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Utility of Analytic Hierarchy Process in Assessing Pharmaceutical Education and Training Process

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Abstract: The aim of the paper was to identify students' preferences for a best pharmaceutical education and training (PET) option. The objectives were to present a useful instrument for academia decision-makers and to exemplify by identifying the most important criteria and alternative methods of education, from the receivers' viewpoint. Using a survey the significant training activities were determined. Applying the direct percentage method, Multiple Criteria Decision Analysis (MCDA) and the Analytic Hierarchy Process (AHP) they were classified into three criteria: teaching, self-training and evaluation activities. Data was analyzed and classified using pair wise comparison matrixes and students' preferences were determined. The consistency ratio values indicated the judgements had been correct and the consensus between respondents concerning the comparisons had been achieved. Results of the sensitivity analysis indicated the critical methods, those most sensible to survey participants' changes of opinion that could affect the decision process: dictation, power point, interactions with students, individual learning based on lecturers' presentations, browsing the entire material, debating and providing explanations for all topics of the subject and following the evaluation criteria previously established. AHP is a reliable tool in ranking alternatives and can be an important instrument for academic decision makers in managing the PET process.

Keywords: Analytic Hierarchy Process, Multi Criteria Decision Analysis, Pharmacy Education and Training, Sensitivity Analysis

1. Introduction

Performance and quality of the education process shapes the future professionals, influences the job opportunities, career paths, and individual contributions to the economic, cultural and social development of the country. Resource allocation decisions are usually intricate and involve compromises between the available alternatives. Depending on reliable evidences for adopting decisions represents an important condition for stakeholders [12].

The need to train for a specific position in the pharmaceutical field seems nowadays more stringent than before because of the increased competition and the insufficiency of material, financial and human resources. Carrier opportunities for pharmacists are mostly in the private sector and/or abroad. Pharmacists are important actors in the European health system and they need to have competencies and abilities in various domains: community and hospital pharmacy, industry, regulatory affaires [19], central administration [2], pharmaceutical marketing [1, 16, 17, 24, 25], pharmacogenetics [13], epidemiology [20, 23]. Employers desire professionals capable of adapting to a wavering environment (politic, economic and demographic). Thus, the academia needs to provide accessible and quality pharmaceutical training programs to satisfy the needs for students, professionals and stakeholders [18, 19].

An effective pharmaceutical education and training model is influenced by many factors, imperfect feedback and confronting trade-offs between alternatives. Inappropriate teaching, evaluation and self-training methods might cause loss of human resources, reorganization of disciplines and high costs for the decision-makers with the expense of competing universities.

According to scientific studies, structured approaches are

used to optimize the decisional process [7, 11, 14]. One of these is Multiple Criteria Decision Analysis (MCDA). This methodology was applied in various domains (defense, health, education, agriculture and forest management etc.) to increase the consistency, transparency and legitimacy of the judgements [4, 5, 27]. MCDA methods and models [9, 30] identify, compile and structure the information for decision-makers. Frequently, multi-criteria problems are analyzed with two or more techniques to compensate for possible deficiencies [15, 26].

The Analytic Hierarchy Process (AHP) approach is applicable for complex decisions concerning elements difficult to quantify [3, 21]. AHP uses ranking of alternatives and comparisons between each pair for every criterion (cluster). This method was selected for the present study because it is standardized, relatively easy to use and can fit sized problems ranking many alternatives. Although some researchers consider that ranking irregularities can occur, AHP has the benefit of underlying the importance of each component by decomposing a decision into its constituent parts and building hierarchies of criteria [10, 22, 28].

The objectives of this paper were to rank students' preferences concerning the methods and criteria used during teaching, self-education and evaluation, and confirm the applicability of AHP in the educational process of future pharmacists. Alternative training methods were compared in a survey designed and applied to pharmacy students, main beneficiaries, to help lecturers determine the best teaching model from the information receiver viewpoint.

2. Methods

To identify the importance of the activities and methods used during the education and training process, from the beneficiaries' standpoint, a survey was applied for final year undergraduate students of the Faculty of Pharmacy in Bucharest. The 4th and 5th years' students were asked to consider their acquired experience concerning the academic process, mainly the teaching, self-training and evaluation stages.

In the survey there were analyzed alternative activities for proposed criteria: 9 for the teaching phase, 3 for self-training and 8 for the evaluation stage (see figure 1).

It was considered that the main determinants of the teaching process were the approach (dictation, power point presentation, interaction with students), design (course organization, structuring, running, accuracy, technical equipment) and interactive alternatives (visits to pharmaceutical and health care facilities or facilitating dialogues with representatives of these institutions).

The quality of learning is also influenced by the amount of time allocated and students' interest concerning self-education. Thus the proposed options considered availability of references, lectures and scientific publications. For the assessment of the accumulated information, the choices targeted a description of the subject (summary of the discipline, distribution on the allocated number of hours), requirements (partial and final grades) and the degree of conformity with the presented prerequisites.

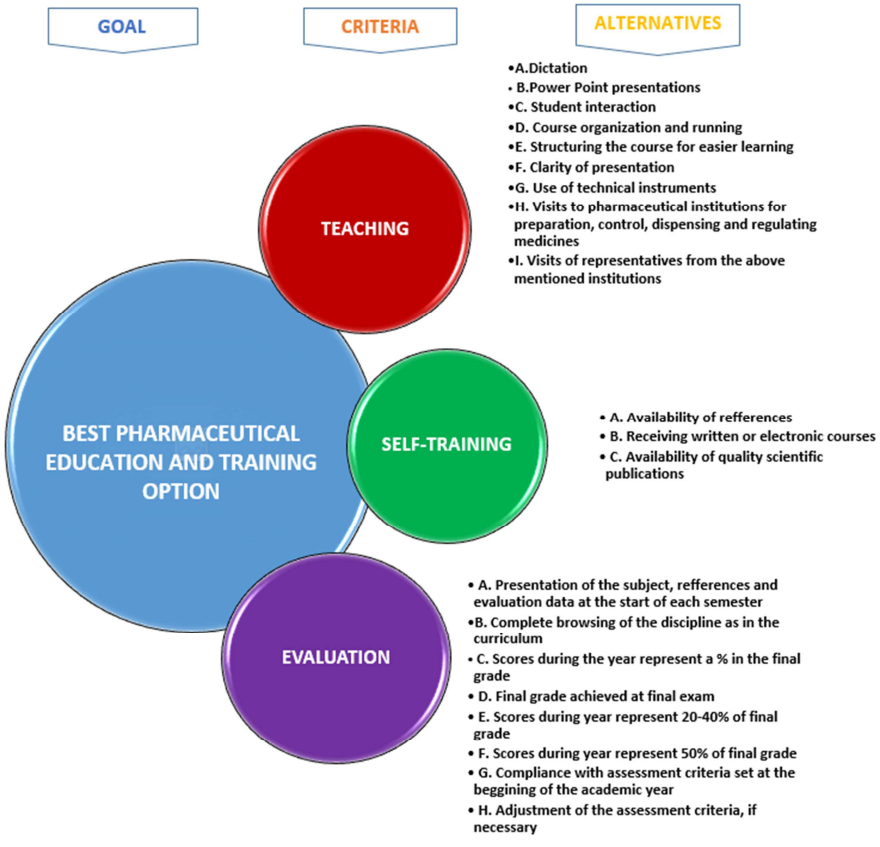

Figure 1. *Pharmaceutical Education and Training option. Goal. Criteria. Alternatives.*

Respondents were asked to rank and make pair wise comparisons for the three criteria and the alternative training methods adapted from the institutional assessment survey applied yearly to academics employed at "Carol Davila" University of Medicine and Pharmacy. Data were processed using a direct method, MCDA and AHP.

2.1. Direct method

In the direct method, criteria and alternatives were scored and the percentages indicated respondents' choices.

2.2. MCDA

To appraise individual methods, MCDA was used as an alternative to structural and functional equation modeling (FSEM) [18]. FSEM represents a set of statistical techniques that examines linear causal relationships, measures and analyzes the interactions between variables. Applying MCDA methodology required ranking the preferences, weight in gand aggregating the results using additive value models. The overall value obtained for each alternative was compared with the others.

2.3. AHP

AHP was selected from the various numbers and types of MCDA approaches, because it is considered, by specialists, to be a reliable method [21]. It was assumed that not all criteria and alternatives would have the same importance in the respondents' opinion [15, 26]. Thus relative priorities (weights) were derived, in respect with each criterion and alternative activity.

Students were asked to rate the paired comparisons, considering their importance, using the fundamental AHP numerical scale with integers from 1 to 9, proposed by professor Saaty in 2008.They indicated how many times more critical or superior one method was versus another. The equivalents used were: 1 if the importance of activities was equal; 3 if one is slightly more important than the other; 5 if an activity is more important than its pair; 7 if an action is much more important than another; 9 if an activity had the higher possible importance. Intermediate values (2, 4, 6 and 8) could be used if compromises were necessary. Results were organized into comparison judgement matrixes for teaching, self-training and assessment of pharmaceutical knowledge:

a) Value 1 on the diagonal;
b) If the value of element (i, j) > 1, factor in the i row is better than factor in the j column;
c) Else, the factor in the j column is better than the one in the i row;
d) The (j, i) element was the reciprocal of (i, j) element.

After normalizing the matrix (corresponding maximum eigenvector was approximated by the geometric mean of each row; then divided with their sum), the overall priorities were obtained and the results, checked for inconsistencies. Consistency ratio (CR) was calculated by comparing the consistency index of the matrix (CI) with the one of a random-like matrix (RI), found in scientific publications [22].

$$CR = \frac{CI}{RI},$$

$CR < 0{,}10$ *acceptable threshold to continue the analysis*

$CR > 0{,}10$ *review of judgements is needed*

$$CI = \frac{\lambda_{\max} - n}{n-1}$$

$n = number\ of\ criteria\ and/or\ alternative\ activities$

$\lambda_{\max} = approximation\ of\ the\ \max imum\ eigenvalue$

The over all priorities were obtained for each criterion and alternative activity using the AHP Excel Template with Multiple Inputs proposed by professor Goepel K. D. in 2013 and revised in 2018. The responses were sampled for groups of maximum 20 because the algorithm had to be applied with a fixed number of iterations. A sensitive analysis was performed to see how robust the optimal solution was and identify the drivers that influence the first results (changes of the results with different weights for criteria).

Critical alternatives [8, 28] were identified. The smallest changes of the best methods (according to weights) had been analyzed in absolute terms (w1-w1, where w1= initial weight and w1`= proposed weight) and relative to each other ($\frac{w_1 - w_1'}{w_1} x100$).

Subsequently the changes in rankings were considered by calculating the sensitivity coefficients: $sens(Ai) = \frac{1}{\min(relative\ w_i)}$, where Ai was the alternative method for each criteria.

Table 1. *Values of absolute and relative changes in criteria weights.*

A1……An		
Comparing alternatives	**Absolute change**	**Relative change**
A_1-A_2 ……. A_i-A_n	$AC = \frac{wA_2 - wA_1}{P_{A_2} - P_{A_1}}$	$RC = \frac{AC * 100}{w_{A_1}}$

A_i= alternatives, i=1…n, where n=9 for teaching methods; n=3 for self-training and n=8 for assessment methods, w_{Ai}= weight, P_{Ai}= overall values (preferences) for alternative A_i.

3. Results

60 questionnaires were collected, of which 50 validated (10 were considered invalid because they were not fully or correctly filled). Using the direct method there were obtained the following percentages for the 3 main criteria with regard to their importance: 33% for teaching methods, 35.6% for self-training and 31.4% for evaluation.

The MCDA value- based approach produced slightly higher rates implying a change in the hierarchy of students' preferences: 34.9% for teaching methods, 33.5% for evaluation and 31.6% for self-training. It was considered that

developing a total value score using weights for each criterion might still not accurately reflect students' choices. Therefore, AHP was applied.

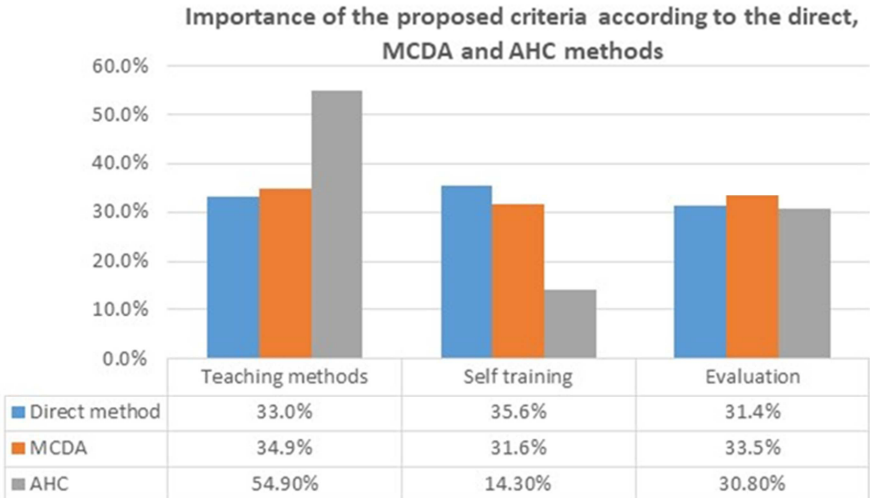

Figure 2. *Results on the importance of education and training criteria according to three statistical methods.*

Results indicated that 54.9% of the students considered teaching methods to be the most important; evaluation methodology was second with 30.80% followed by self-training as reported by 14.30% of survey participants.

As illustrated in figure 2, the direct method, MCDA and AHP were useful instruments in differentiating students' preferences on teaching methods, self-training and evaluation. AHP was the most sensitive one, because it provided a clear prioritization for the criteria.

The consensus between respondents was 77% (λ = 3.0007, CR=0.1) indicating the teaching methods are very significant to students involved in the academic process, followed by the evaluation methodology (30.8%) and the self-training (14.3%).

3.1. Students' Preferences on Teaching Methods

Results of applying AHP methodology to determine the overall preference and rank the alternative methods of teaching are presented in figure 3.The pairwise comparison of the 9 alternative teaching activities resulted in ranking on 4 main levels, according to the students' prioritization: I. discussions with specialists from the pharmaceutical field, II. courses structure, III. quality and novelty of the ancillary instruments and IV. didactic methods. An important place in students' opinions, with 76.8% accord (α =0.1, λ = 9.129, CR=1%), were consolidating the knowledge with the help of practitioners. 53.04% students ranked external visits and free discussions with pharmaceutical professionals as the best uptake methods.

Matrix		1 Dictation	2 Power Point presentation	3 Student interaction	4 Course organization and running	5 Course structuring	6 Clarity of presentation	7 Use of technical instruments	8 Visits to pharmaceutical institutions	9 Visits of representatives of pharmaceutical institutions	normalized principal Eigenvector
Dictation	1	1	5/6	2/3	7/8	1/2	1/4	3/4	1/5	1/5	4.06%
Power Point presentation	2	1 2/9	1	3/4	7/8	5/9	1/4	2/3	1/5	1/5	4.29%
Student interaction	3	1 5/9	1 1/3	1	1	1/2	2/7	7/9	1/5	2/9	5.06%
Course organization and running	4	1 1/7	1 1/7	1	1	3/5	2/7	5/7	1/5	1/5	4.78%
Course structuring	5	1 8/9	1 4/5	1 8/9	1 2/3	1	3/8	1	1/4	1/4	7.08%
Clarity of presentation	6	4 1/6	4	3 3/5	3 2/3	2 2/3	1	2 3/7	2/5	3/8	15.31%
Use of technical instruments	7	1 1/3	1 1/2	1 2/7	1 2/5	1	2/5	1	1/4	1/4	6.37%
Visits to pharmaceutical institutions	8	5 1/5	5 1/5	4 7/9	5	4 1/9	2 1/2	4	1	4/7	24.58%
Visits of representatives of pharmaceutical institutions	9	5 1/2	5 1/2	4 3/7	4 5/7	4 1/9	2 5/7	4 1/5	1 3/4	1	28.46%

Figure 3. *Pairwise comparison matrix for alternative teaching methods. Overall preferences.*

A clear presentation of the subject was considered to be very important in the training process by 15.31%. Therefore, course structuring (7.08%), use of technical, modern instruments (6.37%), interaction with students (5.06%) are similarly relevant for the survey respondents. Students did not considered the power points displays (4.29%) or the dictation method (4.06%) to be significantly different in the apprehension process. To identify the most critical alternatives (A) in terms of priorities and weights, the sensitivity analysis was used. Results are presented in Table 2.

Table 2. *Calculation of priorities for nine alternative teaching methods.*

	A1	A2	A3	A4	A5	A6	A7	A8	A9	Priorities
Weight	0.04	0.04	0.05	0.05	0.07	0.15	0.06	0.25	0.29	$\sum_{i,j=1}^{9} aij * wj$ aij = element from line i and column j wj = weight on column j
A1	1.00	0.82	0.64	0.87	0.53	0.24	0.74	0.19	0.18	0.37
A2	1.21	1.00	0.74	0.87	0.56	0.25	0.67	0.19	0.18	0.39
A3	1.56	1.35	1.00	0.95	0.53	0.28	0.77	0.21	0.23	0.46
A4	1.15	1.15	1.05	1.00	0.61	0.27	0.72	0.20	0.21	0.44
A5	1.88	1.79	1.89	1.64	1.00	0.37	0.97	0.24	0.24	0.65
A6	4.17	3.95	3.59	3.66	2.68	1.00	2.43	0.41	0.37	1.40
A7	1.35	1.49	1.29	1.39	1.03	0.41	1.00	0.25	0.24	0.58
A8	5.18	5.18	4.78	5.08	4.11	2.46	3.92	1.00	0.57	2.25
A9	5.48	5.48	4.44	4.72	4.11	2.73	4.19	1.75	1.00	2.60

According to data in the above table, students would choose the following ranking for the different teaching methods: A9>A8>A6>A5>A7>A3>A4>A2>A1. Visits to or from representatives of pharmaceutical institutions were considered very important in training (A9=2.60, A8=2.25). Accuracy of presentations (A6=1.4) was also an important incentive in the learning process.

Results of the sensitivity analysis showed that changes (absolute values) in hierarchy of alternatives A1 (dictation), A2 (power point presentation) and A4 (organization and running the course) occur more frequently than for other educational activities. In relative terms, methods A9, A8, A6 presented smaller relative changes (in weights) compared to the initial values, indicating these techniques are very important from the students' perspectives. Results for the sensitivity coefficients reflected by the critical degree of each alternative are presented in Table 3.

Table 3. *Sensitivity coefficients for alternative teaching methods.*

Alternatives	A1	A2	A3	A4	A5	A6	A7	A8	A9
Sens (Ai) =1/D, i =1 to 9 Ai= alternative D=critical degree	0.01	0.02	0.02	0.002	0.003	0.003	0.001	0.005	0.001

Values of the sensitivity coefficients confirmed the previous results and the validity of the options used in the teaching process (A1, A2, A3 are the most sensitive alternatives for teaching).

3.2. Students' Preferences on Individual Learning

In the figure 4, there are presented the comparison matrix for alternative methods useful in self-training and the students overall preferences expressed by the normalized principal Eigenvector.

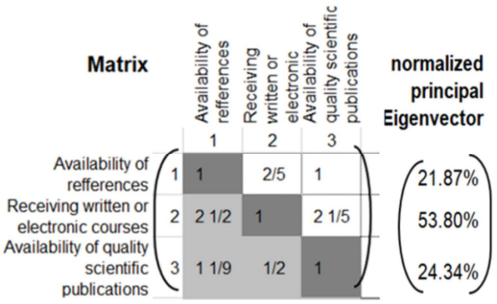

Figure 4. *Pair wise comparison matrix for alternatives of self-training. Overall preferences.*

As seen in the above figure, students want and consider very effective in the self-training process, to receive the written or electronic courses (53.8%). They are less interested to read scientific publications (24.34%) and/or published references (21.87%). The consensus for this criterion was 63.2% (α =0.1, λ = 3.000, CR=0.0%).

Results of the sensitivity analysis showed that the most critical criteria in absolute terms were the first and the third alternative. Results were confirmed by the smaller values for the second alternative in relation with the other two. The most sensitive criteria for the decision-making process concerning self-training were first (sensA1=0.0045) and third (sensA3=0.0044), compared to the second alternative (sensA2=0.003) as agreed by the majority of students that participated in the survey.

3.3. Students' Preferences on Evaluation Methods

Results from the paired comparison of the 8 alternatives considered in the evaluation process are presented in figure 5.

Matrix		1 Presentation of the subject, refferences and evaluation data at the start of each semester	2 Complete browsing of the discipline as in curriculum	3 Scores during the year represent a % in the final grade	4 Final grade achieved at the final exam	5 Scores during the year represent 20-40% of final grade	6 Scores during the year represent 50% of final grade	7 Compliance with the assessment criteria set at the beginning of the academic year	8 Adjustment of the assessment criteria if necessary	normalized principal Eigenvector
Presentation of the subject, refferences and evaluation data at the start of each semester	1	1	2/3	1/2	2/3	1/2	2/3	2/5	2/5	6.68%
Complete browsing of the discipline as in curriculum	2	1 5/9	1	3/5	1	1/2	2/3	4/9	1/2	8.39%
Scores during the year represent a % in the final grade	3	2	1 2/3	1	1 1/8	3/4	1	2/3	5/8	11.96%
Final grade achieved at the final exam	4	1 3/7	1	8/9	1	3/5	5/6	3/7	1/2	9.09%
Scores during the year represent 20-40% of final grade	5	2 1/5	1 7/8	1 3/8	1 2/3	1	1 2/5	3/5	5/9	14.21%
Scores during the year represent 50% of final grade	6	1 5/9	1 3/7	1	1 2/9	5/7	1	2/3	5/8	11.35%
Compliance with the assessment criteria set at the beginning of the academic year	7	2 3/7	2 1/4	1 1/2	2 1/3	1 5/8	1 1/2	1	5/6	18.65%
Adjustment of the assessment criteria if necessary	8	2 1/2	2	1 3/5	2 1/7	1 4/5	1 3/5	1 1/5	1	19.66%

Figure 5. *Pairwise comparison matrix for methods of evaluation. Overall preferences.*

Students believe (45%) that each discipline should start with the main objectives, important references (6.68%) and the specification of assessment requirements (38.32%). 8.39% of the survey participants considered significant if the lecturer runs through the entire material, according to the analytic catalog, during courses.

37.52% of the respondents preferred using the partial scores for each subject (obtained during the education process) in the calculation of final grade compared to 9% who wished that the mark received at the final exam to be the definitive one. Consensus for this criteria was 50% (α =0.1, λ = 8.050, CR=0.5%) and the comparison of the 8 alternatives was valid.

The sensitivity analysis was applied to determine the

critical alternatives for absolute and relative weights and the sensitivity coefficients for each assessment method. The obtained results indicated that both in absolute and relative terms the most critical alternatives, considering changes in students' opinion, were hierarchized as follows: A1>A2>A4>A6>A3>A5>A7>A8.

The most sensitive methods for the decision process concerning assessment criteria were: introduction and description of the discipline and evaluation requirements ($sens_{A1}$=0.050), contribution of partial evaluations in the final grade ($sens_{A3}$=0.049), compliance with the pre-defined criteria ($sens_{A7}$=0.0347) and running through the entire teaching material ($sens_{A2}$=0.0342). The alternatives least prone to influence the decision process were A4 (students' scores for each subject are those from the final exam; $sens_{A4}$=0.02) and A6 (students' performance during the year should represent 50% of the final grade; $sens_{A6}$=0.01).

4. Discussions

As responses indicated, teaching, self-training and evaluation are the relevant and equally important activities during the education and training process for pharmacists. An improvement in the teaching methodology (e.g. interactive presentations) could adjust for a reduced time allocated to self-training and facilitate an accurate assessment of the students (e.g. clear and transparent scales).Thus it can be considered that the 3 criteria compensate each other.

The preliminary results would suggest that sometimes respondents prefer individual study to attending the lectures. However, according to the MCDA value measurement, students would chose to use less personal time for self-training and accumulate the necessary knowledge fast and direct at courses and seminaries.

Although it seemed students considered there was no significant difference between criteria, the AHP method showed a clear hierarchy in terms of importance: teaching methods (54.9%) > evaluation methodology (30.80%) > self-training (14.30%). Next phase of the study was ranking alternatives for each criteria and emphasizing the ones that influence the most the decision-making process.

4.1. Teaching Methods

According to the survey participants, students wish to learn mostly by joining or seeing the professionals work (24.58% want to visit different institutions that employ pharmacists) and discussing specific aspects (28.46% choose to participate at open debates with professionals) concerning the requirements and activities included in the job description. Results emphasized the interest of survey respondents for the future of the profession and indicated a willingness to work in the pharmaceutical field even from the early years of undergraduate pharmaceutical programs.

The disciplines studied influence the importance of teaching methods like dictation, power point presentations and debates, in students 'preferences. A well-structured presentation would facilitate understanding of the subject, could reduce the allocated time for self-training and increases the efficiency of the evaluation process.

The alternatives most sensitive in the teaching process were the format of courses (dictation, power point presentations and discussions) while the less sensible to change, students' favorites, are visits and debates with pharmaceutical professionals.

4.2. Self-training Methods

Results obtained for alternative methods of individual training indicated that students prefer to learn and focus on the basic aspects of the main pharmaceutical disciplines learned during lectures in the undergraduate years. The research competencies and abilities are mostly used throughout preparing and defending the diploma/licence paper. However, in this phase a larger amount of time and effort needs to be allocated to find all the relevant publications.

The importance of self-learning by consulting available references and scientific publications might change faster in students' view, but their first choice would always be to receive the presentations in written or electronic form.

4.3. Assessment Methods

Considering the results for the alternative activities in the evaluation process, it can be seen that students regard as priorities respecting the predefined criteria for evaluation, presented at the beginning of every subject. In some cases, they are willing to accept changes in the examination methods (19.66% compared to 37.52%). This indicated respondents' preferences for transparency of the assessment and its consistency with the requirements established in the curriculum.

The fact that respondents would like that the final grades for each subject to consider their evolution and implication during the training process, suggested the students were interested in learning and developing abilities needed in practice. Although the previous results indicated that in some cases the majority of the survey participants prefer to receive the written or electronic form of the courses instead of attending, students recognized the importance of participating at presentations and discussing all the topics in the discipline plan as well as the evaluation methodology.

5. Limitations

The present study has limitations due to individual-assessment bias (the survey depended on participants' perception and accuracy of their answers) that may influence the internal validity. AHP methodology may present problems because of the interdependence of criteria and alternatives which can produce inconsistencies between judgements and rankings or hierarchy reversal. However, it

was considered that prioritization of criteria and alternatives was superior to other methods previously used in evaluating institutional performance.

6. Conclusions

The results obtained from the survey indicated its usefulness in decisions concerning under- and postgraduate pharmaceutical education programs. Even though at first the conclusion could have been that students viewed alike all the measures, applying AHP helped to identify a between the criteria. Results of the sensitivity analysis indicated the alternative methods needed to assure that the proposed pharmaceutical education and training model will perform effectively if changes occur in variables or assumptions.

The best pharmaceutical education and training option from students' point of view considers important all three criteria - teaching, evaluation and self-training -for the training of future professionals. Students want lecturers to adapt designs and methodologies used in lectures to the specificity of each subject, facilitate access to syntheses of presentations, discuss all topics, respect the evaluation criteria presented and consider performances and participation in the academic process. In conclusion, it was considered according to students' preferences that AHP can be a decision support instrument used to rank alternatives and identify the critical methods that influence an optimum pharmaceutical education and training process, from the students' standpoint.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

Appendix

A. How important are the following criteria and alternatives in the pharmaceutical education and training process? Please propose percentages you consider adequate.

i. Teaching methods
   1) Dictation
   2) Power point presentation
   3) Student interaction
   4) Course organization and running
   5) Structuring the course for easy learning
   6) Clarity of presentation
   7) Use of technical instruments
   8) Visits to pharmaceutical institutions for preparation, control, dispensing and regulating medicines
   9) Visits of the representatives from the above mentioned institutions

ii. Self-training
   1) Availability of references
   2) Receiving written or electronic courses
   3) Availability of quality scientific publications

iii. Assessment
   1) Presentation of the subject, references and evaluation data at the start of each semester
   2) Complete browsing through the discipline as in the curriculum
   3) Scores during the year represent a % in the final grade
   4) Final grade achieved at final exam
   5) Scores during the year represent 20-40 % of the final grade
   6) Scores during the year represent 50% of the final grade
   7) Compliance with the assessment criteria set at the beginning of the academic year
   8) Adjustment of the assessment criteria, if necessary.

B. Please indicate by ticking the appropriate box in each row. Keep in mind that the results of this survey will be used for decision making in a multiple-criteria decision analysis (MCDA) model and in the Analytic Hierarchic Process (AHP).

Table 4. *Comparison of criterion A with criterion B.*

Criterion A	A is dominant 9	A is very strongly more important 7	A is strongly more important 5	A is slightly more important 3	A and B equally important 1	Criterion B
Teaching						Self-training
Teaching						Assessment
Self-training						Assessment
Teaching methods						

Criterion A	A is dominant 9	A is very strongly more important 7	A is strongly more important 5	A is slightly more important 3	A and B equally important 1	Criterion B
Dictation						Power point presentation
Dictation						Student interaction
Power point presentation						Student interaction
Dictation						Course organization and running
Power point presentation						Course organization and running
Structuring the course for easy learning						Clarity of presentation
Dictation						Use of technical instruments
Dictation						Visits to pharmaceutical institutions for preparation, control, dispensing and regulating medicines
Dictation						Visits of the representatives from the above mentioned institutions
Power point presentation						Visits to pharmaceutical institutions for preparation, control, dispensing and regulating medicines
Power point presentation						Visits of the representatives from the above mentioned institutions
Visits to pharmaceutical institutions for preparation, control, dispensing and regulating medicines						Visits of the representatives from the above mentioned institutions
Self-training						
Receiving written or electronic courses						Availability of references
Receiving written or electronic courses						Availability of quality scientific publications
Availability of references						Availability of quality scientific publications
Assessment						
Presentation of the subject, references and evaluation data at the start of each semester						Complete browsing through the discipline as in the curriculum
Scores during the year represent a % in the final grade						Final grade achieved at final exam
Scores during the year represent 20-40 % of the final grade						Final grade achieved at final exam
Scores during the year represent 50% of the final grade						Final grade achieved at final exam
Compliance with the assessment criteria set at the beginning of the academic year						Adjustment of the assessment criteria, if necessary
Presentation of the subject, references and evaluation data at the start of each semester						Compliance with the assessment criteria set at the beginning of the academic year
Presentation of the subject, references and evaluation data at the start of each semester						Adjustment of the assessment criteria, if necessary

Table 5. *Comparison of criterion B with criterion A.*

Criterion A	B is slightly more important 3	B is strongly more important 5	B is very strongly more important 7	B is dominant 9	Criterion B
Teaching					Self-training
Teaching					Assessment
Self-training					Assessment
Teaching methods					
Dictation					Power point presentation
Dictation					Student interaction
Power point presentation					Student interaction
Dictation					Course organization and running
Power point presentation					Course organization and running

Criterion A	B is slightly more important 3	B is strongly more important 5	B is very strongly more important 7	B is dominant 9	Criterion B
Structuring the course for easy learning					Clarity of presentation
Dictation					Use of technical instruments
Dictation					Visits to pharmaceutical institutions for preparation, control, dispensing and regulating medicines
Dictation					Visits of the representatives from the above mentioned institutions
Power point presentation					Visits to pharmaceutical institutions for preparation, control, dispensing and regulating medicines
Power point presentation					Visits of the representatives from the above mentioned institutions
Visits to pharmaceutical institutions for preparation, control, dispensing and regulating medicines					Visits of the representatives from the above mentioned institutions
Self-training					
Receiving written or electronic courses					Availability of references
Receiving written or electronic courses					Availability of quality scientific publications
Availability of references					Availability of quality scientific publications
Assessment					
Presentation of the subject, references and evaluation data at the start of each semester					Complete browsing through the discipline as in the curriculum
Scores during the year represent a % in the final grade					Final grade achieved at final exam
Scores during the year represent 20-40 % of the final grade					Final grade achieved at final exam
Scores during the year represent 50% of the final grade					Final grade achieved at final exam
Compliance with the assessment criteria set at the beginning of the academic year					Adjustment of the assessment criteria, if necessary
Presentation of the subject, references and evaluation data at the start of each semester					Compliance with the assessment criteria set at the beginning of the academic year
Presentation of the subject, references and evaluation data at the start of each semester					Adjustment of the assessment criteria, if necessary

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