# Original Article

# Internal Assessment of the Department of Medical Physics and Biomedical Engineering, Kermanshah University of Medical Sciences (2014)

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## Abstract

**Introduction:** Higher education quality assurance is made possible through assessment of education processes. Internal assessment is determined by favorable feedback, indicating how much the implemented programs have been successful. To evaluate the academic-research validity of the Department of Medical Physics and Biomedical Engineering and to apply it in the short-term and long-term planning, an internal assessment based on the defined criteria in medical education system was performed.

**Methods:** In this descriptive cross-sectional study, the objectives, indicators, criteria and assessment factors were determined by the assessment committee. Questionnaires were designed for five groups, including the head of the department, faculty members, students, graduates and employers. Scoring was carried out by a three-point scale, including desirable, relatively desirable and undesirable. Data were analyzed by MATLAB software (version 7.1) using graphs and tables.

**Results:** The quality of the department was evaluated to be desirable ($2.34 \pm 0.53$). According to the results, the most desirable factor was educational equipment and facilities ($2.5 \pm 0.57$), and the least desirable one was found to be training courses and curriculum ($1.67 \pm 0.58$).

**Conclusion:** The findings indicated that training courses and curriculum did not have a desirable status; therefore, training courses and appropriate curriculum are suggested to be designed based on the needs of students and society as well as educational facilities.

**Keywords:** Internal assessment, Education department, Medical

## Introduction

Expert manpower training and knowledge production are two major objectives of higher education. Development and quality assurance of higher education depend on regular assessment of education and research processes. Internal assessment is aimed at identifying appropriate strategies to promote the education system. Internal assessment is defined as a systematic process of collecting, analyzing and interpreting data in order to determine the weaknesses and strengths of a program and to measure the achievement of its objectives. Assessment is a systematic process defined by McNamara for collecting and analyzing data to determine the advantages and disadvantages of a program and achievement of objectives (1). Therefore, internal assessment of the Department of Medical Physics and Biomedical Engineering is believed to be a starting point for the minor and major studies and an influential step to assure the quality of the department.

By developing an internal assessment plan in medical education for the first time in 1996 in the form of research projects in six departments at medical universities, regular assessment in Iranian higher education was established. The results of this program have shown that internal assessment plays a pivotal role in improving the quality of departments. Currently, the educational planning specialists consider assessment an inseparable part of education processes and emphasize its implementation in various stages of curriculum development (2). With appropriate implementation of assessment and quality control, the success of a curriculum will undoubtedly be assured (3). However, the role of assessment and its status have not yet been well-presented in the education systems of the country, and it is still necessary to pay attention to the quality (not merely quantity). Hence, assessment constitutes a fundamental principle of qualitative analysis of every program (4).

In line with the emphasis of the third national development program on making the assessment system efficient and promoting the quality of higher education, the Ministry of Science, Research and Technology was given the responsibility of evaluating and validating the universities. For this reason, National Education Assessment System has started to support the implementation of internal assessment as the basis for validating the higher education quality assurance system

at departments of universities around the country since 2000 (5).

Fooladvand et al. developed the indicators required to prepare a profile for the faculty members of a university. Their study was performed at Isfahan University of Medical Sciences, and 37 indicators in five domains were formulated. The development of these indicators fulfilled part of the needs of the managers in making decisions about the faculty members (6).

Jafari et al. designed a system for evaluating the performance of faculties of physical education and sports sciences in Iran. They presented 22 components in three dimensions of input, process and output as well as 999 indices to evaluate the goodness of performance assessment components. Accordingly, they designed a conceptual model for their study (7).

Also, the Department of Social Medicine at Semnan University of Medical Sciences performed an internal assessment. The findings showed a satisfactory status considering the existing equipment and conditions based on Gorman classification. Evidently, to achieve an ideal status, it is necessary to revise and change the existing conditions to promote the quality. To this end, the faculty members, experts of departments and educational authorities should make more effort to eliminate the weaknesses and reinforce the strengths (8).

Shahrakipour & Jamali conducted a piece of research aiming to implement internal assessment at the Department of Mechanical Engineering at Islamic Azad University, Qazvin Branch, to present a comprehensive analysis of the quality of department and to provide suggestions to improve it. The study sample comprised of the faculty members, head of the department and students. The results of internal assessment indicated an association between the education quality and determining criteria and indicators and between the faculty members' participation in determining the criteria and indicators and promoting the quality of the department. Also, a relationship was found between the results of internal assessment and increasing accountability for the performance of the department (management and faculty members). Finally, internal assessment was found to be effective in detecting the weaknesses and strengths of the department (9).

Rezaeian et al. carried out an internal assessment of the Department of Social Medicine at Rafsanjan School of Medicine. Gorman classification was performed with five different levels. The results showed a good rank for this department (10).

Assessment is usually carried out to analyze the quality of programs in every department, and assessment factors, criteria and indicators are selected. Since the faculty members participate in the assessment process and come up with helpful suggestions to promote the quality of department, the objectives of the department will be better understood. Further, the motivation of the department members will increase to make more attempts to fulfill the objectives of the department. To this end, strengths, weaknesses, opportunities and threats will be detected and helpful suggestions to enhance the quality of the department will be presented as an internal assessment report. This report reveals a solid foundation for the measures required to be taken to improve the department regularly (11, 12).

Since no internal assessment has been conducted on the Department of Medical Physics and Biomedical Engineering so far, this study was conducted to perform an internal assessment based on the criteria defined in the medical education system to present an appropriate model for assessing the academic-research validity of this department, to provide short-term and long-term plans and strategies to achieve the objectives determined, to revise the curriculum and to identify the weaknesses, strengths and potentials in order to optimize and promote the quality of the programs.

## Methods

This descriptive cross-sectional study was carried out in cooperation with Medical Education Research Center on 46 participants, including all 6 faculty members of the department, head of the department, and 28 students of medical physics and 12 students of biomedical engineering, (9 and 6 of them having already graduated, respectively).

In this study, the required procedures went through several steps. First, the significance of internal assessment was presented, and the assessment committee was established in the presence of the faculty members. Then, the missions and objectives of the department were analyzed and developed. Next, the factors compatible with the objectives were determined in seven domains by the assessment committee.

Criterion is defined as the aspects of a phenomenon under assessment on which judgment is made. Further, indicator is defined as characteristics used for collecting data to judge the intended criteria. In general, several criteria with a common dimension constitute a factor. Criteria were developed for each factor, and indicators were formulated for each criterion. Then, according to the defined indicators, separate questionnaires were developed for the head of the department, faculty members, students, graduates and employers based on the questionnaire developed by Tehran University. In each of the questionnaires, the two-option and three-option questions were designed based on the qualitative response model. Scoring the responses was performed using the numerical scoring system. It should be noted that standard internal assessment forms are present at medical education development centers, which were used in the present study, too. All factors, criteria and indicators in these forms were described in detail. Every factor had several criteria and every criterion had a number of indicators that were completed by five groups of related people.

To extract and analyze data, the indicators were first divided into nominal, ordinal and quantitative categories based on the type of scale. In nominal scale, each option is divided into two or more categories between which there is necessarily no mathematical relation. In this scale, the criterion for classification of respondents is based on their common characteristics, which is compatible with one of the defined categories of the variable. Analysis of data and judgment of indicators were carried out based on the defined standards. In standard definition of these indicators, for the two-option questions, desirable and undesirable levels were considered. As for three-option questions, based on the defined standard, each option was defined at three levels, including desirable, relatively desirable and undesirable. For the indicators consisting of two or three questions, response to each question was matched with the given standard and its desirability level was determined. Then, the weight of each item was determined according to a three-point Likert scale, including desirable, relatively desirable and undesirable, ranging from 3 to 1. Finally, the mean numerical weight of the items was calculated and matched with a three-point scale in Table 1, and the desirability level of the indicator was obtained. The judgment range was also based on the maximum and minimum numerical values of the options of the indicator. On the other hand, the minimum numerical value was placed at one end of the continuum and the maximum numerical value was placed at the other end of the continuum. Then, the distance between these two was divided into three equal parts (13, 14, 15).

**Table 1. Standard three-point scale for converting the scores according to desirability levels**

| Desirable | Relatively desirable | Undesirable |
|---|---|---|
| 2.32 – 3 | 1.66 – 2.31 | 1 – 1.65 |

In the ordinal scale, a rating system is used. For the items of this scale, a hierarchy was defined and an ordinal value was given to each level. To analyze the data of these indicators, based on the weighting method, a numerical value was allocated to the responses of the items. Then, qualitative responses were converted to quantitative ranks. Next, according to the frequency of responses, the score of indicators was computed. Finally, the desirability level was determined according to the three-point scale.

As for the quantitative scale, judgment was made based on the obtained quantity and defined standard. First, the

quantitative data of each indicator were extracted according to the responses, and were then rated based on a three-point scale. After determining the desirability level of each indicator, the indicators of each criterion were weighed again. Then, the mean numerical value of indicators of each criterion was determined according to equation 1, as follows, and mean numerical value of criteria of each factor was computed by equation 2, presented below. Finally, the desirability level of each criterion was determined based on the three-point scale. This process was repeated for other factors as well.

$$(1) \quad \text{Criterion score} = \frac{\text{Sum score of indicators of criterion}}{\text{Total number of indicators of criterion}}$$

$$(2) \quad \text{Factor score} = \frac{\text{Sum score of indicators of factor}}{\text{Total number of indicators of factor}}$$

All processes of converting quantitative data and drawing graphs were performed using MATLAB (version 7.1) software.

## Results

Internal assessment of the Department of Medical Physics and Biomedical Engineering was carried out based on

seven factors, including objectives, organizational status, management and establishments; faculty members; students; learning-teaching strategies; training courses and curricula; educational-research equipment and facilities and graduates using 31 criteria and 100 indicators. The maximum and minimum levels of desirability were reported for the factors "educational equipment and facilities" and "training courses and curricula", respectively (Table 2).

**Table 2. Mean scores of the criteria and their desirability levels in Department of Medical Physics and Biomedical Engineering**

| Factors | Mean ± Standard deviation | Desirability level |
|---|---|---|
| Objectives, organizational status, management and establishments | 2.375 ± 0.74 | Desirable |
| Faculty members | **2.25 ± 0.95** | Relatively desirable |
| Students | 2.25 ± 0.96 | Relatively desirable |
| Learning-teaching strategies | 2.33 ± 0.57 | Desirable |
| Training courses and curricula | 1.67 ± 0.58 | Relatively desirable |
| Educational equipment and facilities | 2. 5 ± 0.57 | Desirable |
| Graduates | 1.8 ± 0.44 | Relatively desirable |
| Total | 2.43 ± 0.54 | Desirable |

The results of all criteria under assessment in each factor are shown separately in a histogram; regarding the first factor (objectives, organizational status, management and

establishments), the criterion "department resources" obtained the minimum level of desirability (Figure 1).
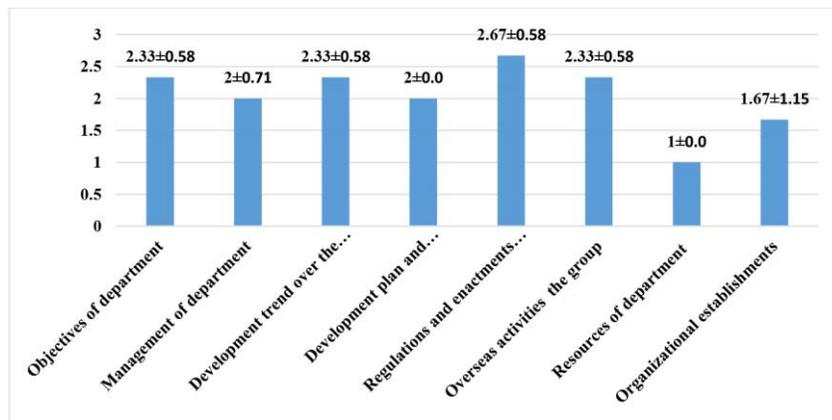
**Figure 1. Results of rating criterion for 8 criterions of the department including objectives, organizational status, management and establishments criterions; the criterions of "regulations and decisions of group" and "resources group" are highest and lowest rated ones, respectively.**

For the second factor (faculty member), the minimum level of desirability was reported for the criterion "faculty members' communication with their colleagues out of university and abroad" (Figure 2).
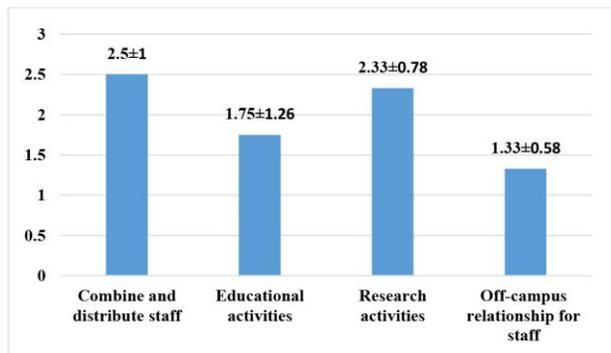


**Figure 2. Results of rating criterion obtained for faculty members; the criterion of "off-campus relationship for staff" is the lowest rated one.**

In the case of the third factor (students), the minimum level of desirability was found for the criterion "students' interaction with faculty members" (Figure 3).
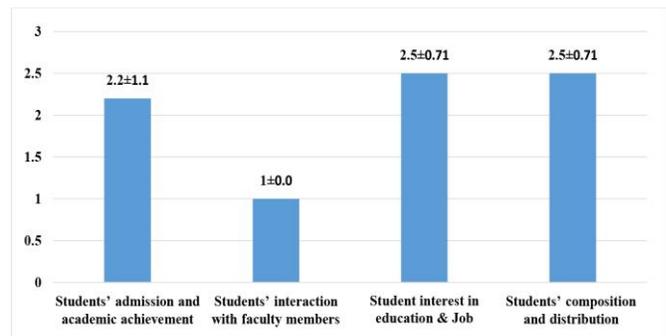


**Figure 3. Results of rating criterion obtained for students; the criterion of "student's interaction with faculty members" is the lowest rated one.**

In the fourth factor (learning-teaching strategies), the maximum level of desirability was observed in the criterion "educational resources and equipment" (Figure 4).
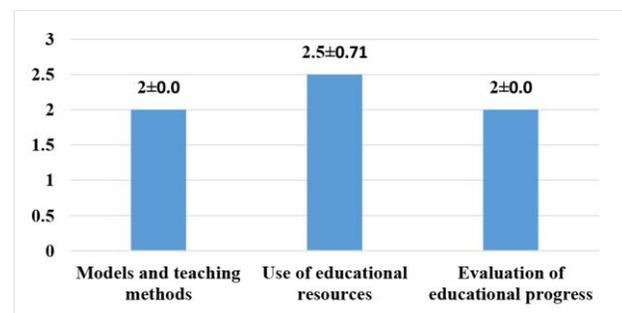


**Figure 4. Results of rating criterion obtained for learning-teaching strategies; the criterion of "use of educational resources" is the highest rated one.**

As for the fifth factor (training course and curricula), the minimum level of desirability was reported for the criterion "graduates' satisfaction with curriculum" (Figure 5).
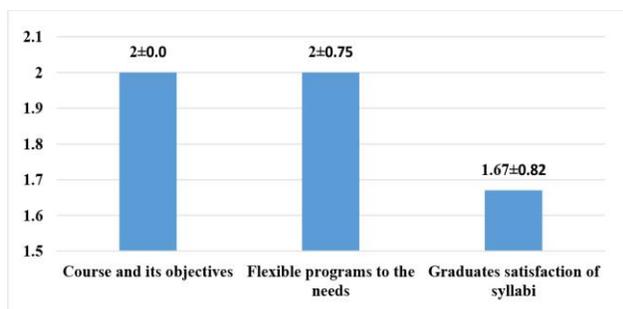


**Figure 5. Results of rating criterion obtained for training courses and curriculum; the criterion of "graduates' satisfaction of syllabi" is the lowest rated one.**

In the sixth factor (educational equipment and facilities), the maximum level of desirability was found for the criterion "educational and administrative space" (Figure 6).
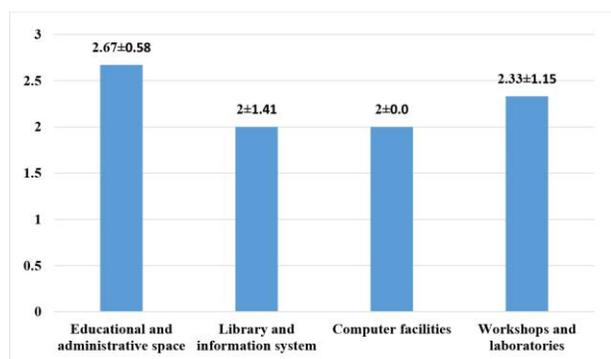


**Figure 6. Results of rating criterion obtained for educational equipment and facilities; the "computer facilities" is the lowest rated one.**

In the seventh factor (graduates), the minimum level of desirability was found for the criterion "further education of graduates" (Figure 7).

## Discussion

Internal assessment is defined as a systematic process of collecting, analyzing and interpreting data to determine the weaknesses and strengths of a program and success rate of its objectives (1). So far, a lot of efforts have been made to institutionalize internal assessment processes in order to improve the quality of education and localize the existing models (8).
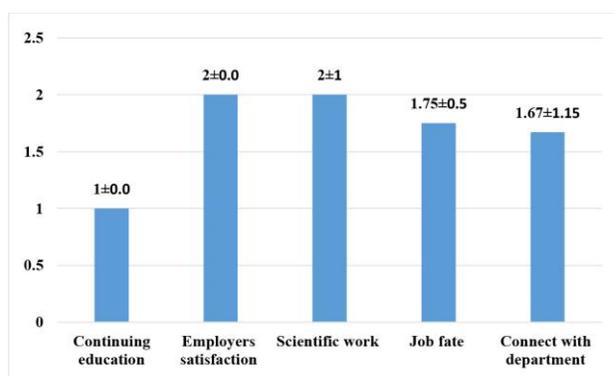


**Figure 7. Results of rating criterion obtained for graduates; the criterion of "continuing education" is the lowest rated one.**

The internal assessment of the Department of Medical Physics and Biomedical Engineering was carried out according to the common research model. The results showed that this department was at a desirable level from 2012 to 2015. Although this department was at an acceptable level in terms of the evaluated factors, it should be noted that the department only accepts master students, and the absence of undergraduate students to some extent overestimates the quality of the department. Therefore, it can be argued that there are still deficiencies in the department that need to be eliminated. In addition, two assessment factors with relatively desirable status did not gain a higher score and were at the borderline of undesirability. These two factors included "training courses and curriculum" and "graduates". By considering the indicators of training courses, it can be said that many indicators are at an undesirable level. Moreover, several other indicators with relatively desirable level do not have a high score in this level. For example, criterion of "graduates' satisfaction of syllabi" which is about graduates' satisfaction with curriculum is at an undesirable level. Thus, it is necessary to reconsider this criterion in the department while planning. Further, based on criterion of "connect with department", it can be argued that graduates do not have a good relationship with the department after graduation.

A weak point of the department is 'faculty members' communication with students. Criterion of "student's interaction with faculty members", which deals with this issue, has an undesirable rating. Thus, it is suggested that students participate in the academic and research activities of the faculty members. The department is recommended to provide the necessary grounds in order to promote the quality of this criterion.

Indicators such as belong to practical courses, have a desirable status, and the graduates of the department are not generally satisfied with the curriculum of the department. A major reason for this can be absence of

practical courses accompanying theoretical ones, as a logical trend. However, the department is at a desirable level in terms of equipment such as computers and per capita educational space, but since the department lacks acceptable laboratory equipment, it may cause graduates' dissatisfaction. Lack of financial independence and unclear annual budget are the major reasons, because of which the department and its management have not been able to take any steps so far. It can even be said that absence of annual conferences and training courses for the department is due to lack of transparency in the budget allocated to the department. Therefore, since many problems of the department are caused by lack of financial independence, this issue is suggested to be taken into consideration to take the required measures to solve the problems associated with it in the shortest time possible.

The faculty members of the department have key positions of responsibility in the university and it could be considered as strength for the department; however, this advantage has not yet been taken into account to solve the problems in the department, which might be due to poor strategies and management. According to the indicators such as "faculty members" and "students' satisfaction with head of the department", satisfaction is at an undesirable level, and the head of the department needs to reconsider his policies for the department. On the other hand, indicator of "having clear mechanism for evaluating the performance of the head of department" indicates the presence of an appropriate mechanism for assessment of the head of the department. This indicator shows an undesirable level in this group. Since the role of the head of department is of great significance in reducing the problems of the department, a proper mechanism should be presented for assessment of heads of departments.

## Conclusion

The internal assessment of the Department of Medical Physics and Biomedical Engineering shows a desirable status for the department. However, the indicators indicate poor quality in some areas. Thus, written objectives and strategies, approved by the faculty members of the department and university authorities, are required to be developed to eliminate the deficiencies and shortcomings and to enhance the quality of the department by relying on the capabilities and strengths.

## Acknowledgments

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