



Assessment of Medical Prescription in Pediatrics by Graduate Program Third Year's Students at the Faculty of Medicine of Parakou in 2015

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Abstract

Objective: Assess learning on medical prescription for children among graduate program third year's students at the Faculty of Medicine in Parakou.

Method: Descriptive, prospective and analytical study conducted during the 2014-2015 academic year in three phases of twelve weeks. Target population: students that were regularly enrolled in the graduate program's third year (DCEM3) on internship in the pediatric unit during the study period. Assessment of the medical prescription writing process at the beginning and at the end of their internship, based on resolution of child's usual health problems in tropical areas was conducted through comparison of findings. Proportions were compared with Pearson Chi-square test at 0.05 threshold limit.

Results: 128 DCEM3 students were involved in the study. Students aged 25 to 28 years accounted for the predominant age group (54.69%). Sex ratio was 2.67. Significant improvement has been found for score 3 achievement between test1 and test2 for drugs prescription accuracy (54.77% vs. 86.677% ($p=0.042$)), galenic presentations (31.25% vs. 78.12% ($p=0.000038$)), doses (42.96% vs. 75.78% ($p=0.0066$)) and dosages (00% vs. 20.31% ($p=0.0000041$)). At the end of tests 75.78% (97 students) during the second test versus 17.96% (23 students) during the first one ($p=0.00002$) submitted a consistent medical prescription. Gender was the only factor associated with the skills acquired or accomplished.

Conclusion: A significant progress was noted at the end of the second tests compared to the first ones. This learning method might be continued so as to help students improve their learning process.

Keywords

Medical prescription; Learning on prescription; Medical students; Pediatric practical internship; Benin

Introduction

Medical prescription learning is fundamental in the medical school; due to its therapeutic and prognostic relevance, both for the patient and for the learner. Medical prescription is a medical and legal procedure which, as part of future physician's practice, will also have a juridical importance. In this context, learning of medical prescription for the patient in general and for the child, is of paramount importance, especially when it deals with a growing body where the metabolic functions are not yet fully matured. In medical practice in general, prescription errors around 5.3% to 19% are noted in the American hospitals [1-3]. The iatrogenic and economic consequences of medical prescription errors are a major challenge of public health [4]. Medical prescription in pediatric practice is more commonly associated with the incidence of infections at that age [5,6]. In pediatric practice, medical prescription requires some precisions as regards dose adjustments in relation to body surface, weight and more rarely age.

The purpose of this research work was to assess learning of medical prescription for children among students in the Graduate program's Third year of Medical studies (DCEM3) at the Faculty of Medicine in Parakou during 2015.

To achieve that objective, we assumed that learning in a pediatric unit would improve medical prescription for children by students in DCEM3.

Setting, Subjects, Materials and Method

Setting

This research work has been carried out in the Pediatric Unit of the Regional University Teaching Hospital of Parakou (CHUD/Borgou) which is the site of practical internship for students of the Faculty of Medicine at the University of Parakou. According to the academic regulations, students in DCEM3 of that Faculty have the obligation to do their external practical internship in the units of Pediatrics, Gynecology and Obstetrics and ENT/Ophthalmology and Stomatology [7].

Method

Type of study and study period: It was a cohort, descriptive and analytical study which was conducted throughout the 2014-2015 academic year, i.e. three phases of twelve academic weeks.

Study target population: This investigative work involved DCEM3 students during the above-mentioned academic year at the University of Parakou in northern Benin.

Inclusion criteria: All the students in DCEM3 regularly enrolled at the Faculty of Medicine, University of Parakou during the 2014-2015 academic years that attended the Pediatrics internship for a period of 12 weeks.

Exclusion criteria: The study excluded all those who did not undergo that pediatric internship for many reasons (persistent absenteeism, long-term illness).

Recruitment and sample size: Recruitment was exhaustive, for the research work was part of a learning assessment concerning students regularly enrolled in the learning group described above.

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A total of 128 students divided into 3 groups of 42, 43 and 43 for a respective exposure to 11, 12 and 13 weeks of internship in pediatrics for the said year according to the documents of the Faculty of Medicine's Internship office [7].

Variables: The main assessment criteria were precision and accuracy of medical prescription. The other independent variables of the study were sex and number of times that the student has repeated that year. Medical prescription was found appropriate based on right choice of drug, appropriate pharmaceutical form, precision of proposed drug doses, accuracy of dose data of each of the drugs prescribed, accuracy of prescribed drug amounts. In addition, as regards the form, medical prescription was considered as consistent based on the accuracy of its presentation. Medical prescription was limited to no more than three drugs. Each drug was thus awarded the score 1 if it is correctly prescribed and score 0, if poorly prescribed. Therefore, each parameter above-mentioned was awarded scores 0 to 3. For each of the parameters scored 0 to 3, the score 0 meant null; the score 1 meant that the student only prescribed correctly one out of the three items. The score 2 corresponds to two correct answers out the three expected and the score 3 corresponds to a correct prescription of the item considered for each of the three drugs prescribed. The correct presentation of the very medical prescription was scored 0 to 1; 0 corresponds to a bad presentation of the medical prescription in its form and 1 corresponds to a prescription correctly presented with the Unit of origin from which resulted the named prescription, the name, the age, the weight of the child for whom it is issued and prescriber's signature. The total of all those scores varied from 0 to 13. A student who got 11 to 13 of scores was considered as having succeeded in writing his or her medical prescription. Those who got scores between 7 and 10 had to make efforts to achieve the goal. They should be followed up and those below 7 during the second test (T2) should also benefit from a particular follow-up.

Operational definitions: Medical prescription has been defined as a medium or standard desirable for any dispensation of drugs and care for the therapeutic follow-up of the patient. It is also the ideal medium for any public health information (dosage etc.). It proves to be an essential medium in the reports existing between the patient as a social insured person and the social protection bodies. It is also the legal means of communication between the patient, physician and pharmacist [8]. It is defined as a health care programme implemented in the form of guidelines which govern the health care plan for a given patient.

In this research work, the expressions students, learners, medical students and physicians-to-be have been used indistinctly and means one and the same entity (medical students in DCEM3, physician-in-training).

Learning procedures: During the internship, two series of tests for learning on medical prescription writing were carried out: Through a simple clinical case, students were asked to prescribe a medical prescription. A first series of tests (T1) was performed at the beginning of the internship corresponding to the 2nd or 3rd internship week planned according to the internship objectives [9] after the presentation on « the rules of prescription of drugs commonly prescribed in pediatrics » and the second test (T2) corresponding to the end of internship assessment in the unit, i.e. the last week of internship according to the internship objective schedule [9]. During those tests, a sample of 10 drugs were given to students for observation of presentation, pharmaceutical forms and dose data. The relevant drugs included a usual antibiotic, an antitussive, an anti-hypertensive drug, a nonsteroidal anti-inflammatory drug and an antipyretic. During the correction of T1 prescriptions, a feed-back

was done to students as far as imperfections and flaws are concerned. The tests consisted of prescription of drugs focused on either an infant suffering from fever with diarrhea made up with non-bloody liquid stools without mucus, or an infant presenting fever with a red throat in the African context. The tests were performed regardless of internship group and of T1 or T2 at the beginning or at the end of the internship. Students were priorly informed of the assessment.

Data collection, processing and analysis: The data were collected based on the medical prescriptions written by students on non-anonymous sheets for individual feed-back purposes. Those data were collected and entered with Epi info 7 software. The list of students with their sociodemographic data has been provided by the Dean's Office of the Faculty. Data were processed. The qualitative data are shown as percentages and the quantitative ones as averages with their standard deviations. For internal validity, a prevalence report was calculated with an Odds Ratio and its confidence interval. Pearson or Fisher Exact Chi-square (χ^2) test and prevalence reports were used for comparisons as the case may be. Difference was considered as significant for p value < 0.05.

Ethical Considerations

We did not require authorization from the ethics committee for this research work due to being part of the usual students' training at the Faculty of Medicine in Parakou and those medical prescriptions were not dedicated to an infant in particular. This research work is strictly done as part of learning and as well as fiction. Anonymity was complied with.

Findings

Out of 135 students enrolled, 128 were involved in the study. Seven students were excluded from the study for many reasons (persistent absenteeism, long-term illness).

Sociodemographic characteristics

Sociodemographic characteristics of students included in the study on learning of medical prescription in pediatrics.

Distribution of DCEM3 students involved in the study on learning of medical prescription in DCEM3 according to age and sex.

Distribution of students included in the study on learning of medical prescription in pediatrics according to the number of enrolments in DCEM3.

Students who repeated a class were estimated at 3.12% (04 students) i.e. one student (0.78%) enrolled for the third time, three students (2.34%) enrolled for the second time and 124 (96.88%) enrolled for the first time in DCEM3.

Regularity of the Medical Prescription

Accuracy of the drugs proposed as prescription for children according to clinical situation proposed during T1 and T2

The second test seemed to be more conclusive, thus showing results statistically better than those of the first test in relation to the knowledge of drugs proposed in clinical cases. Details of these findings are shown in Table 1.

Accuracy of pharmaceutical forms proposed

The pharmaceutical forms proposed as prescription have been correctly written during the second test in 78.12% of the cases (Table 1).

Accuracy of the doses prescribed (D)

The doses of pharmaceutical forms proposed for prescription by students during the second test (D2) were better than during the first test (D1) (75.78% versus 42.96%). Details are indicated in Table 1. An improvement has been noted even in the progression of scores from 0 to 3.

Accuracy of the dosages proposed in prescriptions (Do)

Table 1 shows details of the findings concerning the dosages proposed as prescription during the tests 1 and 2. It is noted that 20.31% have been able to write accurate dosages of the three drugs proposed as prescription during the second test versus 0% during the first test.

Accuracy of presentations of medical prescription

The medical prescriptions were better presented in their form during the second test (Ord2) with a rate of 97.77% versus 57.77% of cases during the first test (Ord1). See details in Table 2.

Correctly written medical prescriptions

In this table, medical prescriptions are properly written during the second test (T2) in 75.78% of cases, versus 17.96% during the first test (T1). A total of 105 students (82.03%) had not submitted a properly written prescription in pediatrics in this kind of exercise

during test1 versus only 31 during the second test (24.22%). These results are detailed in Table 2.

Students' progression between test T1 and test T2

Most students experienced a substantial progression of more than 3 points as score. More than half of the sample of students who attended learning improved through the scores reviewed with at least 3 points of progression as score (57.81%). In that group, 37 students (37 out of 74) experienced a progression of more than 5 points of the assessment score (from 5 to 10). Figure 1 shows students progression during the learning process between the two tests.

Sociodemographic and academic factors associated with prescription of drugs for children by DCEM3 students

The number of enrolments in DCEM3 was not significantly associated with the improvement in learning of medical prescription written by learners. By contrast, sex seems to be associated with it. Progression was significantly higher in male students than in female ones (p=0.00041) (Table 3).

As regards to the group of students who were unable to submit an acceptable medical prescription during that learning, the same trends like those previously described have been noted not only with respect to the number of student enrolments but also in relation to sex. (p=0.00062). These details are specified in Table 4.

Table 1: Distribution of Students according to the achievement score (0, 1, 2, 3) for accuracy of prescriptions, galenic presentations, doses and dosages of medical prescriptions for children during tests 1 and 2.

	Test 1 (%) n=128	Test 2 (%) n=128	p	Chi²
Drugs				
0	03(02.22)	00 (00.00)	0.25	1.3207
1	17 (13.33)	03 (02.22)	0.0053	7.763
2	34 (26.66)	15 (11.11)	0.0127	6.207
3	74 (57.77)	110 (86.67)	0.042	4.125
Galenic forms				
0	23 (17.96)	03 (02.34)	0.000409	12.53
1	20 (15.62)	03(02.34)	0.0014	10.13
2	45 (35.15)	22 (17.18)	0.0121	6.289
3	40 (31.25)	100 (78.12)	0.000038	17.014
Doses (D)				
0	08 (6.25)	00(00.00)	0.015	5.89
1	20 (15.62)	08(06.25)	0.031	4.64
2	45 (35.15)	23(17.96)	0.0174	5.64
3	55 (42.96)	97(75.78)	0.0066	7.359
Dosages (Do)				
0	45 (35.55)	11 (08.59)	0.000035	17.14
1	60 (46.66)	43 (33.59)	0.156	2.005
2	23 (17.77)	48 (37.50)	0.0084	6.932
3	00 (00)	26 (20.31)	0.0000041	21.83

Table 2: Distribution of Students according to accuracy of medical prescriptions' presentation (Ord) for children during tests 1 and 2.

	Test 1(%) n=128	Test 2 (%) n=128	p	Chi²
Medical prescription (Ord)				
Score 0	54 (42.22)	03 (2.22)	0.00000000	56.42
Score 1	74 (57.77)	125 (97.77)		
Overall cumulated score				
≥11	23 (17.96)	97 (75.78)	0.000702	11.486
[7-10]	71 (55.46)	28 (21.87)	0.00000000	31.555
≤ 6	34 (26.56)	03 (02.34)	0.00000000	40.676

Discussion

Relevance of the study

This research work topic has helped us to briefly review a learning method based on practical test. The latter consisted of exercises on medical prescription for children by students in DCEM3, during their internship in a pediatric hospital. Those exercises were performed in two phases. A first test is done at the beginning of their internship, as an exercise of application to a topic presented. That first test was performed when students were not yet familiar with practices and principles guiding pediatric medical prescription, despite the theoretical knowledge acquired in general and clinical pharmacology in the previous years. Then, a second test is done at the end of their 12-week internship in pediatrics during which they had the opportunity to achieve the set objectives [9]. The test performed at the beginning as well as at the end of the internship, is similar. This enabled us to compare those students' progression during the learning, through proposal of accurate drug prescription in a precise clinical situation, accurate doses of the appropriate pharmaceutical form, accurate dosages and accuracy of medical prescription presentation.

To assess that learning method, we used proven learning methodologies and statistical elements which enabled to verify the internal validity of the results obtained. The prospective and analytical study used for this assessment method corresponds to the proposed topic.

The results expected from students were consistent with their internship objectives, adaptation to clinical situation proposed, and the number of drugs proposed for prescription was also limited. In addition, the only influences impacting on those students are their lecturers in medical pathology, surgery and pharmacology who are hospital practitioners [10-14] and their elders.

Achievement of objectives

During those exercises or tests, we can argue that the learning objectives set at the beginning are achieved. We determined the frequency of accurate and wrong prescriptions by students in that learning process both during the first and second tests. We also identified in this context the factors associated to it. Our hypothesis was therefore confirmed. This learning is part of the training of those physicians-to-be, but it also helps check the methodology of the

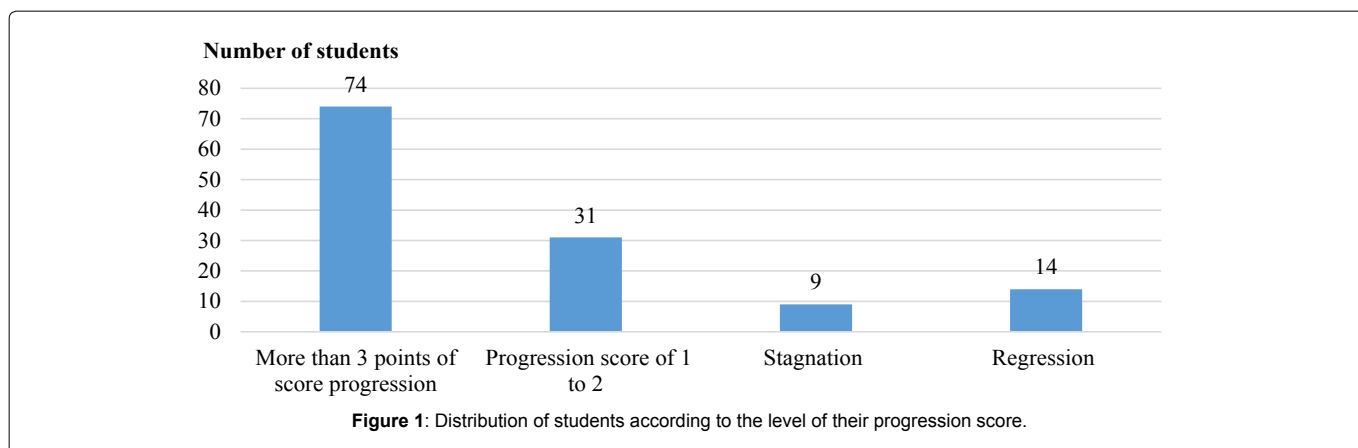


Table 3: Distribution of Students who submitted acceptable medical prescriptions for children at the end of the two testes according to gender and number of registration in the same academic grade.

	Acceptable medical prescriptions		OR	p
	Test 1 (N=23)	Test 2 (N= 97)		
Sex				
Male (93)	11(08.60%)	74 (57.81%)	0.28 [0.111-0.731]	0,0069
Female (35)	12(08.60%)	23(11.78%)		
Number of registration in the academic group the same year				
1 (n=124)	22 (17.18%)	93 (72.65%)	[0.087-44.69]	0,59
≥ 2 (n=4)	01(00.78%)	04 (03.12%)		

Table 4: Distribution of Students who submitted medical prescriptions to be improved at the end of the two tests according to gender and number of registration in the same academic grade.

	Medical prescriptions to be improved		OR	p
	Test 1 (N=105)	Test 2 (N= 31)		
Gender				
Male (93)	82 (64.06%)	15 (14.84%)	3.80 [1.63-8.83]	0.00131
Female (35)	23(17.96%)	16 (15.62%)		
Number of registration in the academic group the same year				
1 (n=124)	102 (79.68%)	30 (26.56%)	[0.021-14.70]	0.618
≥ 2 (n=4)	03 (02.34%)	01(00.78%)		

said learning. However, in reality, only one exercise of the kind would likely be insufficient, but the appropriate procedure rather consists in repeating the mentioned exercise many times, to enable the best students to be maintained in the process of performance acquisition on the one hand, and to also allow the least deserving ones have the opportunity to improve and enhance their ability to prescribe correctly drugs for children.

Internal and external validity

This exercise enables to enhance not only students' mind of precision, accuracy and thoroughness in medical prescription in general, but also abilities that medical prescription in children is required. In the long term, it enables the physician-to-be to strive for excellence in medical prescription, for nowadays in common medical practice, it is admitted that 3 to 19% of medical prescriptions are wrong [1-3].

As regards accuracy of drugs proposed for prescription, learners' poor performances in this clinical situation during the first test is understood for those students who were not familiar with medical prescriptions in child. The objectives set for Pediatrics internship enable them to discover those particularities on one hand, and to become familiar with child-specific drugs on the other hand.

Learning through problem resolution was the learning method proposed. Anglo-Saxons call it « Problem-based pharmacotherapy teaching ». It puts learner in clinical situation, and enables him or her to solve a clinical problem through medical prescription writing. Some authors, including Mouala, have also reported the implementation of that method in their research works [15]. As far as our investigative work is concerned, it first consisted of determining child's clinical problem. Globally, we proposed a usual clinical case which is simple to solve, for what was sought in the student was medical prescription writing based on the proposed clinical case. The second part, focus of this research work, permits to identify the difficulties encountered by the student in recognizing the type(s) of drugs necessary for this clinical situation. Thus, less than half the students who had prescribed two good drugs during the first test, did it during the second test and during the second test 86.67% of the students proposed good drugs, versus 57.77% during the first test. However, the ideal situation would be that all the students succeeded in that prescription during the second test, hence the need to strengthen that learning system need to improve their performance and ability for accurate medical prescription.

Concerning the accuracy of pharmaceutical forms proposed for prescription by the learners, during both first and second tests, the performance indicates a significantly appreciable progression. Thus, it has been noted that less than half the students who, during the first test, submitted two correct pharmaceutical forms, did the same during the second test (35.15% versus 17.18%). In the same vein, 78.12% of those students during the second test, versus 31.25% during the first test ($p=0.000038$), submitted a correct pharmaceutical form for each of the three drugs proposed for prescription (Table 1).

In pediatric practice, adapted pharmaceutical forms are important, and classically those which are the most tolerated in children in case of absence of contraindications are oral forms. Such a learning, sustained and maintained over time, should help reduce errors in prescription of pharmaceutical forms, as reported by Afssaps. According to that agency, that the form of error would occur in 0.7% to 11% of cases [16].

As regards accuracy of doses proposed for prescription by learners, a significant progression was also noted. For instance, the progress is

very clear among the students who prescribed an accurate dose for each of three drugs proposed during the second test, compared to those who have correctly prescribed it for each of the three drugs during the first test (75.78% versus 42.96%, $p=0.0066$ (Table 1). The errors in doses reported by Afssaps were around 10%, with an average of 31% [17].

Concerning the accuracy of the dosages proposed for prescription through drugs in those tests, it has been noted that performances were lower compared to those observed for the other items. For instance, the ratio of students who did not prescribe correctly any good dosage of drugs, or prescribed correctly dosages of only one out of three drugs during the second test compared to the first, was estimated at 08.59% versus 35.55%; $p=0.000035$ and 33.59% versus 46.66% respectively (insignificant difference). That ratio improved for those who prescribed the accurate dosages of two or three drugs during the second test, compared to those who did it during the first test (37.50% versus 17.77%; $p=0.0084$ and 20.31% versus 0%; $p=0.0000041$ respectively for two drugs out of three and three out of three).

In this case, students' capacity to write accurate dosages of drugs in pediatrics seems to require more time for learning and commitment than simple knowledge acquisition. Control over doses of prescribed drugs would require more guidance and seems to develop over time. This fact requires considering the pharmacokinetic and pharmacodynamic particularities, by taking into account body surface, weight and half-life of drugs in child. Classically, a twelve-week internship is probably not sufficient to enable the acquisition of that knowledge in order to transmit the skills required. However, learning seems to be the excellent pathway to acquire abilities.

Regarding the accurate presentation of the whole medical prescription and the accuracy of its content, a significant progression was noted (Table 2 and Figure 1). But it is important to take stock of the students who made lower progression. In fact, in this research work, 23 students (17.96%) did not improve; among them 9 stagnated. This means that an additional guidance should be proposed and provided to those learners.

Sociodemographic and academic factors associated with good prescription

In this research work, the factors studied were gender and number of enrolments in the learning group. Gender seemed to be associated with good prescription of drugs on either side (as regards good medical prescription as well medical prescription to be improved) $p=0.00041$. Male students seemed to have shown the better possible progression compared to female students. But we had to be careful in our analysis, despite the elements of statistical significance, the number of girl students enrolled in that learning group was only 35 out of the 128 students and this fact may introduce a confounding factor that we could not identify in our observation.

Paradoxically, the number of enrolments in the considered learning group had no particular influence.

Strengths, weaknesses of the study and implications for future medical professional practice of student physicians.

At the end of this research work, we can say that the learning method consisted of a behaviorist approach. In fact, that approach allows at once acquisition of theoretical knowledge (knowledge), psychomotor (know how) and psycho-emotional (soft skills) behaviors by students [15].

The learning allowed us to apply cognitivist approach. According to that approach, competence acquisition is centered on the capacity to associate a category of situations with a template of existing solutions. For instance, in real situation, competence will result in successful treatment of the clinical situation in our case.

According to that theory, there are different learning levels in the formation of a competence, the extremes of which are « the beginner » who has a fragmentary approach of the situation and « the expert » who recognizes diagrams. The latter takes into account multiple parameters, organizes and classifies in a hierarchical fashion the assumptions adapted to the context so as to choose between the possible interventions [17]. However, DeVries' research works was about the exercise of medical prescription in adult and not in child. In this investigation, learners are at beginner level in medical prescription in a child with a health problem [17].

According to Article 70 (article R.4127-70 of the French public health Act), any physician is basically entitled to perform all procedures of diagnosis, prevention and treatment. But, he must not, except exceptional circumstances, (...) formulate prescriptions in any areas that exceed his knowledge and expertise, his experience and the means at his disposal [8]. However, in our context, learning deals about knowing how to prescribe accurately for future assurance, well advised and proven professional practice.

As regards didactical aspects, we used the learning method which responds in part to the practice of Objective Structured Clinical Examination (O.S.C.E.), proposed and developed by Harden since the 70's [18]. That method is a strategy through which students acquire competence for identifying, based on specific problems, the means necessary to develop their understanding and carry out their training. The experimentation of that learning pattern has also been reported by Raphael and Aubrege in Nancy in 1999 in its phases of design, implementation and evaluation (by means of a grid) as punitive assessment method in postgraduate program of general medical studies [19]. That method helps identify, at clinical level, the pediatric patient's problem in our context, to specify the therapeutic objective, and choose appropriate or favorite drug and treatment. It also ensures favorite treatment's adequacy with proposed clinical case to be treated. Moreover, it helps establish, analyze and prepare a drug for prescription, write a medical prescription and monitor that treatment. Prescription writing step was proposed in that exercise during two tests. But prescription content also deals with the normative aspects to ensure dispensation within an established medical and legal framework [15].

From Champagnol's research works we learn that, in fact, this learning approach based on problem resolution is implemented through knowledge acquisition and use of that knowledge and part of the applied exercise to solve the problem [20]. For instance, the learner uses abilities expressible through behaviors. For him, in a given context the problem may be considered as the motive for reaching the solution, or as starting point of the learning process [20].

According to literature, interest and satisfaction are noted in learners and lecturers who experience that teaching, for many reasons: several exchanges between participants; strengthened motivation of each of them; better mastered and deeper learning; establishment of relationships between practical (adaptation to virtual practice) and theoretical [15] knowledge. Therefore, students feel they learn in a more relevant and less theoretical manner, as regards drug prescription responsibilities that they will have to take [19], when they attend sick children.

The drawbacks seem to be the huge learning investment to be made by the institution involved in learning through problem resolution, creation of a "databank" of problems and lecturers' training to that form of tutoring [15,20].

Students' satisfaction with this type of assessment has not been evaluated in our study. Nevertheless, learning through problem resolution is often perceived as better, by comparing the satisfaction expressed by the participants to classical programs [21]. A controlled clinical test conducted in seven different countries over four continents (America, Europe, Africa and Asia) has pointed out the positive impact of that method on learning of drug rational prescription [1,15].

Conclusion

A clear progression was observed in that exercise which consisted in learning of writing medical prescription for children by physicians-in-training in a medical faculty. It has been achieved as part of problem-based pharmacotherapy teaching. Learning was preceded by a session of students' theoretical preparation, a presentation on drug prescription in pediatric practice. For instance, at the end of this research work, 7 out of 10 students during the second test, versus less than 2 out of 10 during the first test ($p=0.000702$), submitted an acceptable medical prescription without errors in the presence of the clinical situation presented to them. Improvement of acquisition may lie in repeating the experience over time, in order to establish in those learners sustained practice of medical prescription.

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