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A Comparative Study on Evaluation of Modular Courses in Conservatories by the Fuzzy Delphi Method

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ABSTRACT

The development of modular courses at the conservatory and theoretical courses throughout the country is being developed by the organization of education to design effective and appropriate systems for the development and use of information on the learner's progress. So, in this paper, we try to identify factors that contribute to increasing the efficiency of evaluating the learning - studying processes and teaching modular courses. In the first step, 16 factors influencing the assessment and teaching of conservatory courses were identified using the experts' opinions and identifying the important criteria of modular courses. Finally, we measured the strengths and weaknesses of the modular courses in the conservatories of Chamestan using the fuzzy Delphi technique. Also, the results of the viewpoints of the lecturers in these courses indicate that one of the strengths of these courses is the revaluation factor in each module that makes it impossible to create an atmosphere of anxiety during the study and evaluation for the student. On the other hand, one of the weaknesses of these courses is the lack of space and workshops with courses content, which prevents from the fulfilment of the appropriate effect that the student expects for these courses.

1. Introduction

Education in the present world is considered as a national capital that contributes to the economic, social and cultural development of societies. Undoubtedly, in the condition of globalization and the competitive world, the ever-changing world is inevitable due to the development and promotion of education in various social fields and even has been considered internationally as one of the developmental indicators of interest for societies, governments and institutions.

Among the educational systems, technical and vocational education, which is a combination skill of science and technology, plays an important role in providing the human and efficient workforce of the world and has a developmental issue. Assessment and teaching at the conservatories should be relevant to the standards of professional competence and be developed based on them. In evaluating academic and educational progress in

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technical and vocational branches, the various tools and methods can be used to measure academic achievement and professional competencies. The assessment is done continuously and the athletes must have received a certificate of competency on all modules.

Assessment based on competence is only relevant to the following courses:

1) Courses of non-technical qualifications (technical & vocational branch and professional branch)
   - Course of requirements for the work environment at the grade of the tenth
   - Workshop on innovation and entrepreneurship, application of new technologies and production management in the eleventh grade
   - Professional ethics at the twelfth grade

2) Courses of technical competence (technical & professional branch)
   - 8- hour workshops on the tenth and eleventh and twelfth grade
   - Courses of basic technical knowledge and professional technical knowledge
   - Cooperative courses include computer technical mapping, visual elements of water, soil and plant, and effective communication.

2. Evaluation method

Each course includes five modules (chapters), which independent evaluation must be conducted for each of them by the relevant student. As a result, an independent score is recorded for each of the modules. Acceptable conditions for each module are the score of at least 12. Each module's score consists of two parts, and in the end, only one score is recorded based on 0 to 20. The first part of the evaluation is taken from the qualification of each module with three scores of 1, 2, and 3, and the result is a coefficient of 5.

1 = lack of competence 2 = having competence 3 = having competence higher than expectancy

The second part of the evaluation is a continuous score that will be awarded from 0 to 5 points based on class and workshop activities, discipline, participation, and educational activities. Each module consists of one to three units of learning competency unit. In assessing academic achievement, units of competency will be conducted in accordance with the methodology contained in the textbooks, and the result will be recorded at the class grade registration notebooks. Based on the result of the evaluation of competency units, the module score will be obtained. The student should obtain 12 points in all 5 modules. In this case, the average of the 5 module scores will be taken as the total score of the course in the student's grade.

If he does not obtain a minimum score of 12 on one or more modules, then, he will not receive the passing grade. Reassessment is only carried out on module or modules that have not achieved the required minimum score and are available at least once for the entire academic year.

In this research, we first investigated the factors affecting the efficiency of modular courses. Then, by distributing a questionnaire among students in the Chamestan region, Iran that teaches modular courses, we categorized the criteria and, we reached a consensus on the criteria using the fuzzy Delphi method. And in the end, we have suggested some ways to better presentation of these courses.

3. Research methodology

Based on the research design and the method of data collection, the present study is descriptive and has used two methods of documentary study and fuzzy Delphi to collect information. The experts' data were collected using a questionnaire. In the questionnaire of this research was designed with the aim of obtaining the experts idea about the advantages and disadvantages of the modular courses in conservatories.

Among the factors and methods influencing modular courses, 16 criteria were extracted. In this questionnaire, each expert evaluated his opinion on each of the factors affecting the five-point Likert scale through verbal variables (very low, low, Moderate, high, very high) and with a fuzzy approach, and the mentioned variables are defined in the form of triangular fuzzy numbers according to Table 1.

Table 1: Triangular fuzzy numbers of verbal variables

Verbal variables	Triangular fuzzy number	Definite fuzzy number
Strongly agree	(0, 0.25, 1)	(0.9375)
agree	(0.15, 0.15, 0.75)	(0.75)
No idea	(0.25, 0.25, 0.5)	(0.5)
disagree	(0.15, 0.15, 0.25)	(0.25)
Strongly disagree	(0, 0, 0.25)	(0.625)

In the above table, defined fuzzy numbers are calculated using the Minkowski formula as follows:

$$X = m + \frac{B-a}{4} \quad (1)$$

At each step of the Delphi test, the fuzzy mean for fuzzy triangles numbers of A1 and A2, and..., is defined as:

$$A_m = A_1 + A_2 + \cdots + A_n/n \quad (2)$$

In the formula A_i (a_i, b_i, c_i), the triangular fuzzy number corresponding to the individual i and A_m average is related to each of the questions.

After calculating the fuzzy average for the questionnaire's questions, at each step for each expert, the difference from the mean of community is calculated using the following formula:

$$\widetilde{(A_1^m - A_1^i, B_1^m - B_1^i, C_1^m - C_1^i)} \quad (3)$$

In the above formula, A_1^m and B_1^m and C_1^m are the upper, middle and lower limit of triangular fuzzy numbers corresponding to each of the questions, respectively and A_1^i and B_1^i and C_1^i are the upper, middle and lower limit of person i, respectively.

Then, at a later step, the average of the community at the previous step and the difference of each expert from the average of the community are presented to the individual and again, each individual responds to the difference in the questions related to the questions.

At this step, the person can consider his comment and repeat the comment of the previous step and again, the fuzzy mean is calculated for the new step. The mean difference of two steps is calculated for each question and if the average of the two steps is calculated using the formula No. 3 to be less than 0.1. Consensus has been reached on that question. This step will continue until to reach a satisfactory consensus.

3.1. The first step of the survey

At this step, a questionnaire containing 16 criteria was provided to the experts for modular courses and asked them to comment on each criterion in the form of the verbal variable contained in the questionnaire table. According to the results of the questionnaire at the first step, each of the components was obtained using the equation 2 and 3 of the fuzzy mean (Table 2).

$$A_i = \left(a_1^{(i)}, a_2^{(i)}, a_3^{(i)}\right), \qquad \text{i} = 1, 2, 3, \ldots, \text{n} \quad (4)$$

In this regard, A_i represents the expert opinion of i and n is the number of experts

$$A_{ave} = (m_1, m_2, m_3) = \left(\frac{1}{n}\sum_{i=1}^{n} a_1^i, \frac{1}{n}\sum_{i=1}^{n} a_2^i, \frac{1}{n}\sum_{i=1}^{n} a_3^i\right) \quad (5)$$

Here, A_{ave} is the average of experts' opinions.

In the Table 3, the triangular average is calculated using formula (4) and then, using the Minkowski formula, formula (1) has been. The obtained definite mean indicates the agreement intensity of experts with each component of the conceptual model in the research.

Table 2: Frequency of experts answer

No.	Title	Agree Strongly	Agree	Agree Slightly	Disagree
1	Emphasis on the innovation process and creativity of students on each module	9	11		
2	Complete attention to the knowledge, attitudes and skills of the student	8	11	1	
3	Coordination between goals and content and methods of teaching-learning in evaluation	6	8	6	
4	Use of evaluation types in the teaching -learning process	6	14		
5	The minimum score for each module is 12 out of 20	5	12	1	2
6	Using the competency score of 1, 2, and 3 with a coefficient of 5 for each module	0	3	10	7
7	Using score 5 as a continuous score on each module	8	11	1	
8	Re-evaluation in each module and its repetition until obtaining competency score	2	1	9	8
9	The proportion of the training hours of each module with the timetable	0	5	10	5
10	Evaluation of Final module in the final exam	8	11	1	1
11	Presenting the final project of each module by the student	11	9	1	
12	Attributing a score to the group activity in the final evaluation score of the student	10	10		
13	Using evaluation results to improve the teaching-learning process of other modules and modify them	2	15	3	
14	The proportion among the content of the course with existing locations and workshops	0	1	6	13
15	Preventing to use anxious conditions during education and evaluation	11	9		
16	Adequate and various evidence for the judgment of the student	4	14	2	

3.2. Second step survey

As shown in Table 3, the most agreement among the experts on the modular courses is attributed to the criterion (non-use of anxious conditions) and the least agreement is related to the criterion (using coefficient 5 for the competency score of 1, 2, and 3 for each module for each student) during the studying, evaluating and re-evaluating in each module, and repeating it until obtaining the competency score.

According to Cheng Ling et al., if the difference between the two steps of the survey is less than the threshold as very low (0.1), the survey process is stopped (Cheng chin, Hesur Lin, 2002). Therefore, in the second step of the survey, previous opinions of each expert and their differences with the views of other experts were sent along with a questionnaire for another member of the expert group. The results of the counting the presented responses in the second step were analyzed as the first step using the equation 1 and 5 that the results of which are shown in Table 4.

Table 3: Average of expert's viewpoints from the first survey

No.	Title	M	α	β	Defuzzyfication Average
1	Emphasis on the innovation process and creativity of students on each module	0.86	0.2	0.08	0.83
2	Complete attention to the knowledge, attitudes and skills of the student	0.83	0.2	0.1	0.81
3	Coordination between goals and content and methods of teaching-learning in the evaluation	0.75	0.21	0.14	0.73
4	Use of evaluation types in the teaching-learning process	0.83	0.18	0.11	0.81
5	The minimum score for each module is 12 out of 20	0.75	0.18	0.12	0.74
6	Using the competency score of 1, 2, and 3 with a coefficient of 5 for each module	0.45	0.2	0.2	0.45
7	Using score 5 as a continuous score on each module	0.84	0.2	0.1	0.82
8	Re-evaluation in each module and its repetition until obtaining competency score	0.46	0.21	0.18	0.45
9	The proportion of the training hours of each module with the timetable	0.5	0.2	0.2	0.5
10	Evaluation of Final module in the final exam	0.85	0.2	0.1	0.83
11	Presenting the final project of each module by the student	0.91	0.22	0.08	0.87
12	Attributing a score to the group activity in the final evaluation score of the student	0.88	0.2	0.08	0.85
13	Using evaluation results to improve the teaching-learning process of other modules and modify them	0.74	0.18	0.15	0.73
14	The proportion among the content of the course with existing locations and workshops	0.35	0.23	0.23	0.35
15	Preventing to use anxious conditions during education and evaluation	0.89	0.21	0.07	0.86
16	Adequate and various evidence for the judgment of the student	0.78	0.18	0.13	0.77

Table 4: Frequency of expert opinion in the second step

No.	Title	Agree Strongly	Agree	Agree Slightly	Disagree
1	Emphasis on the innovation process and creativity of students on each module	9	11		
2	Complete attention to the knowledge, attitudes and skills of the student	8	11	1	
3	Coordination between goals and content and methods of teaching-learning in the evaluation	6	8	6	
4	Use of evaluation types in the teaching-learning process	6	14		
5	The minimum score for each module is 12 out of 20	5	12	1	2
6	Using the competency score of 1, 2, and 3 with a coefficient of 5 for each module	0	3	10	7
7	Using score 5 as a continuous score on each module	8	11	1	
8	Re-evaluation in each module and its repetition until obtaining competency score	2	1	9	8
9	The proportion of the training hours of each module with the timetable	0	5	10	5
10	Evaluation of Final module in the final exam	8	11	1	1
11	Presenting the final project of each module by the student	11	9	1	
12	Attributing a score to the group activity in the final evaluation score of the student	10	10		
13	Using evaluation results to improve the teaching-learning process of other modules and modify them	2	15	3	
14	The proportion among the content of the course with existing locations and workshops	0	1	6	13
15	Preventing to use anxious conditions during education and evaluation	11	9		
16	Adequate and various evidence for the judgment of the student	4	14	2	

Table 5: The average of experts response at second step

No.	Title	M	α	β	Defuzzyfication Average	Mean difference tween the second a third steps
1	Emphasis on the innovation process and creativity of students on each module	0.96	0.24	0.02	0.91	0.08
2	Complete attention to the knowledge, attitudes and skills of the student	0.94	0.24	0.04	0.89	0.08
3	Coordination between goals and content and methods of teaching-learning in the evaluation	0.93	0.24	0.04	0.88	0.15
4	Use of evaluation types in the teaching-learning process	0.93	0.23	0.04	0.88	0.07
5	The minimum score for each module is 12 out of 20	0.85	0.21	0.03	0.81	0.07
6	Using the competency score of 1, 2, and 3 with a coefficient of 5 for each module	0.56	0.2	0.16	0.55	0.1
7	Using score 5 as a continuous score on each module	0.88	0.22	0.07	0.84	0.02
8	Re-evaluation in each module and its repetition until obtaining competency score	0.68	0.2	0.15	0.67	0.27
9	The proportion of the training hours of each module with the timetable	0.78	0.2	0.1	0.76	0.26
10	Evaluation of Final module in the final exam	0.9	0.23	0.04	0.86	0.03
11	Presenting the final project of each module by the student	0.94	0.23	0.04	0.89	0.02
12	Attributing a score to the group activity in the final evaluation score of the student	0.9	0.21	0.06	0.86	0.01
13	Using evaluation results to improve the teaching-learning process of other modules and modify them	0.95	0.23	0.03	0.9	0.17
14	The proportion among the content of the course with existing locations and workshops	0.48	0.19	0.15	0.47	0.12
15	Preventing to use anxious conditions during education and evaluation	0.96	0.24	0.02	0.91	0.05
16	Adequate and various evidence for the judgment of the student	0.85	0.21	0.09	0.82	0.05

As shown in the table above, in most of the components, the members of the expert group were unanimous about the criteria of No. 1, 2, 4, 5, 6, 7, 10, 11, 12, 15 and 16, and the difference between the first and second steps was less than the threshold (0.1). Therefore, the survey on the above components is stopped and the third step survey is examined with the remaining variables in No. 3, 8, 9, 13 and 14.

3.3. Step three: distribution of the questionnaire

At this step, after investigating the results of the questionnaire at the second step, it was tried to show the first results of each question and general answers of each person to the experts. Then, a third questionnaire was presented to individuals. The results of the responses are presented in Table (6). Also, the fuzzy results of the studied options are also presented in Table (7).

Table 6: The frequency of expert opinion in the third stage

No.	Title	Agree Strongly	Agree	Agree Slightly	Disagree
1	Coordination between goals and content and methods of teaching-learning in the evaluation	10	8	2	
2	Re-evaluation and repetition of it until gaining competency score	4	6	4	6
3	The proportion of the training hours of each module with the timetable	4	8	8	
4	Using evaluation results to improve the teaching-learning process of other modules and modify them	16	6		
5	The proportion among the content of the course with existing locations and workshops	2	5	8	5

Table 7: Average of expert's response at third step

No.	Title	M	α	β	Defuzzyfication Average	Mean difference between the second and third steps
1	Coordination between goals and content and methods of teaching-learning in the evaluation	0.85	0.21	0.09	0.82	0.06
2	Re-evaluation and repetition of it until gaining competency score	0.6	0.24	0.14	0.58	0.09
3	The proportion of the training hours of each module with the timetable	0.7	0.21	0.16	0.69	0.07
4	Using evaluation results to improve the teaching-learning process of other modules and modify them	0.93	0.22	0.05	0.89	0.01
5	The proportion among the content of the course with existing locations and workshops	0.5	0.18	0.15	0.49	0.02

According to the presented views in the second step and comparing them with the results of this step, if the difference between the two steps is less than the threshold, then, the survey process is stopped.

4. Conclusions

In this paper, the views of twenty selected experts were considered using the Fuzzy Delphi method in the fields related to teaching modular courses, that they were investigated the various and suggested points as strengths and weaknesses. Finally, the following clauses were announced from 16 proposed clauses in order to achieve the goal of

"Strengths and weaknesses of modular courses" and subsequently, the following strategies were suggested for these areas:

- An evaluation of obtaining competency with three scores of 1, 2, and 3 with a coefficient of 5 is better to apply with 5 scores of 1, 2, 3, 4 and 5 with coefficient 3. So that score 1 and 2 do not qualify and score 3 and 4 are competency score and score of 5 is competency higher than expected, so that students score seems more realistically, and score 5 is allocated only for students who are really higher than expected and with creativity and innovation at that module.
- Regarding the fact that revaluation at any module distracts anxiety from the student, it causes the student's illness and fatigue, and the student will ignore the exam due to the repetition of the module, and ignores the substantive lessons of the course. However, it is better to re-assessment only once for each module.
- By offering modular courses in vocational schools and schools, places and workshops appropriate to these courses should be available for student in order to create a more favorable effect.
- In some modular courses, the training hours of each module are not matched to the timetable provided with that course, which is better to be modified according to the syllabus.
- -Attributing a score to the final project of each module and group activity will enhance the group's activity and individual's activity of student and, on the other hand, it will be easier to evaluate, because it is done in a theoretical-practical-workshop and allows students the opportunity to use evaluation types in any module, and the evaluation score appears to be more realistic and there is sufficient evidence to judge the student.
- -As modular courses are done as theoretical-practical-workshops courses provide creative innovation and creativity in the student and consider the knowledge, attitudes and skills of the student.

The conclusion should be based on the experts' opinions, and interview should be done with several scholars and researchers who did not participate in the process to determine the validity of the findings. Also, before starting the process, the criteria to reach conclusion should be specified. A few questions should be used and sufficient time should be provided for respondents to think about issues and research topics.

Group members and professionals should be specialized in any their own field of study in order to be ready in the face of problems. The research group should be accessible and, should manipulate the research process as little as possible.

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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