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Impact of Active Teaching Methods Implemented on Therapeutic Chemistry Module: Performance and Impressions of First-year Pharmacy Students

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ABSTRACT

This study investigates the positive impact of the Case Method implemented during a 4-hours tutorial in "therapeutic chemistry module". We view the Case Method as one particular approach within the broader spectrum of problem based or inquiry based learning approaches. Sixty students were included in data analysis. A pre-test and post-test were conducted along with the tutorial class. A standard anonymous questionnaire was used to survey students' impressions about lectures. Results show that students obtain higher scores for the post-test compared with the pre-test. We could state that there is clearly a need to extend this experience even for other modules. However, it would seem essential to admit that professors, especially in our context, need to acquire complex teaching competences. The new reform of pharmaceutical studies, planned for the next academic year 2015-2016, would represent an excellent opportunity to plan regular workshops and training sessions for professors in active pedagogy field.

Keywords: Problem based learning, tutor skills, metacognitive skills, tutor training, tutor effectiveness

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INTRODUCTION

Casablanca Medical and Pharmaceutical College, belonging to University Hassan II Casablanca, is the second oldest Medical and Pharmaceutical College of Morocco, admitting nearly 60 students annually in the pharmaceutical curriculum. The pharmacy programme offered in Casablanca Medical and Pharmaceutical College as well as the other Moroccan public college in Rabat, belongs to regulated access universities of the Ministry of Higher Education ("Official Bulletin n° 5222 of June 17th, 2004,"). It is a 3-year semester-based programme followed by a 1-year trimester-based practical training that leads to a doctoral degree in pharmacy. The pharmacy section was introduced in Casablanca Medical and Pharmaceutical College in 2010 with a class size of 65 in the academic year 2012-2013. To integrate the pharmacy curriculum in Morocco, student must have a General University Studies Diploma, following a 2-year semester-based programme in the Biology and Geology department in Faculty of Sciences (Article 4, Decree No. 2-85-144 of August 5, 1987). Then, students have to pass an entrance examination ("Official Bulletin n°3901 of August 5th, 1987,page:233,"). The total number of years studied after the High-School Certificate in the Moroccan pharmacy curriculum is 6 years.

Four educational forms are preconized by the Moroccan Decree: lectures, tutorials, practicals and coaching Clerkship (Article 4, Decree No 2-98-548 of Febriary 15th, 1999). According to that Decree, professors should update the content and teaching methods whenever necessary and with the assistance of professional backgrounds. Nevertheless, only traditional teaching forms have been used up to now in “therapeutic chemistry module”. The traditional teaching forms of the “therapeutic chemistry module” include 56 hours of lectures, 12 hours of tutorials, and 16 hours of practicals (see Table 1).

Table 1 Number of chapters, hours and teaching forms of the three sections of ‘therapeutic chemistry module’

Sections	Number of chapters	Number of hours allocated to lecture	Number of hours allocated to tutorial	Number of hours allocated to practicals
Chemical nomenclature	3	8	4	16
Organic chemistry	3	24	8	
Medicines’ specificities	4	24	0	

In this paper, we focus on the teaching forms of the module-3 of ‘Common Technical Document’ (CTD). The CTD chapter is taught in a mix of deductive teaching, examples, and inquiry-based teaching. Deductive teaching is applied for the contents headings and hierarchy of module-3 of CTD (see Table 1). Examples are usually used to illustrate deductive information during lectures. These examples concern some real documents of the CTD such as European monograph, analysis certificate, Safety Data Sheet, stability results, etc. The inquiry-based teaching is used, for example, to teach the various sources and types of impurities in pharmaceutical products. So, instead of beginning with enumerating sources and types of impurities and then getting some examples for application, students are presented with a challenge (question about what could be the various sources of impurity in pharmaceutical products?) and they thought and grappled to give the correct answer. To accomplish the desired learning in the process, we give them chemical structures of both pharmaceutical product and many impurities and ask them the type (organic or inorganic) and the source of these impurities such as degradation, manufacturing processes, Synthetic intermediates, etc. (Pilaniya et al., 2010).

Despite efforts made, we have noticed that students could not remember the contents headings and the hierarchy of CTD items. Moreover, many students could not understand how the real CTD information looks like. For example, they could not recognize nor assign an analysis certificate and safety data sheet of a pharmaceutical product to defined locations of CTD format. This finding is not new since it was already affirmed and recommended by Dewey that students should be presented with real life problems and then helped to discover the information required to solve them (Dewey, 1944). The American College of Clinical Pharmacy (ACCP) indicated also that there is a discrepancy between pharmacy education and the actual environment in which the pharmacist will eventually practice (ACCP, 2000). Similar finding stood out in some international reports about the education and training sector in Morocco (Ndem et al., 2013). It was stated that the efficiency level of Moroccan education system is low, both in terms of quantity as regards enrolment and in terms of quality as regards student learning. Despite the favorable context afforded by the labor market dynamics, it was noticed firstly that vocational training graduates face real integration difficulties, and secondly that there is growing gap between higher education output and the professional jobs available on the labor market. This growing imbalance leads to downgrading and unemployment. To decrease this gap and imbalance, the improvement of curricula and teaching methods remain an important bottleneck ("UNICEF Annual Report 2013 - Morocco,").

The present article (i) provides a description of a small-group Case Method adopted during a tutorial of ‘therapeutic chemistry module’, (ii) reports pre-test and post-test scores, and (iii) describes student impressions on teaching methods used in a section of “therapeutic chemistry module”.

METHODS

The subjects were all students (*n = 65*) enrolled in Year 1 of the pharmacy curriculum in the academic year 2012-2013. Sixty students, who completed the pre-test and the post-test, were included in the data analysis. Five students were excluded because they were absents during the tutorial and/or the post-test.

We planned a 4-hours tutorial in which the Case Method approach was used (Barrows, 1986). The Case Method is one particular approach within the broader spectrum of Inductive teaching methods. These methods present an umbrella term that encompasses a range of instructional methods, including inquiry learning, problem-based learning, project-based learning, case-based teaching, discovery learning, and just-in-time teaching. They have many features in common, besides the fact that they are qualified as inductive, they are all student-centered, meaning that they impose more responsibility on students for their own learning than the traditional lecture-based deductive approach (Prince & Felder, 2006). Moreover, inductive teaching methods encourage students to adopt a deep approach of learning (Coles, 1985 ; Norman & Schmidt, 1992). Similarly, 'problem-based learning' (PBL) does not refer to specific educational method. PBL could have many different meanings depending on the design of the educational method employed and the skills of the tutor (Barrows, 1986). In this paper, we highlight the positives outcomes of the Case Method which conveys a sense of reality through cases to the course material, but also emphasizes the process of learning, the learners' thorough engagement with the case and the role of the facilitator (Burgoyne & Mumford, 2001; Hmelo-Silver CE, 2006).

The tutorial was related to CTD chapter taught in the medicines' specificities section. Students were divided into 9 groups made up of 6 to 8 students each. We minimized subgroups formation by distributing some students to foster cohesiveness. To control between-group variability and to minimize the effect of the subjects' idiosyncrasies, we used our knowledge of subjects' background and characteristics to distribute them over groups.

The complete case was distributed to each group in a dedicated folder at the beginning of the tutorial. Each folder contained also a marker, and three transparencies for oral restitution. The cases were about one medicine but designed in complementary ways. The cases were about an oral bilayer tablet of a nonsteroidal anti-inflammatory active ingredient, ketoprofen. The tablet is double layer comprising a white layer and a yellow layer. The white layer contains ketoprofen quick release, and the yellow one contains ketoprofen extended-release. Each case was designed either in the white layer or in the yellow one or in both (see Table 2). The cases are designed to stimulate discussion among each group members and among the nine groups (Allery, 2012; Duek, Wilkerson, & Adinolfi, 1996; Nicholl & Lou, 2012). In this tutorial, we focused on two kinds of specific educational objectives. The first ones were specific to each case in order to create complementary learning objectives among groups. The second ones are common across the nine cases (see Table 2).

Table 2 Objectives and folders content of the nine tutorial cases

Case N°	Folder content	Specific objectives	Common objectives
1	- Composition tablet bilayer - 2 analysis certificates of ketoprofen (by 2 different laboratories) - Safety Data Sheet of ketorpofen - Monograph of ketoprofen - Flow chart of the white layer manufacturing process	- To criticize the validity of analysis certificates - To verify calculations: batch size, unit formula, equipment capacity, etc. - To verify the "In Process Control" (IPC) parameters	- To identify : monograph, analysis certificate, and safety data sheet; - To assess authenticity of raw materials by using analysis certificate; - To compare specifications of analysis certificate with those of European monograph; - To assign monograph, analysis certificate and safety data sheet to defined locations of 'Common Technical Document' format of 'Marketing Authorization Dossier for Medicinal Products'; Additional behavioral objectives are targeted in this tutorial as follows: - To develop an increased motivation for learning; - To develop interpersonal skills and teamwork spirit; - To demonstrate the ability to synthesize, organize, and disseminate relevant information to audience; - To develop an effective reasoning process; and - To demonstrate critical thinking and problem solving during the short oral presentation of specific cases.
2	- Composition tablet bilayer - Analysis certificate of lactose - Safety Data Sheet of lactose - Monograph of lactose - BSE/TSE and Prion free Certificate of lactose - Flow chart of the yellow layer manufacturing process	- To verify calculations: batch size, unit formula, equipment capacity, etc. - To understand the administrative requirement for biological pharmaceutical ingredients : security for human health - To verify IPC parameters	
3	- Composition tablet bilayer - Analysis certificate of gelatin - Safety Data Sheet of gelatin - Monograph of gelatin - BSE/TSE and Prion free Certificate of gelatin - Flow chart of bilayer manufacturing process	- To enhance students assimilation of quality assurance system. - To find out and administrative requirement for biological pharmaceutical ingredients (security for human health) - To analyze critically manufacturing process	
4	- Composition tablet bilayer - For yellow layer: 6 analysis certificates, 6 Safety Data Sheets, and 6 monographs of ketoprofen, HEC, calcium hydrogen phosphate dehydrate, Riboflavin-5'-phosphate Monosodium, magnesium stearate, water.	- To distinguish and gather documents of each pharmaceutical ingredient - To correspond English names of pharmaceutical ingredients to French ones	
5	- Composition tablet bilayer - For white layer: 7 analysis certificates, 7 Safety Data Sheets, and 7 monographs of ketoprofen, lactose, starch, silica, water, gelatin, magnesium stearate - 2 BSE/TSE and Prion free certificates (lactose and gelatin)	- To distinguish and gather documents of each pharmaceutical ingredient - To correspond English names of pharmaceutical ingredients to French ones	
6	- Composition tablet bilayer - 2 analysis certificates of ketoprofen (by 2 different laboratories) - Safety Data Sheet of ketorpofen - Monograph of ketoprofen	- to explain analytical technics described in the ketoprofen monograph (characters, identification, tests, and essay) - to compare analytical technics and results between analysis certificate and monograph - to decide if ketoprofen powder tests are compliant with monograph requirements	
7, 8, 9	- Composition tablet bilayer - 2 analysis certificates of ketoprofen (by 2 different laboratories) - Safety Data Sheet and monograph of ketorpofen - Disintegration tablet test according to European Pharmacopoeia - Table of Climate Zones Classification (by WHO) - Tablets, general chapter, of European Pharmacopoeia - Hardness test according to European Pharmacopoeia - Mass uniformity test of single-dose preparations according to European Pharmacopoeia - Dosage uniformity test according to European Pharmacopoeia - Stability results - Protocol of stability study	- To compare conditions described in stability study with those preconized by WHO for Morocco - To identify if the study was conducted on pilot or manufacturing batch - To evaluate stability protocol - To evaluate if stability testing results are in compliance with established guidelines Note: These documents are similar for groups 7, 8, 9, except for: stability results and stability protocol.	

The tutorial was given three weeks after the end of lectures in a large classroom. Students' seats and tables were arranged in nine circles. So that, students were facing one another to discuss and study documents given by the facilitator. The duration and breakdown of the chronologically ordered tutorial activities are shown in Table 3.

Table 3 Breakdown and duration of tutorial activities chronologically ordered

Activities	**Duration**
Summative evaluation of lecture sessions	30 minutes
Work groups	2 hours
Groups oral restitution – 7 minutes per group	1 hour
Formative evaluation of the tutorial	30 minutes

The professor's role in this tutorial was to facilitate learning as it is described by Malcolm Knowles in the seven elements for an andragogical learning process design (Knowles, 1975; Neville, 1999). To increase students' participation and critical thinking, and to keep discussion focused and productive, the facilitator provided guidance to all students at the beginning of the tutorial. In each group, the facilitator assigned a reporter and a moderator. Around the classroom, the facilitator followed the nine groups by using his personal fact sheets to avoid missing out the key issues (Coelho, 2014 ; Stentoft, Duroux, Fink, & Emme, 2014). Students had researched the learning issues of cases and generated a summary. Starting from group 1 to group 9, the nine reporter students have succeeded each other by presenting orally in seven minutes the case via an overhead projector. If any student misunderstood something, s/he was allowed to ask questions orally at the end of the presentation. Both the reporter and the group members could answer. Whenever the need aroused, the facilitator intervened by clarifying the missing question. Then, the facilitator led a class discussion to address additional comments and answer further questions. The ultimate objective is to identify the relevant information to retain.

In order to verify and to determine how these cases may supplement each other and enrich pharmaceutical skills in the module-3 of CTD area, it was relevant to conduct two tests within the tutorial. The pre-test was administered at the beginning of the tutorial, and the post-test was done at the end. We informed students that they would take a pre-test and a post-test but did not point out they would be similar in content. Each one of the tests was two double-sided pages long, including six items presented as five short-answer questions and one problem in the stability analysis of active ingredient (See Table 4).

Table 4 - Topics and scores of pre-test and post-test

	Items	Topics	Score (out of 20)
Pre-test and post-test	SAQ1-1	Identify and determine the analysis certificate interest	1
	SAQ1-2	Identify and determine the monograph interest	1
	SAQ1-3	Identify and determine the Safety Data Sheet interest	1
	SAQ2	Determine if polarimetry is available as technic to identify ketoprofen	2
	SAQ3	Determine statement of lactose solubility according to its chemical structure.	1
	SAQ4	Assign documents of the SAQ1 to defined locations in CTD format of Marketing Authorization Dossier for Medicinal Products	6
	SAQ5-1	Analyze an extract of Ketoprofen European monograph – identification technics	2
	SAQ5-2	Analyze an extract of Ketoprofen European monograph – importance of test C as primary identification method	1
	SAQ5-3	Analyze an extract of Ketoprofen European monograph – listing of all the methods advocated in pharmacopoeia for Test A	1
	Problem	Analyze an extract of stability results	4

Legend:
SAQ : short-answer questions

At the end of the tutorial, we used an anonymous questionnaire to survey students' impressions and opinions about the overall course. The questionnaire included a free section for additional comments and suggestions. Only the section related to the medicines' specificities in the 'therapeutic chemistry module' was surveyed. The other sections of the module were not concerned by this survey.

We processed and analyzed data using SPSS ver. 13.0 statistical software for Windows (Inc., Chicago, IL). Data are presented as means (SD). The level of significance for all tests was set at $p < 0.05$. The statistical comparison of the scores between the pre-test and post-test was performed as related groups of asymmetrical quantitative distribution using a Wilcoxon signed-ranks test.

RESULTS

Sixty students were eligible for study inclusion. The attendance rate was 92.3%. The mean student grade for the pre-test was 6.87 (SD=0.39) out of 20 (median 7.0). The mean student grade for the post-test was 13.48 (SD=0.33) out of 20 (median 14.0). In the pre-test**,** 78.3 % of the students obtained a score less than 10; 18.3% obtained a score between 10 and 12; and

1.7% obtained a score between 12 and 14. In the post-test, only 5% of students obtained a score less than 10; 15% obtained a score between 10 and 12; 28.3% obtained a score between 12 and 14; 25% obtained a score between 14 and 16; 25% obtained a score between 16 and 17; and one student obtained 19. The details of undefined, wrong, and true answers of all short-answer questions (SAQ) and also of the stability problem of the pre-test and post-test are shown in Table 5 and Figure 2.

Table 5 - Details of student answers in the pre-test and post-test

		Number (%)			
		True answer	Wrong answer	Undefined	*p*
SAQ1-1	Pre-test	4 (6.7)	54 (90)	2 (3.3)	< 0.001
	Post-test	38 (63.4)	22 (36.7)	-	
SAQ1-2	Pre-test	18 (30)	40 (66.7)	2 (3.3)	< 0.001
	Post-test	49 (81.7)	11 (18.3)	-	
SAQ1-3	Pre-test	5 (8.3)	53 (88.3)	2 (3.3)	< 0.001
	Post-test	46 (76.7)	14 (23.3)	-	
SAQ2	Pre-test	17 (28.3)	28 (46.7)	15 (25)	< 0.001
	Post-test	50 (83.3)	9 (15)	1 (1.7)	
SAQ3	Pre-test	9 (15)	49 (81.7)	2 (3.3)	< 0.001
	Post-test	50 (83.3)	10 (16.7)	-	
SAQ4	Pre-test	55 (91.6)	4 (6.7)	1 (1.7)	= 0.001
	Post-test	58 (96.6)	1 (1.7)	1 (1.7)	
SAQ5-1	Pre-test	48 (80)	12 (20)	-	= 0.001
	Post-test	52 (86.7)	8 (13.3)	-	
SAQ5-2	Pre-test	5 (8.3)	55 (91.7)	-	< 0.001
	Post-test	32 (53.3)	23 (38.3)	5 (8.3)	
SAQ5-3	Pre-test	11 (18.3)	49 (81.7)	-	< 0.001
	Post-test	29 (48.3)	23 (38.3)	8 (13.3)	
Problem	Pre-test	4 (6.7)	56 (93.3)	-	< 0.001
	Post-test	33 (55)	20 (33.3)	7 (11.7)	

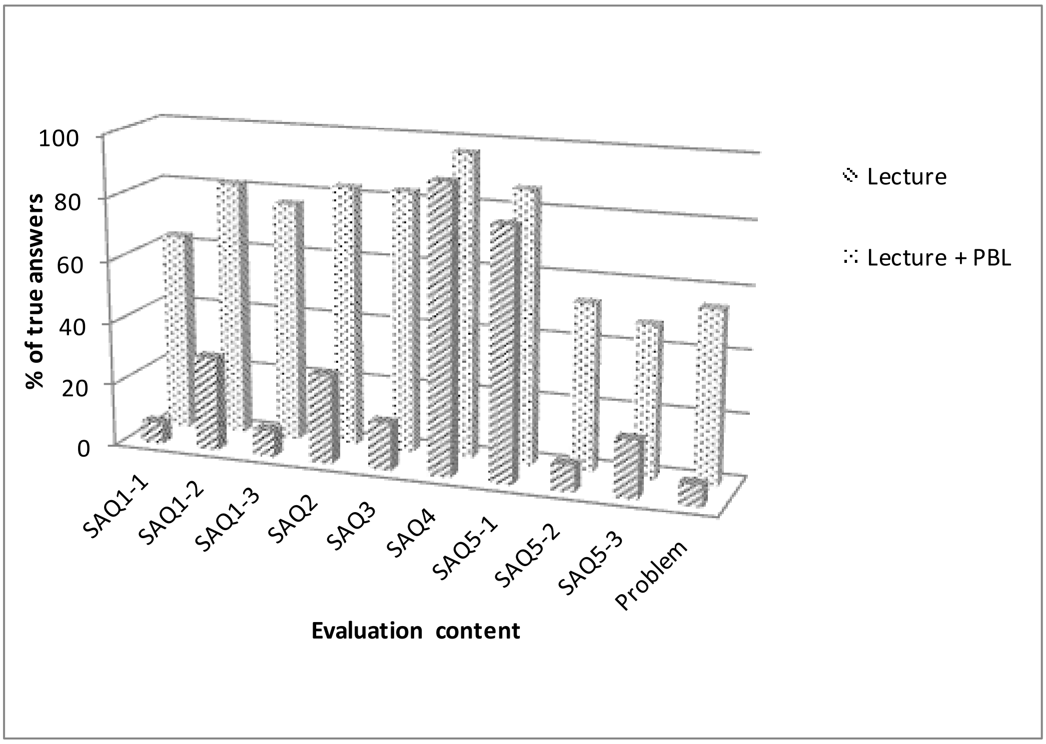

Figure 1: Student performance on the pre-test and post-test

Students' impressions on the teaching methods used in a section of "therapeutic chemistry module" are presented in Table 6 (n=65; response rate 92.3%). Responses were based on a 4-point scale: 1 = always, 2 = Often, 3 = Seldom, 4 = Never.

Table 6 - Student impressions on the teaching method used in the 'therapeutic chemistry module'

	%				
Survey questionnaire items	**Always**	**Often**	**Seldom**	**Never**	**Blank**
The professor announces the specific learning objectives	93.33	1.67	1.67	-	3.33
The professor encourages questions and comments	60	18.33	5	3.33	13.33
The professor provides assistance in case of misunderstanding	53.33	33.33	6.67	-	6.67
The professor asks questions individually to students	13.33	30	25	10	21.67
The professor asks questions to the entire class	60	23.33	3.33	1.67	11.67
The professor encourages students to interact	45	20	8.33	1.67	25
The professor uses examples	41.67	36.67	5	1.67	15

Of the 19 (31.6%) respondents who made suggestions in the free section included at the end of the questionnaire, many expressed their views regarding the adoption of the active learning approach as well as the methodology of the Case Method. Five students appreciated the Case Method as a complementary method to traditional teaching methods. One student stated that folders should be distributed to groups prior to the tutorial in order to present adequately the summary generated during oral presentation. One student suggested that the number of hours allocated to teaching by Case Method should be increased. Another student commented that this tutorial was the first time when students enjoyed working on their assignments as a team. A fourth student stated the tutorial allowed them to assimilate many important concepts. The rest of students, however, pointed out that more details are usually provided in the lectures part.

DISCUSSION

The first part of this study is related to the 4-hours tutorial planned for the first year of pharmacy curriculum. This tutorial highlights the positive outcomes of the Case Method through two tests. The pre-test made a summative evaluation of the lectures whereas the post-test measured students learning progress just after the tutorial. The first outcome is related to the improvement of student integration of the course materiel. Indeed, students' performance on the post-test (13.48 out of 20) was significantly higher than those on the pre-test (6.87 out of 20). These results corroborate findings of previous researches, since PBL led to significantly improved test scores compared with lecturing as a traditional mode of teaching (Cheng, Alafris, Kirschembaum, Kalis, & Brown, 2003; Cisneros, Salisbury-Glennon, & Anderson-Harper, 2002; Klegeris & Hurren, 2011; Romero, Eriksen, & Haworth, 2004, 2010; Ross et al., 2007; Shaw, Gerrett, & Warner, 2006). The second outcome is related to enhancement of students' thinking and their problem-solving skills despite the limited duration of the tutorial. Indeed, through audience students' pertinent questions, and relevant oral presentation of each specific case, we have noticed that students developed progressively teamwork skills and begun to use reasoning skills critical to solving problems. This finding fits with other studies which highlight that millennial students are more comfortable with a group-based approach to learn (ACPE, 2012; Haworth et al., 1998; Howe & Strauss, 2000; Marshall & Nykamp, 2010; Novak, Shah, Wilson, Lawson, & Salzman, 2006; Pierce & Fox, 2012; Pinder-Grove & Groscurth, 2009; VanLeit, 1995). The third outcome is related to improvement of our experience in term of design, planning, and practice of the Case Method. Indeed, we planned deliberately this tutorial three weeks after the end of lectures because the average period between the end of lectures and written examination of the module vary from two to three weeks. The aim targeted was to simulate conditions of written examination and see if students still memorized the relevant information of lectures. The duration was limited to four hours, since it was the first experience in this kind of teaching method both for the professor and students. Moreover, we felt that it would be pertinent to introduce progressively the Case Method as teaching method; especially for some students who are much accustomed to lectures mode of learning (Borrego, Rhyne, & Hansbarger, 2000; Wood, 2003). The cases' preparation was quite difficult since we focus on two contradictory objectives: complementary cases with similar objectives. To generate carefully the nine cases, we spent more than three months. We were assisted by Rabat Laboratory of Medicinal Chemistry professors and PhD in the National Laboratory of Medicines Control. Other challenges are time and money consuming and worth be cited like the time slot reservation, the rearrangement of the classroom furniture, the printing of documents for each case outside of College, documents' classification within folders, etc.

The second part of this study is related to the overall positive students' impressions that stand out on the survey questionnaire of the teaching method. We adopt in lectures a mix of deductive teaching, examples, and inquiry-based teaching; because we believe that, in practice, neither teaching nor learning is ever purely inductive or deductive. Learning process involves movement in both directions and good teaching helps students learn to do both (Prince & Felder, 2006). Moreover, to give students the main thread, we outline the specific objectives at the beginning to help students to follow the professor; and at the end of the session to verify if students reach these objectives. Thus, 93% of students noted that "The professor 'always' announces the specific learning objectives". For the inquiry-based teaching, 60% and 23% stated respectively that the professor 'always' and 'often' "asks questions to the entire class"; also 60% and 19% of students stated respectively that "The professor 'always' and 'often' encourages questions and comments". But only 45% of respondents indicated that "the professor 'always' encourages students to interact" while 25% prefer do not respond to this question. To explain these results, we could say that the professor had noticed previously that some students were reluctant when she adopted an inquiry-based teaching. This reluctance could be explained by resistance to this teaching method, shyness, lack of self-esteem, or fear to talk nonsense, or their beliefs that the teacher's job is to transmit knowledge to students (Valtanen, 2014). Whatever the reason, to clarify any student' incomprehension the professor appealed to a paper notebook. This notebook moves among students, and is collected by the professor at the end of each lecture session. The professor analyzes students' questions, and provides more explanations at the beginning of the following lecture session. Hence, 53% and 33% of students ranked respectively that "The professor 'always' and "often" provides assistance in case of misunderstanding". In order to measure the impact of examples used in the course, we integer this item in the questionnaire. Thereby, 42% and 37% of students stated respectively that "the professor 'always' and 'often' uses examples". Actually, the professor illustrates lectures by examples like the extract of European monograph, analysis certificate, Safety Data Sheet. Nevertheless, the pre-test results confirm that using examples only did not ensure an effective assimilation of the course; since 90% did not recognize the monograph extract, 66% could not identify the analysis certificate and 88% did not manage to identify the Safety Data Sheet. This finding is similar to those demonstrated in previous researches which confirm that students exposed to worked examples are not able to solve problems with solutions that deviate from those illustrated in the examples. Also, they cannot clearly recognize appropriate instances in which procedures can be applied, and have difficulty solving problems for which they have no worked examples (Atkinson, Derry, Renkl, & Wortham, 2000).

Above, we have seen how students reach more behavioral skills and higher scores after the Case Method tutorial. We could state that there is clearly a need to extend active methods to the other sections of “therapeutic chemistry module” or even to other pharmaceutical modules. However, it would seem essential to state that, in this kind of teaching methods, professor should make explicit connections for students with both the teaching and the learning processes; connections that students are required to reflect upon in light of their own future teaching practice (Murray-Harvey, Pourshafie, & Santos Reyes, 2013). If not, several difficulties could arise such as students’ negative perceptions, dissatisfaction with group work, etc. (Holen, 2000). Thus, we admit that professors, especially in our context, need to acquire complex teaching competences which involve knowledge, skills, engagement and personal commitment. This could be possible only by implementing regular workshops and training sessions in the pedagogy field (Coelho, 2014). The new reform of pharmaceutical studies, which is going to be applied in the next academic year 2015-2016, would represent an excellent opportunity to plan these workshops and training sessions for professors in the active pedagogy field.

This work has several major limitations. The pre-test and the post-test was not administered after the same gap period of time which is in our context three weeks. The pre-test was administered three weeks after the end of lectures while the post-test was administered immediately at the end of the tutorial. The number of hours allocated to this tutorial is limited. The questionnaire survey does not distinguish between tutorials and lectures.

CONCLUSIONS

As it was verified through the Case Method tutorial, active teaching methods encourage students to adopt a deep learning and impose more responsibility on students for their own learning. To implement active teaching methods, trained facilitators have to guide students rather than to teach them. The new reform of pharmaceutical studies, which is going to be applied in the next academic year 2015-2016, would represent an excellent opportunity to plan regular workshops and training sessions for professors in the active pedagogy field.

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