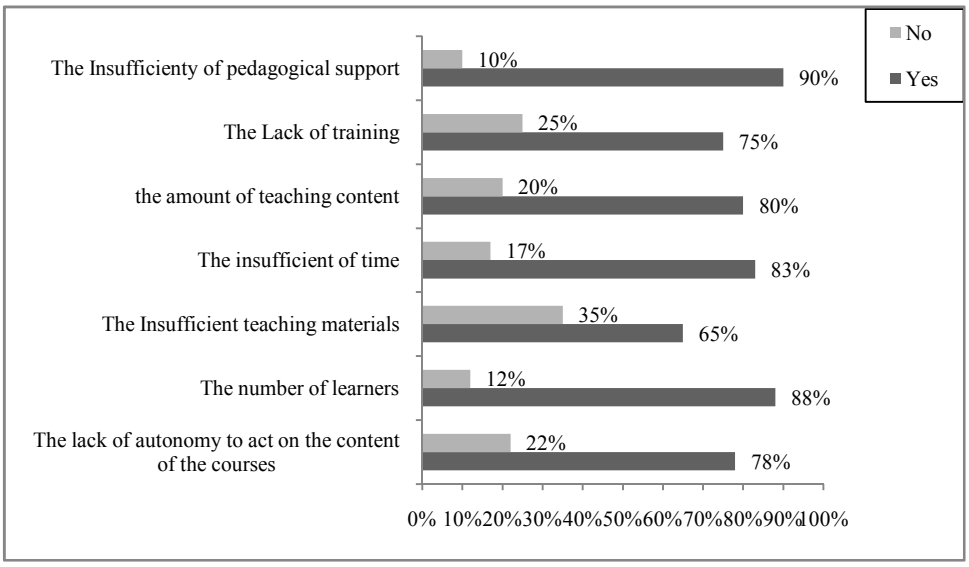

Figure 4 The causes that hinder the use of active methods

The majority of students (learners) ask the teacher questions during or after the class (Fig 5). However, about 25% of students never ask questions. Of those who ask questions during the course, over 70% do so during the course, and 55% ask after the course. The teacher answers most of the questions asked during the course. But afterwards, he feels less constrained to answer the students' questions, so he answers only 58% of the questions asked after the course. The students' questions relate to the course for 85% of the cases. However, the teacher does not answer 60% of questions not directly related to the course. Finally, 72% of students are satisfied with the teacher's answers.

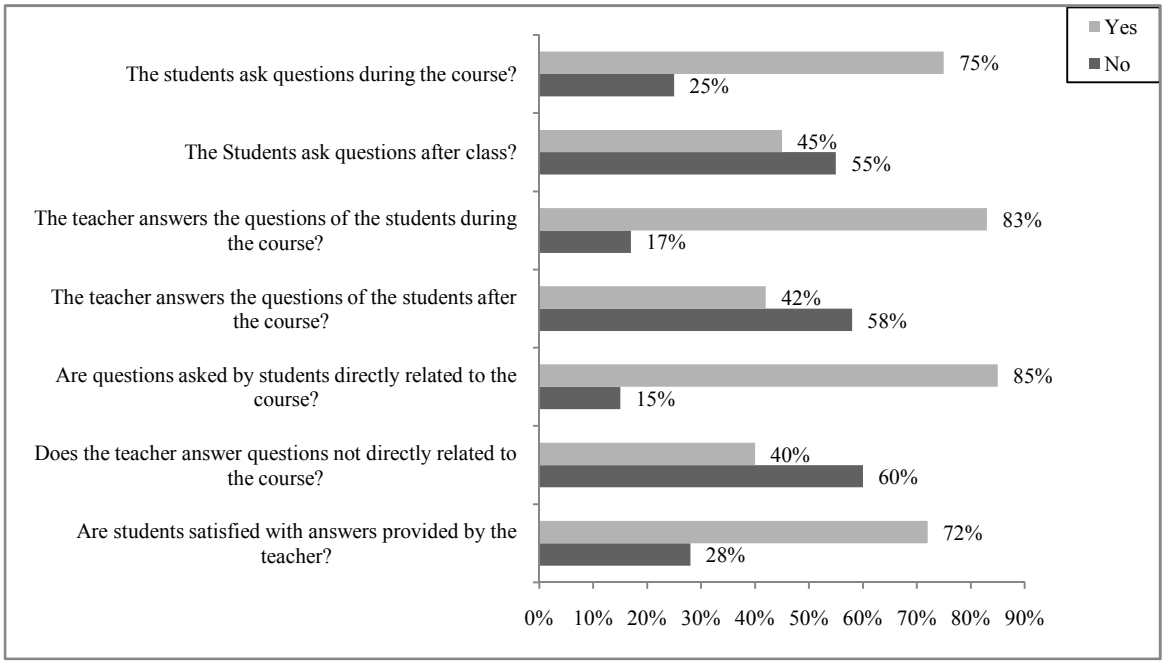

Figure 5 Student questionnaire responses on their responses to teachers' practices.

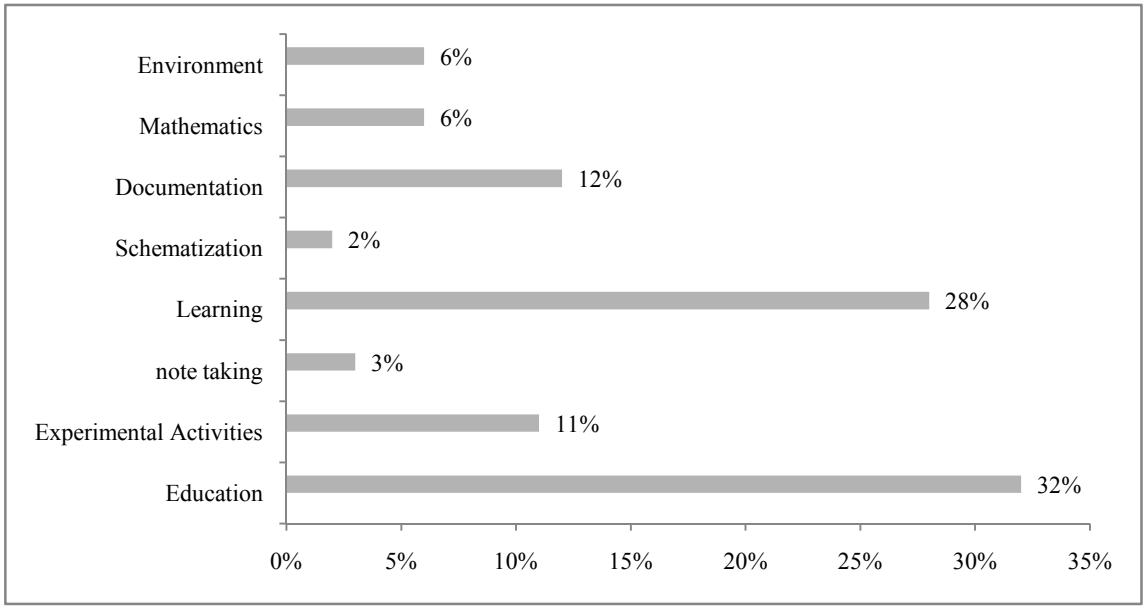

Figure 6 Causes of Student Difficulties in Science Learning.

The items proposed to the students (learners) to discuss their difficulties in the learning of the physical sciences are shown in Fig 6. It can be seen that students find the primary source of their difficulties (32%), The quality of the teacher's communication, the clarity of the explanations provided, the opportunities for students to ask questions during the course and to obtain answers to them, secondly, comes learning and it is declined in with 28%, documentation (books and other documents to deepen the course, fascicles or annals to practice the course), with 12%, the experimental workload is 11%, and the other variables invoked: the family environment, Mathematical formulations (curve plots, algebraic equation solving, etc.), the realization of illustrative diagrams of physical science courses (schematization) and note taking courses in the notebooks under the dictation of the teacher, they have a weight which Varies between 2 to 6%.

DISCUSSION

The results show that learners are a source of relevant and reliable information on teachers' practices. They participate in the course by asking questions, demonstrating the need to

understand and their interest in the physical sciences. Teachers respond positively to student demand as it relates directly to the course but are set in a teaching style; they do not place enough emphasis on issues not directly related to the course, which would cause a disappointment, a decline in motivation for the sciences that some researchers appear to have noted in other education systems (Ratziu, 2000). The difficulties encountered by students are strongly linked to the teacher's methods, but also to the conceptions of teachers, as has already been shown in this field (Sall, 2002). Feyant (2011) and Hattie (2012) found that the teacher is the most influential factor in student learning, which is consistent with students' responses to learning difficulties, and the quality of teacher communication, time management, ability to clarify objectives, conduct of experiments, opportunities for students to ask questions during the course, and obtain answers. The transmissive methods used by the teacher can be expected to generate many difficulties and influence student success.

The results also show that it is not easy for teachers to use in the classroom various methods that arouse the interest of learners, their active participation and improves learning (Chall, 2000). They have also shown that they use active methods in their teaching (interrogative, situation problem, investigation, cooperative), which use a student-centered learning approach according to its rhythm and preferences (Pézard, 2002). This type of pedagogy advocates the use of genuine and complex activities in which the teacher acts as facilitator and guide, proceeding mainly by questions from students (Bru, 2004).

In evaluating the effectiveness of teaching methods on student learning, teachers have advanced four key points: (a) reducing performance gaps between strong and weak students as Kahn (2012) reminds us, (b) Inspection reports that provide a narrative of teaching practices and that evaluate teaching practices more than students' learning (Marcel and Veyrac, 2012). De Wolf and Janssens Frans (2007) show that the beneficial effect of the inspections is not always present, it may be against productive and includes display effects, (c) student motivation is a key factor scholar's success, Viau (2009) showed that more students will be intrinsically motivated, the more his school results will be good and he will persevere in his work and (d) the school performance of students through an evaluation system allowing teachers to monitor the progress of their students (formative evaluation) (Talbot, 2012) to identify possible difficulties students, check and guide their activities.
It should also be remembered that teaching cannot be fully effective without quality classroom management. Wang *et al* (1993) reported that classroom management is the first important variable to promote student achievement. Boissonnette *et al* (2010) and Gauthier *et al* (2013) show that explicit teaching of classroom management behaviors is associated with student achievement. Explicit teaching of behaviors makes it possible to specify expectations (values), rules and routines and to ensure their stability within the group and to help maintain a functional order conducive to learning.

On the other hand, teachers put forward obstacles that hamper the use of these active methods in their teaching. The obstacles present in the teaching discourse concern:

- The lack of time and the amount of content to be seen: since school time has not increased in proportion to the expansion and diversification of content, there has been a tendency to overburden programs. These content constraints have led to the emphasis on memorizing a large number of definitions, formulas and concepts, as opposed to a more problem-solving and skill-development approach Attitudes (Legendre, 1994).
- Overloaded classes and insufficient teaching materials;
- The lack of autonomy to act on the content of the courses;
- The lack of training and insufficient support pedagogical.

However, active teaching methods are still present in their practices. An effective teacher is a teacher with high expectations in terms of school performance. It should foster a strong learning culture, create a favorable class climate, facilitate peer learning, and use an emulation system for behavioral management (Cèbe and Goigoux, 1999).

CONCLUSION

In conclusion, it is therefore up to the teacher to constantly search for the most relevant methods and techniques most suited to the students' intellectual capacities and material conditions. A good quality lesson is one that achieves the goals set. The interrogative method and the problem situation dominate in frequency and preference. The expositive method seems to be still used while the teachers admit never to use the method by project. This observation calls into question the continuing education and pedagogical support of teachers to use the various teaching methods active in their practices, which is currently imperative.

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