TOWARDS HIGHER EDUCATION QUALITY ASSESSMENT
Framework for Students Satisfaction Evaluation

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Abstract: This paper presents the framework of higher education quality assessment. The estimates of education quality can be used by the chiefs of higher education establishments (HEE) to take management decisions. The suggested approach is based on SERVQUAL method, supposing that education quality is the quality of provided service. Within the elaborated framework students fill in the questionnaire, their answers reflect the gap between perceived and expected education quality. The survey results are processed with the help of Rasch model. This approach was tested at the Information and management faculty of National Technical University "Kharkiv Polytechnic Institute".

1 INTRODUCTION

Nowadays quality criterion becomes a basis for decision-making in the system of higher education. Therefore various researches are dedicated to different aspects of education quality assessment.

Education quality is foremost associated with knowledge assessment. Since students' knowledge is the most obvious and important result of educational process, a huge amount of researches is dedicated to knowledge and skills assessment (Koenig, 2011). Higher education quality can be assessed at a state level (Maslak, et al., 2005), which provides the comparison of this characteristic between countries worldwide. Education quality of higher education establishments (HEE) is also a subject of investigations (Kachalov, 2001; European Training Foundation, 2004). Quality of resources, courseware, educational curricula and syllabus are intently studied as well. In many countries licensing and accreditation are the tools of guaranteeing quality in HEE. Certification of conformity to ISO standards is widely used for HEE as well.

To implement all of the suggested techniques of higher education quality assessment the information technologies (IT) seem to be a powerful tool. IT usage provides efficient ways for retreiving, processing and storing big volumes of information.

The rest of this paper is organized in the following way. Section 2 summarizes existing trends in quality assessment. Section 3 substantiates the necessity of students satisfaction assessment. Section 4 describes the elaborated approach of problem solving. Section 5 illustates the obtained results. Section 6 presents conclusions and prospect on future work.

2 MODELS AND APPROACHES REVIEW FOR EDUCATION QUALITY ASSESSMENT

The classification of education quality assessment models is based on the approaches of understanding what the education is and how it should be evaluated. Education can correlate with the following aspects: result of learning, educational process and HEE, i.e. organization that provides educational service.

Education as a result of learning process provides students with knowledge, abilities, skills, and competences. As a rule, psychometric theory is used for assessing students' achievements (Barker, 2002). The tools that can be applied for this purpose include Classical Test Theory (CTT) (Steyer, et.al., 2001) and Item Response Theory (IRT) (Reeve, 2009). The result of the obtained knowledge application is reflected in the statistics that deals with employment assistance. To assess these results

statistical methods are used.

Considering education as a process leads to its representation as a service. In this case education quality is a quality of service provided. Such methods as GAP analysis, CSI (Customer Satisfaction Index) calculation, benchmarking (Predvoditeleva and Balaeva, 2005), and SERVQUAL technique (Parasurman, et al., 1985) can be applied to assess it. Within a process-oriented approach the quality of resources ensuring and organization of educational process is also considered. In this case Total Quality Management, benchmarking (Okes and Westcott, 2000) and Six Sigma (Lowenthal, 2002) are used.

Higher education quality connecting to HEE can be assessed with the help of internal and external models (Borisova, 2007). Considering HEE as an organization makes it possible to use ISO standards for education quality management (Okes and Westcott, 2000).

In the present research we consider higher education quality management on the basis of consumers' satisfaction.

Since quality management is one of university's management problems and activities, education quality assessment is usually integrated into HEE management information systems (IS).

There are the following HEE information systems according to their functionality: IS of administrative and financial management, IS of educational process management and support, IS of scientific researches management, and IS of information resources management (Amrita, 2011; UMC, 2011). Quality management system is incorporated into all IS mentioned above. We can say that there is a tendency of integration of all the mentioned IS into a single information space.

This research represents the elaborated IS for higher education consumers' satisfaction assessment.

3 EVALUATION PROBLEM STATEMENT

The main activity of higher education quality management is monitoring. Monitoring is defined as "a continuous function that uses systematic collection of data on specified indicators to provide management and the main stakeholders of indications of extent of progress and achievements of objectives" (OECD, 2002).

Since monitoring deals with large amounts of data and supposes frequent data collection activities, it seems to be reasonable to automate this procedure.

We suppose that education quality assessment must be done from the point of view of stakeholders, for example, the state, the enterprises and the students. In the present research education quality is assessed based on students' opinion. The data that indicates education quality can be collected from dean offices, personnel and practice departments, enterprises and CV banks, as well as from surveys.

Students are the main consumers of educational services who have entered HEE to get knowledge and practical skills in some domain. The result of their education will be clear after their graduating from HEE and working at the enterprises for some time. The quality of educational process is expressed through the quality of the obtained knowledge and the quality of the process itself. Knowledge can be estimated by testing (for example, using CTT or IRT) or as the results of alumni's jobs. The quality of processes in HEE can be assessed by students' survey. So the quality of education service can be measured via processing data from surveys.

The appropriate survey tool has to be chosen for students' satisfaction evaluation. The survey results should be processed with the help of some mathematical model. So there is a task of model selection. To define a degree of confidence in the obtained estimates of education quality the reliability of measurement should be calculated.

To implement monitoring and evaluation procedures IS should be developed.

4 FRAMEWORK FOR STUDENTS SATISFACTION EVALUATION

In this research it is suggested to use a poll based on some questionnaire as a survey method (Figure 1). Unlike the interviews it can be automated and requires less time for results processing.

To measure students' satisfaction it is suggested to use SURVQUAL technique (Parasurman, et al., 1985). Its main idea is to measure the gap between consumers' expectation and perception of service quality. The following dimensions play the role of quality criteria: reliability, tangibility, responsibility, security and empathy. As it is shown by Oliveira O.J. and Ferreira E.C. (2009) SERVQUAL method can be successfully used for measuring higher education quality. They suggested two questionnaires with 19 statements to assess expected and perceived quality.

In the present research these two questionnaires were transformed into a single one. Each its question is formulated in such a way that the answer on it
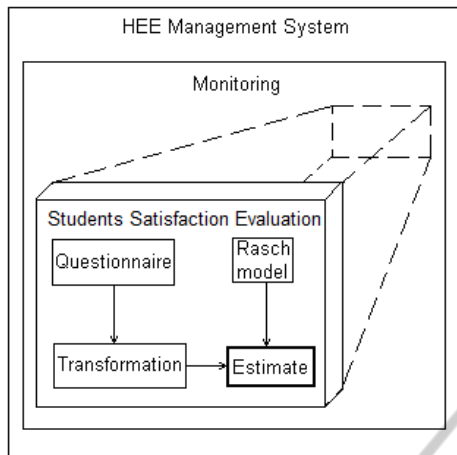
Figure 1: Estimates of students' satisfaction.

measures the gap between perceived and expected education quality. For example, instead of the original statements "Excellent HEE must have modern equipment, such as laboratories" and "Your HEE has modern equipment, such as laboratories" we now have a single question "How much does the equipment of your HEE differ from your expectations about it?". In such a way a student has to define how much the quality of education that he/she has finally obtained differs from the quality that he/she expected to get entering the HEE. Students are supposed to answer the questions using 7-points scale. The scores range from 1, which means a strong negative difference, through 4, which denotes the absence of any gap, to 7, which means a strong positive difference.

After considering different approaches for survey's results processing we have chosen the IRT (Reeve, 2009). This theory allows to obtain on the basis of statistics the estimate of one-dimensional latent variable in the interval scale. Students' satisfaction can be considered as a latent variable, therefore IRT will be applied for questionnaires processing. From the variety of IRT models we have chosen Rasch model as it is the basic one and the most widespread one (Wright and Stone, 1999). The goal of evaluation is to determine whether the HEE satisfied the students' expectations or not. Therefore we suggest to convert 7-points scale into dichotomous. The perceived quality can either exceed (coincide) the expected one (expressed by positive gap) or the expectations can be not justified (expressed by negative gap), which corresponds to two possible states. This seems to be similar to Rasch model dichotomous items.

The poll is anonymous. Filling the questionnaire a student must mention only his/her organizational

unit, i.e. faculty, department or specialty. After survey is finished, the matrix Y with students' answers is formed (Figure 2). Its elements $\{y_{ij}\}$ represent the answer of student i to question j.
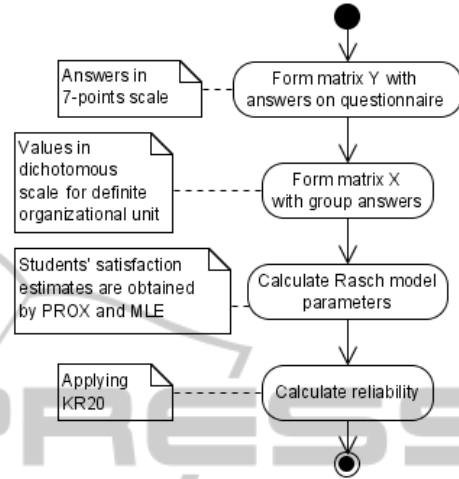

Figure 2: Process of students' satisfaction evaluation.

The initial matrix Y has to be transformed into calculation matrix X which elements $\{x_{ij}\}$ represent the values of i organizational unit for question j. Matrix X is used to group the answers of students that refer to a particular organizational unit. Matrix X must contain only zeros and units. If the specified majority of students of organizational unit i put 4 and more points for question j, then $x_{ij} = 1$. This means that the majority of students defined a positive gap or its absence between perceived and expected education quality. If majority of students put from 1 to 3 points, then $x_{ij} = 0$, which expresses the negative gap between perceived and expected quality.

The estimate of organizational unit is calculated with the help of Rasch model (Reeve, 2009):

$$P(x_{ij} = 1 \mid \theta_i, \beta_j) = \frac{\exp(\theta_i - \beta_j)}{1 + \exp(\theta_i - \beta_j)}, \qquad (1)$$

where x_{ij} is a value of gap of organizational unit i for question j; θ_i is a students' satisfaction value; β_j is difficulty of question j.

The difference $(\theta_i - \beta_j)$ is considered as a single variable, that is why Rasch model is often called one-parametric model (Reeve, 2009). Both parameters of Rasch model are measured in logits. Initial estimates of students' satisfaction and questions' difficulties are calculated by PROX algorithm for Rasch model's parameters estimation

(Wright and Stone, 1999). The final estimates are obtained by adjusting initial ones with the help of maximum likelihood estimation (MLE) procedure.

The estimates of students' satisfaction can be used for education quality assessment in quality monitoring and management system only after evaluation of their reliability. After analyzing different approaches for reliability estimation we have chosen the method of internal consistency based on calculation of Cronbach's coefficient. Its modification for dichotomous data is KR20 reliability coefficient (Wright and Stone, 1999) that has to be calculated within the given framework.

5 CASE-STUDY

To implement the suggested approach the Information System of Education Quality Assessment has been elaborated.

We suggest examining the following case-studies. The first one has been implemented on the example of three departments of Information and management faculty of National Technical University "Kharkiv Polytechnic Institute". The following departments have been considered: Department of computer-assisted management systems (CAMS), Department of strategic management (SM), and Department of system analysis and management (SA&M).

120 students took part in the survey. They were the representatives of both qualification levels: bachelors (B) and masters (M). Their answers have been processed and transformed into the calculation matrix (Table 1). The final estimates of students' satisfaction are obtained with the help of PROX and MLE procedures (Table 2).

The second case-study refers to students' satisfaction assessment of four specialties of CAMS department: Information driving systems and technologies (Specialty 1), Software of computer systems (Specialty 2), Management of organizations (Specialty 3), and Management of foreign activities (Specialty 4). There have been 110 respondents. Their answers are transformed into calculation matrix (Table 3). The students' satisfaction estimates are shown in Table 4.

To confirm results acceptability KR20 reliability coefficient was calculated. For the fist case-study it is equal to 0,87 and for the second one to 0,82.

Table 2: Students' satisfaction estimates (1st case-study).

Department	Level	Students' satisfaction estimate, logits	Standard error
CAMS	M	3,67	1,81
	B	1,42	0,87
SM	M	3,67	1,81
	B	0,77	0,78
SA&M	M	2,35	1,1
	B	2,35	1,1

Table 1: Calculation matrix X (1st case-study).

Question	Departments					
	CAMS		SM		SA&M	
	M	B	M	B	M	B
1	1	1	1	0	1	1
2	0	1	1	1	1	1
3	1	1	1	1	1	1
4	1	0	0	0	1	1
5	1	1	1	0	1	0
6	1	1	1	1	1	1
7	1	1	1	1	1	1
8	1	1	0	1	1	1
9	1	1	1	1	1	1
10	1	1	1	1	0	0
11	1	1	1	1	1	1
12	1	1	1	1	1	1
13	1	1	1	1	1	1
14	1	1	1	1	1	1
15	1	1	1	1	1	1
16	1	0	1	1	1	0
17	1	1	1	1	1	1
18	1	1	1	1	1	1
19	1	1	1	1	1	1

Table 3: Calculation matrix X (2nd case-study).

Question	Specialties			
	1	2	3	4
1	1	1	0	1
2	0	1	1	1
3	1	1	1	1
4	1	0	0	1
5	1	1	1	0
6	0	0	1	1
7	1	1	1	1
8	1	1	0	1
9	1	0	1	1
10	1	1	1	0
11	1	1	1	1
12	1	1	1	0
13	0	1	1	1
14	1	1	0	1
15	1	1	1	0
16	1	1	0	0
17	1	1	0	0
18	1	1	0	1
19	0	1	1	1

Table 4: Students' satisfaction estimates (2nd case-study).

Specialty	Students' satisfaction estimate, logits	Standard error
1	1,16	0,59
2	1,54	0,66
3	0,26	0,53
4	0,53	0,26

6 CONCLUSIONS AND FUTURE WORK

The given work presents an approach of students' satisfaction evaluation which is a part of education quality assessment in HEE. The suggested framework is based on survey method. One of the quality management postulates states that if we need to assess service quality we should ask the consumers about it. Therefore the presented approach uses the transformed questionnaire to ask students about their opinion concerning university's education quality. To be confident in obtained results the number of respondents should be big enough. The obtained estimates of students' satisfaction rely on statistical data processing which provides all advantages of statistical methods.

The elaborated Information System of Education Quality Assessment can be applied in several ways. The estimates obtained can be used as the parameters of monitoring of students' satisfaction in quality management system of HEE. These estimates can be used for building a strategy of HEE development.

The comprehensive estimate of education quality must take into account opinions of different stakeholders. Education quality assessment from students' point of view must be a part of this comprehensive estimate.

The suggested approach provides surveys conduction and students' satisfaction estimates calculation. This IS can work as independent software or it can be integrated into the monitoring information system.

Future researches are supposed to be conducted in the direction of formalization the processes of higher education quality assessment from the point of view of different stakeholders.

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