European Journal of Operational Research 238 (2014) 199–207

Contents lists available at ScienceDirect

European Journal of Operational Research

journal homepage: www.elsevier.com/locate/ejor

Decision Support

On the student evaluation of university courses and faculty members' teaching performance

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ARTICLE INFO

Article history:
Received 12 July 2013
Accepted 10 March 2014
Available online 19 March 2014

Keywords:
Higher education
Student evaluation
Questionnaire
Statistics
Control charts
Hypotheses testing

ABSTRACT

Trying to determine higher education quality, one gets quickly to one of its significant dimensions, namely the quality of faculty members' teaching. The latter and, overall, the quality of any university course should be certainly evaluated by their recipients, namely students. In this paper we develop a statistical framework based on Statistical Quality Control mainly, which can be used in order to exploit student evaluations as much as possible. More specifically we present two directions of data monitoring and analysis; the one uses control charts and the other hypotheses testing. The results that can be raised through both directions are crucial for any decision maker.

Introduction

For many years now, there have been numerous researchers and practitioners who have studied and written a lot about quality of products and, lately, about quality of services. It is well known that the differences between those two quality variations are many and unquestionable. For instance, consider the following indicative dimensions of service quality which are not so popular in product quality: courtesy, friendliness and responsiveness of employees, accessibility of service and convenience of clients, time and timeline issues, etc.

Focusing on services, things get more complicated, especially when we consider educational issues. The traditional concept of quality is inadequate when it comes to referring to and assessing quality in education and more specifically in higher education. Even a simple definition like "fitness for purpose", when it is interpreted for higher education it depends on the values and priorities set. In other words, the outcomes might be very different depending on who defines the purpose of higher education. Harvey and Green (1993) address the nature of the concept of quality in relation to higher education and conclude that quality is "stakeholder-relative". For example, the attention for students and teachers might focus on the process of education, while employers might focus on the outputs of higher education. There are various "stakeholders" in higher education including students, parents, employers, teaching and non-teaching staff, government and its funding agencies, assessors (including professional bodies) and auditors (Burrows & Harvey, 1992). Consequently, it is not right to consider quality a unitary concept.

Overall, the mission of higher education institutions is fulfilled by two main activities (Green, 1994):

1. Producing graduates to meet the human resource needs of (any type of) organizations.
2. Advancing knowledge via research.

The first activity is closely related with a significant dimension of higher education quality, namely the quality of teaching. Moreover, given that the direct receivers of the teaching service are students, it is absolutely normal and expected that they express their opinion and insights on the quality of the offered services. Their experience is crucial as per any monitoring of higher education quality, despite the fact that often institutions choose alternative or at least additional ways of evaluating their quality, such as external accreditation or peer review (Douglas & Douglas, 2006).

Quite a few researchers have dealt with the evaluation of higher education quality. Politis and Siskos (2004) attempt to evaluate the performance of processes in a Greek engineering department and to construct a framework for the evaluation of organizations using

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http://dx.doi.org/10.1016/j.ejor.2014.03.018
0377-2217/

quantitative methods. Their methodology is based on multicriteria analysis principles, assess the department's operating level and identify some crucial matters. Ray and Jeon (2008) provide a different perspective on the ranking of the various MBA programs and evaluate their efficiency levels, employing a measure of Pareto–Koopmans global efficiency.

Very recently, Kuzmanovic, Savic, Gusavac, Makajic, and Panic (2013) propose an approach for conducting an objective evaluation of university teachers, which is based on previously obtained conjoint analysis data concerning the importance of criteria – from a student's point of view – that are preset by universities and used by students to rate their teachers. Lupo (2013) considers a recent extension of the ServQual model in order to evaluate the student satisfaction level of Italian higher education. Their method uses both the Analytic Hierarchy Process as well as the Fuzzy Sets Theory to effectively handle uncertainty in service performance analyses.

In this paper we develop and present a statistical framework based mainly on Statistical Quality Control (SQC), which can be used in practice by Institution decision makers in order to analyze and exploit student evaluations as much as possible. More specifically, we present two directions/axes of data monitoring and analysis; the one make use of the most important SQC tool, namely control charts and the other exploit "multiple" hypotheses testing.

In what follows, we first present the student evaluation procedure (Section 'The student evaluation procedure'), making references to the practices followed in Greece. Then (Section 'The statistical dimension of student evaluation'), we refer to various statistical issues of the procedure, while in Section 'The proposed statistical framework' we present the basic points of our statistical framework. In Section 'The proposed methodology for continuous evaluation of one course assignment in consecutive semesters – Axis 1' we examine in more detail the Axis 1 of our framework, while in Section 'The proposed methodology for instantaneous evaluation of all course assignments at the same semester – Axis 2' we do the same for Axis 2. In both these sections we also present numerical case studies. We conclude our research in Section 'Discussion and conclusions', referring also to some future research ideas.

The student evaluation procedure

Student evaluations of the quality of university courses and faculty members' teaching ability have been a routine and mandatory part of undergraduate and graduate education for a long time period (Mohanty, Gretes, Flowers, Algozzine, & Spooner, 2005). The style of student evaluations varies from country to country, or even from institution to institution, but, generally, the most common form of this type of evaluation is completion of a multi-item survey/questionnaire assessing areas such as specific and general ratings of course effectiveness (for example course content, organization and difficulty, etc.) and/or specific and general areas of teacher's effectiveness (for example his/her communication skills, organization, enthusiasm and knowledge of the taught subject, etc.).

In Greece, quality assurance of educational and other services in higher education has gained lately significant attention. The same stands also for the evaluation of higher education institutions. According to the relevant Greek legislative framework, the quality evaluation procedure is conducted periodically, in two ways: internally, by the Schools and the Departments of institutions, and externally, by accredited third parties. Moreover, in order to enable the evaluation procedure, the legislative framework provides for the establishment of a new organizational structure at every institution, namely the Quality Assurance Unit (MODIP), which acts in parallel and in collaboration with the rest units of the institution. The coordinating body of all higher education institutions' MODIPs is the Quality Assurance Authority (ADIP), which oversees the evaluation of institutions nationwide and sets the rules, standards and criteria for the quality evaluation.

The evaluation of quality of university courses and faculty members' teaching performance is conducted in Greece by students, through questionnaires. ADIP has designed a standard questionnaire, which has been adopted and is used by all Greek higher education institutions. Through its questions students state the level of agreement or disagreement (on a 5-point Likert scale) regarding several quality characteristics of the educational work of their institutions, grouped in five categories:

- Course issues.
- Teacher/instructor's characteristics.
- Teaching assistant(s)' characteristics.
- Lab issues.
- Students' participation.

Moreover, there is a section of general comments, which is completed by students using free text. Through this general, university-wide questionnaire every institution can benchmark courses and faculty members, not only within the different institution units (e.g. departments), but also at a national level, considering the respective metrics of other institutions.

Departments as well as individual teachers have the option to add their own questions to the evaluation questionnaire, giving a more personal and occasionally a more useful mapping of factors that are important to higher education quality. For example, those that rely a lot on laboratory work, studio sessions, or other specific forms of pedagogy may ask questions that are related to these elements.

In Greece, the evaluation of every assigned course and its teacher is conducted during a lecture that takes place in the period between the 8th and the 10th week of every academic semester. Questionnaires are completed by students anonymously, either electronically or in a paper form. In order for a student to participate in the evaluation process, he/she has to be present in the classroom on the date the questionnaires are distributed. Participating in the evaluation process is completely optional.

A course assignment is the basic *evaluation unit*. For example, a teacher that has undertaken two classes (i.e. groups of students) on a laboratory course and one class on a theoretical course, is considered to have two course assignments, namely one assignment for the laboratory course (consisting of two classes) and another assignment for the theoretical course (consisting of one class). Thus, he/she will be evaluated regarding those two assignments.

The statistical dimension of student evaluation

Every educational work of an Institution occurs within a system of interconnected processes, which contain many sources of variation. For example, teachers have different upbringings, educational backgrounds and working experiences, which make each one of them unique in terms of personality and values. They work with different students, which have unique personalities, while they interact with various individuals on campus (other teachers, administrators and staff) and perform different kinds of tasks. Moreover, they often utilize a variety of resources (e.g., textbooks, reference books, notes, writing instruments) and their work involves the use of different kinds of equipment, with varying features, capability, and performance. They work under different supervisors, who may have a variety of management styles and they are also affected by many environmental conditions (e.g., family relationships, noise level, the collegiality of the work