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Pharmacy students' perception and satisfaction with chemistry education: a crosssectional study

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RESEARCH ARTICLE

Pharmacy Students' Perception and Satisfaction with Chemistry Education: A Cross-sectional Study

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Abstract

Chemistry is an important part of the curriculum for pharmacy students, as there are many disciplines within chemistry that are actually involved in the design and development of drugs, namely; general chemistry, synthetic organic chemistry, analytical chemistry, biochemistry, pharmaceutical chemistry (or therapeutic chemistry), pharmacognosy and materials chemistry for the design of dosage forms. The learning of chemistry by pharmacy students is generally influenced by their perception of theoretical courses, tutorials or practical work. In order to evaluate this perception, we conducted a cross-sectional study based on an anonymous electronic questionnaire distributed to students of all the Moroccan Faculty of Pharmacy over a period between January and March 2022.

A total of 151 responses were received of which 78.1% were women. The results show that the majority of students are satisfied with theoretical courses (68.2%), tutorials (75.5%) and practical work (91.4%), lectures (74.2%), and flipped classrooms (33.1%). Pharmacy students also see a logical and coherent progression of theoretical teaching from one year to the next (72.1%).

The majority of pharmacy students are satisfied with the chemistry courses they have received, but they are not very motivated by the e-learning methods, especially the flipped classrooms.

Keywords: Satisfaction, Chemistry, Tutorials, Practical work, Flipped classrooms

1. Introduction

Chemistry plays a major role in the discovery and production of new drugs and, in the past, great pharmacists have very often been great chemists. Today, the vast majority of new drugs approved by the Food and Drug Administration (FDA) have chemical small molecules as active ingredients, accounting for 70–80% [1]. Chemistry therefore still has its place in therapeutic research with significant advancements in various fields such

as antivirals, natural products for cancer, bacterial, or antimalarial treatment [2]. Furthermore, chemistry also directly intervenes in the design of biological molecules, whether for the conjugation of small molecules to monoclonal antibodies or for the transport of small interfering ribonucleic acids (siRNA) packaged in liposomal nanoparticles [3].

Therefore, chemistry is an important element in the education of pharmacists, as from the first year pharmacy students take courses in general, analytical, and organic chemistry [4–6]. The learning

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process continues in the following years and students learn about electrochemical and spectral analysis techniques, physical-chemical separation methods, biochemistry, therapeutic chemistry and pharmacognosy [7].

Chemistry courses are traditionally considered difficult for both students and professors [8]. The teaching of chemistry in pharmacy programs faces several problems, as a decline in average test scores is observed, and this can be due to many reasons [9].

This research aims to study the perception of pharmacy students towards the teaching of chemistry, in fact, some students find difficulties in chemistry, as a significant number fail their chemistry exams during the first session and require a second chance.

The study, whose results are presented in this article, was conducted between January and March 2022, and its goal was to measure the perception that pharmacy students have of the learning of the chemistry courses taught during their years of study in pharmacy.

2. Materials and methods

This is a descriptive study conducted within the Faculty of Pharmacy at the Mohammed VI University and Health Sciences during a period of three months. We conducted a cross-sectional survey from January to March 2022 among pharmacy students in Morocco.

The target population was all students enrolled in 1st to 6th year in a Faculty of Pharmacy in Morocco.

We developed a questionnaire that evaluates the perception and degree of satisfaction of students with regard to the teaching of chemistry in their curriculum. The questionnaire was organized into 4 themes; 1/sociodemographic data, 2/theoretical teaching, 3/practical teaching and 4/knowledge evaluation.

The questionnaire was hosted on Google Forms and the link was sent to representatives of the faculties of pharmacy in Morocco and to student representatives. The data were collected anonymously and exported to an Excel file and saved on a computer protected by a password by the primary author. Statistical analysis was performed by the Jamovi software. Qualitative variables were expressed in frequencies and percentages and quantitative variables were expressed in means and standard deviation.

3. Results

A total of 151 participants responded to the questionnaire, three were excluded for not having answered all questions. Of the participants, 78.1% are women, 40% in second year, 18% in third year, 13.2% fourth year, and 16% fifth year (Table 1).

The average age of participants was 20.4 ± 2.96 , they are enrolled in 1st, 2nd, 3rd, 4th, 5th, and 6th year of pharmaceutical studies, they represent 12.6%, 39.7%, 17.9%, 13.2%, 15.9%, and 0.7%, respectively (Fig. 1). The vast majority of these participants are Moroccan and non-repeaters (Table 2). The results show that the majority of

Table 1. Socio-demographic data of the study population.

Categories	n (%)	Mean + - Standard deviation
Level of studies		
First year	19 (12,6)	
Second year	60 (39,7)	
Third year	27 (17,9)	
Fourth year	20 (13,2)	
Fifth year	24 (15,9)	
Sixth year	1 (0,7)	
Nationalité		
Marocaine	149 (98,7)	
Gabonaise	1 (0,7)	
Canadienne	1 (0,7)	
État Civil		
Célibataire	148 (98)	98
Marié (e)	3 (2)	2
Redoublé		
Non	148 (98)	98
Oui	3 (2)	2
Age (year)	Moyenne + - Ecart-type	20,4+- 2,96
Sexe	Effectif	Pourcentage
Femme	118	78,1
Homme	33	21,8

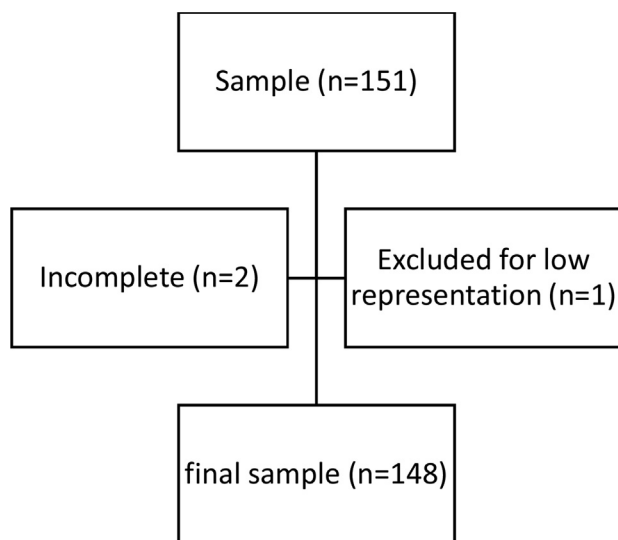


Fig. 1. Sampling organigramme.

students are satisfied with the theoretical courses (68.2%), directed work (75.5%), and practical work (91.4%), lectures (74.2%), and flipped classes (33.1%). Pharmacy students also see that the theoretical teachings from one year to another present a logical and coherent progression. It was noted that 48.3% consider that the teaching methods give a taste for research (Table 3, Fig. 2).

The results also show that pharmacy students have a lot of interest in the chemistry directed work in all these areas, as they are satisfied at 75.5%, the majority 82.8% also see that the directed work allows them to actively participate in the class and 85.4% consider that the directed work develops their ability to solve problems. At the same time, 92% believes that the directed work helps to better understand the course, and they are also satisfied 72.7% of the teachers who provide them (Fig. 3).

Table 2. Lecture courses satisfaction.

	Does agree n (%)	Does not agree n (%)
Theoretical courses satisfaction	103 (68,2)	48 (31,8)
The best method for theoretical teaching is the lecture	112 (74,2)	39 (25,8)
The best method for theoretical teaching is distance learning	43 (28,4)	108 (71,4)
The best method for theoretical teaching is flipped classrooms	50 (33,3)	101 (66,9)
The modules taught have complementarities between them	127 (84,1)	24 (16,9)
The theoretical lessons, from one year to another, present a logical and coherent progression	109 (72,1)	42 (27,9)
Teaching methods give you a taste for research	73 (48,3)	78 (51,7)

Table 3. Satisfaction about examen duration and clarity of questions.

	Does gree n (%)	Does not agree n (%)
The examination subjects are adapted to the duration of the exam	110 (73,0)	36 (23,8)
Exam topics are clearly formulated	125 (82,8)	24 (17,2)

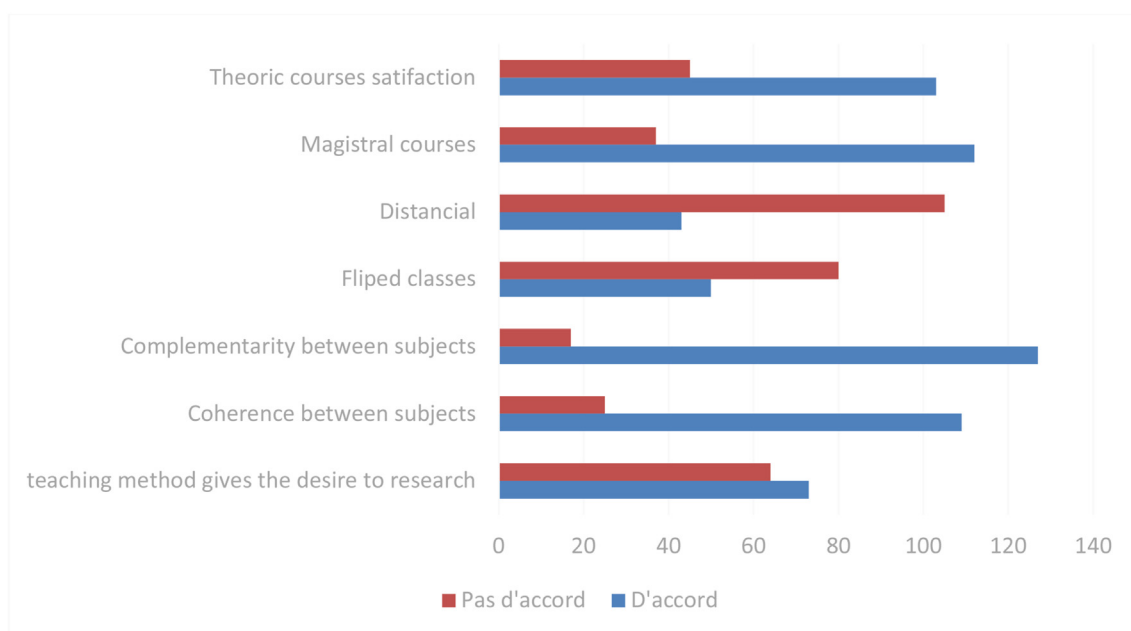


Fig. 2. Graphical representation of theoretical courses satisfaction.

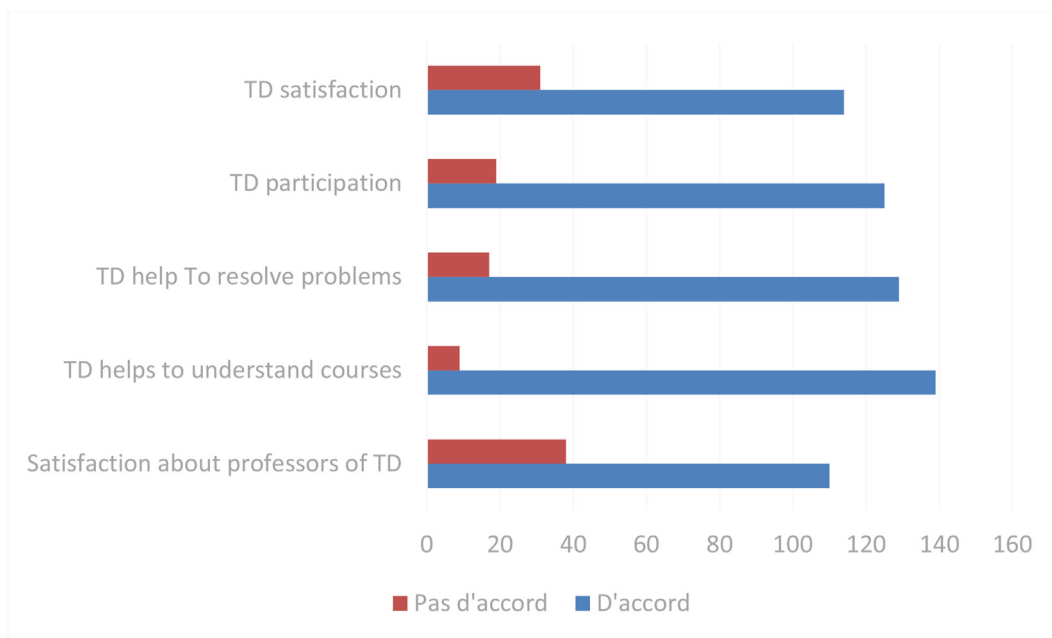


Fig. 3. Pharmacy students' satisfaction with tutorials.

The practical work aspect was also addressed during this study, the results showed that 93.4% of the students enjoy participating in practical work, they are satisfied (75%) with the role of practical work in the teachings and are also satisfied 78.8% of the size of the practical work groups. The students were also questioned about filmed practical work and the results showed that 35.1% of the students are satisfied with it (Fig. 4).

The examination aspect was addressed in the study, we found that 72.9% of the participants see that the examination subjects are adapted to the duration of the test and 82.8% also consider these subjects are clearly formulated. Regarding the examination methods, the authors asked the students to choose which type of examination they prefer, the results say that 70.2% prefer multiple choice questions (MCQs), 16% want a combination of different

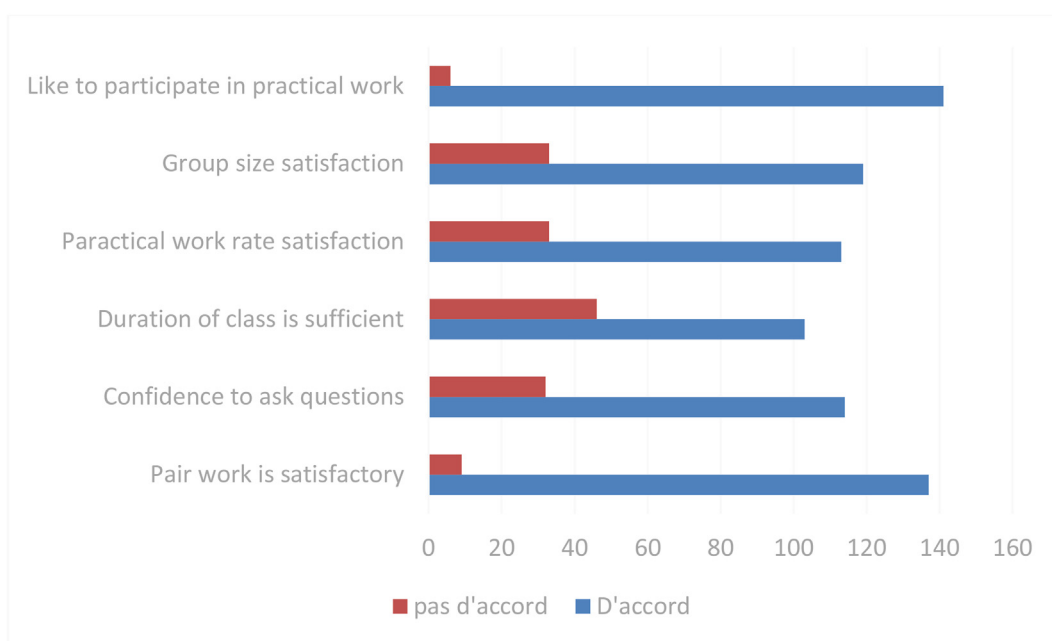


Fig. 4. Pharmacy students' satisfaction with the practical work.

Table 4. Type of exam preferred by students.

Levels	Counts	%
Combination of different types of questions	24	15,9
Essay questions	3	2
Multiple choice questions (MCQs)	106	70,2
Open-ended and short answer questions (OSQ)	13	8,6
Problem solving and case studies	5	3,3

types of questions, 8.6% want to have short open-ended questions (SOEQ) and only 2% prefer essay questions (Table 4).

4. Discussion

In this study, we are interested in the perception and satisfaction of pharmacy students regarding the learning of chemistry. Several parameters have thus been evaluated. The survey results showed that the majority of students are satisfied at different points of the theoretical courses, directed work, practical work, and lectures. However, the results indicate that the majority of students were not satisfied with the flipped classes (33.1%). Pharmacy students (72.1%) also see that the theoretical teachings, which are mostly given as lectures, from one year to another present a logical and coherent progression. We have noted that 48.3% consider that the teaching methods give a taste for research. Lectures have been widely written about in recent years, in terms of their definition, their pedagogical and didactic description, and their effectiveness in terms of student success [10]. In some respects, the lecture can be considered a “mode of teaching in which a teacher presents his or her knowledge to an audience” [11]. A review of the literature on the subject shows that lecturing is largely associated with lecturing or teaching from a position of authority, itself too often equated with traditional teaching [12]. As a result, we can qualify the lecture as a teaching method derived from cognitivism. For centuries, the lecture has been the most commonly used mode of teaching in universities, particularly in the first years of the teaching program, especially in chemistry. In a university context, the lecture allows both to teach the largest number of students and it constitutes a revelation of the break with secondary education and the transition to a new pedagogical environment [13]. The student satisfaction about the lectures is maybe related to several advantages. It allows to provide basic theoretical foundations in the field of chemistry and it is from general, organic and analytical chemistry to pharmaceutical chemistry, to bring new information, to offer accessible content despite its complexity and to

structure the approach towards the acquisition of important notions in the field [14]. It is well known that one of the main limitations of the lecture is the passivity of students since it is up to the teacher to perform the most important intellectual tasks: identifying, exploring and confronting information and knowledge with minimal interaction. This teaching approach is the subject of multiple representations in which teaching a large group would foster student absenteeism or encourage a surface learning approach [15,16], something that is generally rarely observed among pharmacy students given the importance of the discipline and the difficulty of the notions introduced by teachers which require presence and attentive follow-up of the lecture. Furthermore, it is possible to make the lecture interactive by maintaining the attention of students and encouraging them to actively participate. Flipped classes are pedagogical models in which classes and homework are reversed in their chronological order of events. For example, video capsules presenting the content of the classes can be viewed by students before the class session; class time is then devoted to exercises, projects, or discussions. This approach was not really appreciated by pharmacy students as their degree of satisfaction with flipped classes was low (33.1%). This could be attributed to the fact that these students are already familiar with a traditional teaching method and may find it difficult to adapt to a new approach [17].

Implementing the flipped classroom approach is likely to result in enhanced academic performance among students, although the extent of improvement may vary across different fields of study. Moving forward, it is crucial for future researchers to address key inquiries such as identifying the essential component of the flipped classroom methodology and understanding its role in promoting effectiveness. As previously suggested by Abeysekera and Dawson [18], the differentiating factor of a flipped classroom compared to traditional teaching lies not only in the pre-recording of information or the utilization of technology for accessing fundamental knowledge outside of lectures. Rather, the distinguishing feature is the opportunity, it provides for students to actively participate in learning and problem-solving activities with hands-on guidance from an expert. Furthermore, the structure of the flipped classroom model allows students to allocate more time towards engaging in active learning practices, thereby further enhancing the efficacy of these approaches [19]. Additionally, students may prefer to have the class sessions to be able to ask questions and have discussions with their professors and classmates. Therefore, it may

be more beneficial to use a blended approach which combines traditional teaching methods with technology-based methods, such as online resources, videos, and interactive activities, to enhance the students' learning experience.

5. Conclusion

The pharmacy students were mostly satisfied with learning of chemistry during their curriculum. They are mostly satisfied about lectures, theoretical courses, tutorials and practical works. Otherwise, they showed less satisfaction about flipped classrooms.

For the exam section, students wish to have multiple choice questions, as this is applicable in other subjects. An analytical study is recommended in order to detect any associations between all these parameters and better understand and interpret the preferences of students in order to improve teaching approaches and ensure pedagogical effectiveness.

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Conflicts of interest

The authors declare no conflict of interest.

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