A Combined AHP- PROMETHEE II approach in Educational Assessment of Islamic Education lessons for Medical Courses in University of Medical Sciences

Research Article

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Abstract

This study aims to introduce and use new combined methods called analytic hierarchy process (AHP) and PROMETHEE II in order to prioritize the important criteria and indexes in educational assessment of Islamic education lessons for medical courses at university from the point of view of students. For this purpose, the comments of medical students of Tehran University of medical sciences were used. The number of samples was selected to be 191 by using Cochran formula and a researcher based questionnaire including 3 criteria of cognitive, Attitudinal and scientific skills with 14 overall indexes has been designed. Then, by using AHP method, the weights of criteria were determined and then the best index was selected for developing the aims of curriculum using PROMETHEE II and other indexes were prioritized. Based on the results, it has been determined that students believe that in assessing of Islamic education lessons for medical course at universities, the scientific, Attitudinal and cognitive skills must be prioritized as first to third ranks and also among the given indexes, convincing students to do research, rising their knowledge in different fields, improving Mental powers, Voluntary actions and being educated and trained accurately are prioritized as first to third ranks.

Keywords: Needs Assessment, Educational Assessment, Islamic Education Lessons, Medical Course, AHP, PROMETHEE II .

Introduction

Today, assessment in educational organizations is the powerful arms for principals and teachers by which, we can make a decision about stopping, continuing, adjusting or modifying and developing of curriculum. Assessment is one of the most important ten-fold elements of strategic model in designing curriculum (1). The aim of assessment is to clarify the errors, advantages and disadvantages of curriculum and acquiring more information, which can effect on making decisions related to curriculums. In this case, by discovering the beneficial solutions, those involved in educational system can achieve their goals. Assessment is actually a kind of "feedback system" and if the students fail to accomplish, these courses must be held again and if they succeeded to accomplish, they must promote to next level and in case that the goals are not beneficial, they must be revised.

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The first definition of assessment was recorded in the name of Tyler. He considered the assessment as a means to determine the success of curriculum in order to achieve the favorable educational goals(2) Stufflebeam (3) defined the assessment as, the process of determining, acquiring and preparing useful data to judge decisions. Cronbach (4) considered the assessment as collection and using the data to make decisions about curriculum. In according to his belief, determining whether the curriculums are successful or not can be possible by collecting the data in actual, learning-teaching situations and any kind of decision about the curriculum must be made based on the collected data. Also, other authors presented alternative approaches to program evaluation which included, in chronological order, publications by(5-21) assessing the curriculum in three fold stages of designing, implementing and assessing can be done, which are called diagnostic, formative and finals assessment. Diagnostic assessment is done before starting teaching and its aim is not only to collect data relating to the ability and background knowledge of students in order to inform about the educational shortcomings and its compensation, but also the diagnostic assessment evaluates the basic learning's or the initial behavior of students, which is required to learn new materials in order to make decisions about starting teaching. The aim of informative assessment is to inform about the gradual progress of student in some parts of lessons during teaching and help him to improve and complete the new

learning's based on the predetermined educational aims. The informative assessment is applied aiming at improve teaching and learning. This assessment leads to emerge the students' thoughts and evaluates their status. The final assessments, which are called summative assessment, are applied at the end of a training course or the end of a unit course. The most important strategies of assessment include: multiple choice tests, true- false tests, matching tests, explanatory or writing tests, the assessment of team work, workbooks, self-assessment, evaluation by classmates, writing and collecting a scientific article and projects(22,23). When the teacher wants to present the contents by teaching methodology, facilities and training materials, it is essential that the methods and techniques of assessment be prepared shortly after codification of educational goals because as you know, the educational aims shows the function of learner on one hand and the expectation of teacher on the other hand. In other words, the educational aims predetermine the criteria and methods of assessment, so every teacher exactly knows how to assess what he wants to teach.

The assessment, on one hand, should be a tool of diagnosis which means that it should be able to gain reliable data about the level of activities of students during learning and the amount of learning's, progress and failure; and on the other hand, it should be able to show the strength and weakness of teaching methods, whether the aims of teaching is valuable or explicit, the validity of content and also choosing the accurate teaching material and adequacy of tools applying in measuring the learners' progress. So the essential principles of assessment process include: the symmetry of assessment with learning aims, considering the assessment as a part of learning process, using the tools and various strategies, continuous supervision on the quality of strategies, making feedbacks and helping to improve learning, being holistic and related to the actual life, being related to the learning theories governing on the assessment curriculum;

The aim of this study was to recognize and prioritize the important criteria in educational assessment of Islamic education lessons for medical courses at university from the point of view of students and based on three main criteria of cognitive, attitudinal and scientific skills. For this purpose, the AHP and PROMETHEE II Techniques were integrated.

Materials and Method

Using multi-criteria decision-making methods requires the separation of a problem with three different levels, which the high level represents the main goal of the decision-making process, the second level represents the main criteria and, final level, provides of decision options.

By studying the theoretical principles researches in this field and interviewing with 39 professors and experts, important Criteria and indexes in the assessment of Islamic education lessons for medical course at university were extracted.

Finally, after receiving the opinions of these individuals, the final questionnaire with a main goal, three main criteria and 14 options were prepared. Figure

1 shows the decision tree for the subject under study (Table 1).

Table 1: decision tree for the subject under study

Main goal	Prioritization of Criteria and Indexes Effective in the Formulation of Educational Objectives for Islamic education lessons in medical courses

Criteria	Indexes
Cognitive skills	Deepening in cognition and believing in principles
	Deepening in professional ethics
	Strengthening the analysis powers in students
	responsibility and work ethic
	Raising awareness of professional and ethical guidelines and respect their rules
Attitudinal skills	Reinforcing and promoting the human dignity
	Boosting the mental powers, Voluntary actions, being educated well
	Self-actualization and preparing the personal growth and purification
	Simplifying the human growth and development and divine and human ideals
	Reinforcement and consolidation and deepening the divine, national and human dignity of students
	Social character development
Scientific skills	Expanding the borders of knowledge and sublimation and its promotion
	Arising the level of general knowledge in different fields
	Convincing the students to do research

The present study is of cross-sectional type and its sample included medical students of Tehran University of Medical Sciences during 2013-2016.

With regard to the limited number of investigated samples, 191 samples from 380 samples were determined by classified sampling and randomly and based on Cochran formula.

According to Table 1, in order to prioritize the important criteria in the assessment of educational process of Islamic education lessons for medical courses at university, a researcher made questionnaires were handed out among the students. The mentioned questionnaires included 14 indexes for three criteria of cognitive (5 indexes), attitudinal (6 indexes) and scientific skills (3 indexes).

At this stage, the reliability and validity of the designed questionnaire for reviewing the viewpoints of students about the assessments of educational progress in medical course were investigated.

In addition, by AHP method, the weight of each criterion was determined and finally by PROMETHRE II method, the indexes were ranked.

In this study, process of research includes 4 stages. First, the given issue is arisen and then by using

the comments of experts and previous studies, the proper criteria for codifying the educational aims of Islamic education lessons for medical courses at university. The weights of these criteria are obtained from collecting the comments of experts by AHP method. Finally, the main indexes are ranked by using the weighted criteria during the process of PROMETHEE II.

Analytic Hierarchy Process (AHP)

As a multi- criterion decisions making method, AHP is mostly applicable in solving the advanced issues with complicated criteria. Applying this method in solving various issues suggests the capability and functionality of this method (24).

Analytic Hierarchy Process (AHP) is one of the most famous techniques of multiple decision making which was invented by Thomas L Saaati Araghi-Asl in 1970s. This method is used when decision-making faces with different competitors and criteria of decision-making options. The proposed criteria can be qualitative and quantitative. This decision-making method is based on pair comparison. The decision maker starts with preparing the hierarchical decision tree. Hierarchical decision tree shows the factors being compared and the competitor options being assessed. Then some pair comparison will be done. These comparisons determine the weight of each factor in parallel with competitor options. Finally, AHP integrates the matrixes resulting from the paired comparison, which results in optimized decision.

The first step in AHP is creating graphical figures in which the aims, criteria and sub-criteria are shown. In AHP, the components of each level are compared in pairs with its related component in higher level and their weights will be calculated. These weights are called relative weight.

To calculate the relative weights, four methods can be used: 1. Row sums, 2. Column sums, 3. Arithmetic mean, 4. Geometrical sums.

Then, by combining the relative weights, the final weight for each option will be determined. All of the comparisons in AHP are done in pair.

PROMETHRE II

Applying PROMETHRE II requires two additional data. The one includes data about the relative importance (that is weights) of investigated criteria and the other includes data about the decision-maker preference function which is used separately when comparing the options with respect to each criterion (25). When we compare two criteria of a,b ϵ A, we must state the results of these comparisons based on a preference(26). In PROMETHRE II, preference function of each criterion is mostly determined by the nature of each criterion and viewpoint of decision maker (27). Preference function shifts the difference between the amounts of *a* and *b* options changing from 0-1(25):

$$P_j(a,b) = F_j(d_j(a,b)] \tag{1}$$

In which:

$$d_j(a,b) = f_j(a) - f_j(b) \tag{2}$$

$$0 < P_j(a,b) < 1 \tag{3}$$

There are 6 functions predetermined for $F_j(d_j(a,b)]$ which cover most of the applications and include: general criterion, Gaussian measure, linear (v shape), the same level criterion, criterion with linear preference and indifferent standard and parts standards (U shape) (27). Any form og preference function depends upon two threshold values of *q* and *p*. The value of q is the indifference threshold which suggests the largest deviation that can be ignored and p suggests the smallest deviation that can be considered as definite preference, p cannot be less than q. Also, Gaussian measure is an intermediate value which can be used by Gaussian preference function. In next level, total preference index is calculated as:

$$\pi(a,b) = \sum_{j=1}^{k} P_j(a,b).w_j \tag{4}$$

In which π (a,b) is weighted sum of P(a,b) for each criterion and w_j is the related weight with j. The positive flow (output) of preference is calculated as:

$$\Phi^-(a) = \frac{1}{m-1}\sum \pi(a,x) \tag{5}$$

The negative flow (input) of preference is calculated as:

$$\Phi^-(a) = \frac{1}{m-1}\sum \pi(a,x) \tag{6}$$

PROMETHRE I method ranks the options slightly while PROMETHRE II ranks the options completely by calculating net flow. The net flow is calculated by:

$$\Phi(a) = \Phi^+(a) - \Phi^-(a) \tag{7}$$

Some data about the incomparable options in PROMETHRE II method are removed(28). The more the output flow and the less the input flow is, the better the activity will be. Comparison of non-ranking flows for PROMETHRE II is calculated by:

$$\begin{cases} aP^Ib \text{ if} & \begin{pmatrix} \emptyset^+(a) > \emptyset^+(b) \text{ and } \emptyset^-(a) < \emptyset^-(b) \\ \emptyset^+(a) > \emptyset^+(b) \text{ and } \emptyset^-(a) = \emptyset^-(b) \\ \emptyset^+(a) = \emptyset^+(b) \text{ and } \emptyset^-(a) < \emptyset^-(b) \end{pmatrix} \\ aI^Ib & \emptyset^+(a) > \emptyset^+(b) \text{ and } \emptyset^-(a) = \emptyset^-(b) \\ aR^Ib & \text{otherwise} \end{cases} \tag{8}$$

Then, this partial order will be delivered to the decision maker in order to make a decision about the issue. If the decision maker needs the general order, the method of complete ranking (PROMETHRE II) will be used. This method can simplify the ranking of activities (28).

A will be preferred to b if Φ(a) > Φ(b) and also a will be incomparable to b if Φ(a) = Φ(b).

Results and Discussion

The demographic data of scholars in this study is shown in Table 2.

Table 2: Demographic data of scholars

Mean age	40 years old
Job experience mean	8 years
Gender	32 males and 7 females
Scientific degree	Professor 4, associate prof 5, assistant prof 9, instructor 21
Number of participants	39 professors and experts in religion course

The reliability and validity of the designed questionnaire for reviewing the viewpoints of students about the assessments of educational progress in medical course were investigated. The amounts of coefficients for this questionnaire are shown in Table 3.

Table 3: Validity and reliability of the questionnaire

Dimensions	The number of questions	average variance extracted (AEV)	Reliability coefficient (RC)	Cronbach's alpha coefficients
Cognitive skills	5	0.82	0.88	0.826
Attitudinal skills	6	0.84	0.91	0.881
Scientific skills	3	0.85	0.92	0.805

According to the above table, Cronbach's alpha coefficients for each dimension and total coefficient are more than 0.7, which suggest the high reliability of the questionnaire. Also, regarding to the amounts of RC and AVE, convergent validity of the questionnaire is approved.

Then, the experts and scholars were asked to compare three main criteria with other criteria and determine its significance. For this purpose, the scales of completely important, very important, more important, less important and equally important were used which were shown as 9,7,5,3, 1, respectively. According to Table 4, after determining the inconsistency rate of comments and excluding the inconsistent comments by AHP, the weights of main criteria were determined.

Table 4: Weights of main criteria based on AHP method

Investigated criteria	Weight
Cognitive skills	3.65
Attitudinal skills	3.78
Scientific skills	4.23

Regarding the obtained weights from the criteria for ranking the main indexes in the educational assessment, the PROMETHEE II was used (Table 5).

Table 5: Weights of criteria and indexes relating to The educational assessment of Islamic education lessons for medical courses in University of medical sciences.

Criteria	Criteria weight	Indexes	Index weight
Cognitive skills	3.65	Deepening in cognition and believing in principles	0.24
		Deepening in professional ethics	0.18
		Strengthening the analysis powers in students	0.22
		responsibility and work ethic	0.20
		Raising awareness of professional and ethical guidelines and respect their rules	0.16
Attitudinal skills	3.78	Reinforcing and promoting the human dignity	0.21
		Boosting the mental powers, Voluntary actions, being educated well	0.28
		Self-actualization and preparing the personal growth and purification	0.08
		Simplifying the human growth and development and divine and human ideals	0.11
		Reinforcement and consolidation and deepening the divine, national and human dignity of students	0.20
		Social character development	0.12
Scientific skills	4.23	Expanding the borders of knowledge and sublimation and its promotion	0.22
		Arising the level of general knowledge in different fields	0.36
		Convincing the students to do research	0.42

Since, in PROMETHEE method, only one level of criteria is considered, we should multiply the weights of secondary criteria by the weights of primary criteria according to Table 6.

Table 6: Ranking of defined indices to determine the curriculum goals of Islamic education lessons for medical courses in university of medical sciences.

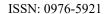| Indexes	Final weight	Ranking
Deepening in cognition and believing in principles	0.876	5
Deepening in professional ethics	0.657	10
Strengthening the analysis powers in students	0.803	6
responsibility and work ethic	0.730	9
Raising awareness of professional and ethical guidelines and respect their rules	0.584	11
Reinforcing and promoting the human dignity	0.794	7
Boosting the mental powers, Voluntary actions, being educated well	1.06	3
Self-actualization and preparing the personal growth and purification	0.302	14
Simplifying the human growth and development and divine and human ideals	0.416	13
Reinforcement and consolidation and deepening the divine, national and human dignity of students	0.756	8
Social character development	0.454	12
Expanding the borders of knowledge and sublimation and its promotion	0.931	4
Arising the level of general knowledge in different fields	1.523	2
Convincing the students to do research	1.777	1

Conclusion

In this article, first, the criteria, which can be considered in educational assessment and the educational progress in medical course at university, were obtained using the backgrounds and comments of experts and then a combined model of AHP and PROMETHEE was presented to select and prioritize the main indexes. It's the first time that the combined model is introduced in review of literature and one of its advantages is increasing the accuracy in multi indexed decision.

Based on the obtained results, it was determined that students prioritized the scientific, attitudinal and cognitive skills as first to third ranks in educational assessment of medical courses. They have also ranked the indexes like convincing the students to do research, Arising the level of general knowledge in different fields and boosting the mental power, voluntary actions and being educated accurately as first to third ranks.

References

1. Van den Akker J, Curriculum perspectives: An introduction. Curriculum landscapes and trends: Springer. 2004: 1-10.
2. Ralph T.W, Basic principles of curriculum and instruction. Chicago: The University of Chicago Pres. 1949.
3. Stufflebeam D.L, A depth study of the evaluation requirement. Theory into practice. 1966;5(3): 121-133.
4. Cronbach L.J, Shapiro K, Designing evaluations of educational and social programs: Jossey-Bass. 1982.
5. Campbell D.T, Methodology and epistemology for social sciences: Selected papers: University of Chicago Press. 1988.
6. Cousins J.B, Earl L.M, The case for participatory evaluation. Educational evaluation and policy analysis. 1992;14(4): 397-418.
7. Fetterman D.M, Ethnography in educational evaluation: Corwin Press. 1984.
8. Fetterman D.M, Empowerment evaluation. Evaluation practice. 1994;15(1): 1-15.
9. Nave B, Miech EJ, Mosteller F, A rare design: The role of field trials in evaluating school practices. American Academy of Arts and Sciences at Harvard University. 1999.
10. Nevo D, The evaluation-minded school: An application of perceptions from program evaluation. Evaluation Practice. 1993;14(1): 39-47.
11. Scriven M, Evaluation thesaurus. Newbury Park: CA: Sage; 1991.
12. Scriven M, Hard-Won Lessons in Program Evaluation. New directions for program evaluation. 1993;58: 1-107.
13. Scriven M, Evaluation as a discipline. Studies in educational Evaluation. 1994; 20(1): 147-166.
14. Scriven M, The final synthesis. Evaluation Practice. 1994; 15(3): 367-382.
15. Scriven M, Product evaluation-The state of the art. Evaluation Practice. 1994;15(1): 45-62.
16. Smith ML, The whole is greater: Combining qualitative and quantitative approaches in evaluation studies. New Directions for Program Evaluation. 1986;1986(30): 37-54.
17. Stake RE, Smith N.L, Book Reviews: Quieting Reform: Social Science and Social Action in an Urban Youth Program. Educational Evaluation and Policy Analysis. 1986; 9(4): 363-365
18. Stake RE, The art of case study research. London. Sage. 1995: 1-175

19. Stufflebeam D, A standards-based perspective on evaluation. Advances in program evaluation. 1997; 3: 61-88.
20. Stufflebeam DL, Madaus GF, Kellaghan T, Evaluation models: Viewpoints on educational and human services evaluation. 2 ed. Netherlands; Springer Science and Business Media New York. 2000; 49: 1-509
21. Torres RT, Improving the quality of internal evaluation: The evaluator as consultant-mediator. Evaluation and Program Planning. 1991;14(3): 189-198.
22. Marks-Maran D, Educational research methods for researching innovations in teaching, learning and assessment: The nursing lecturer as researcher. Nurse education in practice. 2015;15(6): 472-479.
23. Simons H, Enhancing the quality of education through school self-evaluation. A Developmental and Negotiated Approach to School Self-evaluation. 14ed. Emerald Group Publishing Limited; 2013: 1-18.
24. Javedani M, Aerab-Sheibani H, Madadi Y, Ladanyoonesi relationship between C-reactive protein and carotid artery intima media thickness in polycystic ovarian syndrome patients. Acta Medica Mediterranea. 2015; 31: 1393.
25. Safari H, Fagheyi MS, Ahangari SS, Fathi MR, Applying Promethee method based on entropy weight for supplier selection. Business management and strategy. 2012;3(1): 97-106.
26. Macharis C, Springael J, De Brucker K, Verbeke A, PROMETHEE and AHP: The design of operational synergies in multicriteria analysis.: Strengthening PROMETHEE with ideas of AHP. European Journal of Operational Research. 2004;153(2): 307-317.
27. Albadvi A, Chaharsooghi SK, Esfahanipour A, Decision making in stock trading: An application of PROMETHEE. European Journal of Operational Research. 2007;177(2): 673-683.
28. Wang JJ, Yang DL, Using a hybrid multi-criteria decision aid method for information systems outsourcing. Computers and Operations Research. 2007;34(12): 3691-3700.

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