

Quality in the Classroom

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Abstract

The Castelldefels School of Technology, at the Technical University of Catalonia, has, since 1999, the ISO 9001 certificate of quality (initially the 1994 version, and currently the new 2000 version). This certificate, issued by Det Norske Veritas, is valid for the “Design of the education programme and the organisation and development of the educational activities”.

As required by the current ISO norms, our school has adopted the process model for the implementation and improvement of quality management system. In this system we have included a new process called “teaching innovation”, whose mission is to *promote, evaluate and disseminate teaching innovation projects in order to improve the academic performance and satisfaction of students (as well as the satisfaction of teachers), and increase the prestige of the school as a teaching centre*. One of the projects that have been launched by the teaching innovation process is called “Quality in the classroom”, which is supported by the Department of Universities, Research and Information Society (Generalitat de Catalunya). The first objective of this project is to experiment with the application of the quality principles promoted by the ISO 9001 norm in the process of preparation and delivery of teaching (that is, everything that happens in the classroom and in the teacher office). To that purpose, a group of six teachers, that have been already audited by the Det Norske Veritas) will form a first line of experimentation. A second objective of the project is to prepare a set of materials, procedures and recommendations so that the rest of teachers in the school can easily adopt the quality scheme, without worrying about a terminology (that of the quality world) which is frequently difficult to understand and sometimes even rejected by the academic world.

1. Introduction

The culture and terminology of quality, and its tools and methods have impregnated in the last decades, industries and companies in general. The world of education has been also influenced. In particular, a lot of work has been done to translate the concepts related to quality to the context of higher education [MuMo1994], [MEHS], [MMRS1996].

Recently, the idea of quality in higher education is receiving a lot of interest at the institutional level. In particular, different institutional movements at the European, national and autonomic levels can be mentioned.

At the European level, the different recommendations and strategies to build the European Higher Education Area (Bologna Declaration, Sorbone Declaration, Prague Communiqué, etc) put the emphasis, among other important topics, in the convenience to improve the transparency, compatibility, flexibility and comparability of the different

higher education systems. To that purpose, a key aspect is the cooperation to establish scenarios for mutual acceptance of evaluation and accreditation/certification mechanisms. Among others, two initiatives in this direction can be pointed out:

- The creation of the ENQA (European Network for Quality Assurance in Higher Education), that is a forum for discussion about quality assurance systems, with participation of national and autonomic quality agencies.
- The Joint Quality Initiative, which is a working group to discuss issues related to quality accreditation and assurance [JQI].

At the national level, section V of the Organic Law for Universities is devoted to the evaluation and accreditation of programs, and promotes the creation of the ANECA (Agencia Nacional de Evaluación de la Calidad y Acreditación), that will have the responsibility to evaluate and accredit the different programs for official degrees. The ANECA has been created recently, although its initial focus is on teacher accreditation.

Finally, at autonomic level, the Catalan Law for Universities designates the Agencia per a la Qualitat del Sistema Universitari Català (AQSUC) as the main instrument for the promotion and evaluation of quality. This agency will assume will participate in the evaluation, accreditation and certification of quality in the context of higher education in Catalunya.

In this context, an important question arises: will all this movement related to quality in higher education affect what happens inside the classroom? Or will it become just more administrative work for some people in the management and direction teams.

This paper describes a proposal to introduce quality principles into the classroom, in the context of a school (the Castelldefels School of Technology) with large experience in quality accreditation.

2. The Castelldefels School of Technology

The Castelldefels School of Technology (EPSC) started in 1991. At present, four different degrees are given: two first cycle degrees on telecommunication engineering (telecommunication systems and telematics), one first cycle degree on aeronautics engineering (aerial navigation systems) and a second cycle degree on telecommunication engineering. The number of students currently enrolled is about one thousand.

In 1999 the EPSC obtained the ISO 9001:1994 certificate, issued by Det Norske Veritas (DNV). This certificate is valid for the "Design of the education programme and the organisation and development of the educational activities". Last year, this certificate was renewed, according to the new version of the norm ISO 9001:2000.

An important aspect of the ISO certificate is the fact that the delivery of teaching is view as a service that is provided by the different departments, which are outside of the quality system. The direction of the EPSC evaluates different aspects of this service (through satisfaction questionnaires, meetings with students, etc.), but the teaching that happens inside the classroom is not required to follow the ISO principles of quality.

The authors of this paper are involved in a project whose objective is to include the teaching delivery in the quality system. That means that teachers should organize their teaching according to a set of quality principles and should be ready to be audited by the agency that issues the ISO certificate. In this paper we describe the set of quality

principles that we propose for the process of teaching delivery. But before we present our model, we review in the following section the ISO norm.

3. The ISO 9001:2000 norm

The ISO norm specifies the requirements for the quality management system, to be applied when the organization:

- Needs to show its capability to provide, in a consistent way, the products and services which satisfy the requirements of its clients and other external requirements
- Wants to increase the satisfaction of its clients through a process of continuous improvement of the system, and through the assurance of conformity with client and external requirements.

The ISO norm is based upon 8 quality principles:

- An organization focused on client satisfaction
- Leadership
- Participation of all employees
- Organization based on processes
- Management based on systems
- Continuous improvement
- Decision making based on facts
- A mutually beneficial relationship with service suppliers

The norm promotes the adoption of an organization based on processes for the quality management system. The quality system in the EPSC has 18 processes:

Strategic processes

01. Planning and reviewing of the quality system
02. Design, reviewing and validation of programs and teaching organization
03. Documentation and dissemination politics
04. Territory and society
05. Teaching innovation

Key processes

06. New students orientation
07. Pre-registration and registration
08. Regular teaching
09. Complementary education
10. Professional practice
11. Students exchange
12. Final project
13. Evaluation and accreditation of students

Support processes

14. Assessment, analysis and improvement
15. Resource management
16. Human resource management and government commissions
17. Teaching organization
18. Library

4. The teaching innovation process

The mission of the teaching innovation process is to *promote, evaluate and disseminate teaching innovation projects in order to improve the academic performance and satisfaction of students (as well as the satisfaction of teachers), and increase, as a result, the prestige of the school as a teaching centre*. At present, the projects that have been launched by the teaching innovation project are:

- *Quality in Classroom*, to introduce quality criteria in teaching delivery (more details below)
- *Adapt your subject to the ECTS model*, to help teachers to adopt the European Credit Transfer System in the organization of their subjects
- *The wireless school*, to introduce wireless technology in classroom activities

The “Quality in Classroom” project, which is the focus of this paper, is supported by the Department of Universities, Research and Information Society, of the Generalitat de Catalunya. The main objective is to define a set of protocols, tools and methods to achieve a certain quality level in the teaching of a subject, so that the teachers of this subject can participate in the accreditation process. It is expected that the effort to pass the accreditation process results in systematic improvement of teaching quality.

The project is carried out by a group of six teachers (the authors of this paper) who have already been audited by Det Norske Veritas, which is the company that issues the ISO certificate to the EPSC.

Since introducing the ISO quality criteria in the teaching of a subject can be seen by teachers as an overwhelming task, the project is organized into two steps. The first step is to define, experiment and document a preliminary quality level, that we call quality level 0, that can be seen as affordable by teachers, but at the same time represents a step in the direction of ISO standards. The result of this first step will be a set of tools to help other teachers to achieve the quality level 0 in their subjects. As a second step, we will define the quality level 1, that will be a further step to the ISO standard. In the following, we will give some details about the elements which characterize each of these levels of quality.

5. Quality in Classroom: Quality level 0

The requirements to achieve the quality level 0 should be few, and easy to understand by teachers, who frequently are unaware of, and sometime even reject, the quality terminology. We propose that the quality level 0 has 5 elements that are described in the following.

A definition of learning goals

The learning goals of a subject establish the learning that must have been acquired by the students at the end of the subject. A learning goal is a sentence where the subject is the student, the verb corresponds to an observable action, and complements determine the conditions in which the action must be carried out by the student. An example of learning objective is:

Given a declaration of variables, and a sequence of sentences in C (a programming language), the student must be able to determine the values of the variables at the end of the execution of the sentences.

The definition of learning goals is a key element for a correct functioning of a subject. When learning goals are well defined, students:

- Are able to self-assess their progress in the subject (they know what they should be able to do).
- They have a clear idea of how they will be evaluated, which reduces anxiety (no surprises in exams).
- They are able to increase the level of autonomy (if they miss a class, they know better what to do to recover).

On the other hand, a good definition of learning goals is essential for teachers, since:

- It facilitates the selection of adequate teaching and evaluation methods
- It facilitates the coordination among different teachers
- It allows an optimization of class time, since teachers can concentrate in what is relevant to the learning goals

Every manual on good teaching practice insists in the importance of establishing learning goals as the starting point for program design. In the context of quality, the issue is even more important, since, as frequently said: what is not defined cannot be measured, what is not measured cannot be improved, and what don't improve gets worse.

Although any subject has a certain definition of learning goals, frequently these definitions are far away from what should be considered a good definition. Some of the mistakes when defining learning objectives are:

- The subject of the sentence (sometimes implicit) is the teacher:
In this subject the basic features of a processor will be described (to achieve this objective, the teacher just has to explain in the blackboard)
- The sentence really does not have a verb:
This subject includes the following topics: virtual memory, cache memory, parallelism and pipelining techniques (but what should be done with these topics?)
- The verb does not correspond to an observable behaviour:
The student must understand the function of a cache memory (are we going to ask in an exam: do you understand the function of a cache memory?)

A program of activities for the subject

The program should be a plan for the activities that must be carried out to achieve the learning goals of a subject. The important point is that this plan must be stated in terms of what should be done by the students, since this is what is really relevant for the achievement of the learning goals.

This is a radical change regarding the way subject programs are usually done. Very frequently, programs are not more than an ordered list of topics, with an indication of the time that the teacher will require to explain the topic in class. In other words, it is a plan for the work of the teacher in class. If asked for the work of students, usually the

answer is something like: to take notes in class and to devote x hours of study at home, without many details about what should be done in these x hours.

A good program must describe the activities that must be carried out by the students, including:

- The learning goals of the activity
- The key dates and places to perform the activity
- The amount of time that should be devoted to the activity
- The result (product) of the activity, and when should be delivered
- The way students will know if their results are good or not, and why
- The way the activity will be taken into account to compute the final grade

A program stated in these terms is a fantastic guide for students, who will know at any time the path to follow. This is the best way to achieve one of the desires of teachers: that students work in a continuous way during the term, and don't accumulate work for the final period. But preparing a program in this way forces the teacher to adopt the point of view of students, to analyze the nature of his learning objectives, to determine the methods that are adequate for every objective, to prepare the required materials, and to determine his role in every activity.

This way of subject programming is in agreement with the philosophy of the European Credit Transfer System (ECTS). According to that system, the number of credits of a subject must indicate the amount of time that students must devote to the subject. The objective is to stimulate teacher to build their programs in terms of student activities. This is in clear contrast to the current Spanish credit system, where credits measure class time. A subject with a program stated in the terms proposed here will be in a good starting point to adopt the ECTS.

A system for teaching assessment

Assessment in the context of a subject is usually restricted to the problem of determining to what extent students have achieved the learning objectives, so that teachers can decide if students pass or fail the subject (assessment of learning). Introducing quality in a subject requires the adoption of a wider perspective of assessment, including data of student satisfaction, and others (assessment of teaching). Data obtained through this assessment system should feed a system of continuous improvement.

Usually, teachers do not assess their teaching in a methodical and systematic way, do not use much data, and take decisions based on personal impressions. If much of the assessment data come from final examination results, then this data can only be used to improve the next edition of the subject, but not the current one. A continuous learning assessment system, based in frequent exams and exercises allow teachers to monitor the progress of student and intervene to improve.

In a step forward, many universities use an assessment system based on questionnaires, where students give, at the end of the term, their opinions about different aspects of the subject and the teachers. These questionnaires provide more information but usually they do not allow to identify the source of problems (items are too few and too general), and results arrive at the teachers hands too late to be useful for improvement.

Two years ago, the EPSC introduced the use of a middle term questionnaire, where students can state the positive and negative aspect of every subject. The results can be consulted by teachers and academic responsables. Our experience says that this kind of questionnaires are more useful for teachers that want to improve.

The questionnaires that have been mentioned are designed and administered by the institution (the central services of the University, or the school). Teachers should complement these instruments with others more suitable to the idiosyncrasy of their teaching, and to their improvement objectives.

To feed a process of continuous improvement, teachers must determine which is the relevant data, and how and when to obtain and analyze this data. To that purpose, it is important to consider the following points:

- The time the student will require to fulfill questionnaires, participate in interviews, etc, must be considered when designing the program of the subject.
- The time spent by teachers analyzing data must be computed as part of his teaching activity.
- Students may get tired of answering questionnaires, and a lot of data may make difficult the analysis.
- Data must be analyzed as soon as possible, after recollection, and students must know the conclusions of the analysis, and the changes that teachers will introduce as a result of this analysis (in this way they will know that their opinions are taken into account).
- Frequently, more information is obtained by talking to students than through questionnaires. In meetings with groups of students, not only problems are identified but also the sources of these problems. According to the authors experience, these meetings are more effective in a context where students feel comfortable. A round table (with coffee) gives excellent results.
- Written evidence of student opinions and comments is not necessary (except when these results are use for accreditation of teachers). For ISO accreditation, a hand written sheet with the conclusions of a meeting with students is as valid as the pack of questionnaires fulfilled by students.

As mentioned before, the subject program must be presented in terms of activities to be carried out by students, with time estimates. To check that these estimates are correct, students should be asked in a systematic way. A simple way to do that is to circulate, at the start of the first class in the week, a sheet where every student should write the amount of time devoted to the subject during the last week. Teachers should use this information to adjust the workload and correct miss-predictions during the term.

In our project we propose the use of two questionnaires to collect the opinions of students on the value of the subject program.

Critical incidence questionnaire

At the end of a period (for instance, at the end of an activity of the program), it may be very useful to ask students to fulfill a critical incidence questionnaire [Broo1995]. Every student should fulfill a sheet to answer two questions: What was the most positive (and the most negative) incidence in the last period of the subject? The questionnaire is anonymous and students must answer very fast (if they require long time to remember,

then there are not critical incidences, and a blank answer is ok), and be very concrete (for the answer to be really useful).

When analyzing the student answers, teachers will have a very clear picture of student perceptions, that should be very useful to identify improvement for the next period of the subject. Teachers must feedback as soon as possible to students the conclusions and improvements to be introduced. In this way students will put even more interest in answering the next critical incidence questionnaire. In general, as students get used to answering this kind of questionnaires, the quality of their comments improves.

End of term questionnaire

In our project we use the SEEQ questionnaire (Students Evaluation of Educational Quality) [MaRo1994], for several reasons:

- It is a very solid questionnaire, that has been validated by a large amount of research that has proved its validity, reliability, etc.
- The items of the questionnaire consider different aspects of teaching, which facilitates the identification of areas for improvement
- The questionnaire is widely used, which facilitates comparisons among institutions.
- There is a certain amount of material specifically designed to help teacher to improve the items of the questionnaire

Obviously, the SEEQ questionnaire suffers from the same problems that any other: it is not suitable for all possible subjects or ways of teaching. For instance, the SEEQ questionnaire is not very suitable for distance education. Anyway, there are adaptations of the SEEQ questionnaire for different scenarios that may be also useful [Curt].

The end of term questionnaire is a good instrument to guide a final assessment, and to identify those aspects of the program that must be improved during the next term.

A well documented continuous improvement process

The quality level 0 requires that the teachers of the subject are always involved in a continuous improvement process. Every term they must have a improvement plan for the subject (it may be a modest one), and this plan must be based on data collected through the system of teaching assessment, mentioned above.

Ideally, the teachers of the subject must produce, for every term, a document containing the following information:

- What are the aspects to be improved next, according to the analysis of data
- What is the improvement plan
Description of actions to be carried out to achieve the improvement. There must be a clear justification that these actions are connected to the improvement objectives.
- Evaluation plan
It is important to identify which type of assessment data will change as a result of the improvement plan (i.e. the results on item x of SEEQ, the amount of students that achieve the learning objective y, etc.). It is very convenient that the evaluation plan includes indicators in mid term, so that teachers can have soon a feedback about the effectiveness of their plan, and be on time to adjust the plan if necessary.

- Impact analysis
This section of the document must evaluate the impact of the improvement plan, which should be easy if there is a good evaluation plan. This is also the point to identify the next possible aspects of improvement.

A web page that documents the quality level of the subject

The elements that demonstrate the quality level of a subject must be made public, for several reasons:

- Students should be able to consult, at any time, some of the elements (for instance, the learning objectives or the program of activities). On the contrary, these elements will not play their role.
- It should be possible to audit the subject. That means that all the documents, material, etc. that characterize the quality level should be accessible by external people (in particular, by the certification agency).

Today, the best way to make public the material of a subject is to build a web page, where some of the elements may have a restricted access (for instance, results of student questionnaires).

6. Quality in Classroom: Quality level 1

Once quality level 0 has been achieved, teachers should be able to afford quality level 1, which takes the subject closer to the ISO standard of quality. In the following, we enumerate the elements that could define quality level 1.

- An specification of input requirements
The definition of what student should already have learned at the beginning of the term
- A system for formative evaluation
The subject should have a system to inform students frequently about their progress during the term, on time to make corrections.
- A manual of procedures for teachers involved in the subject
A requirement of ISO standard is to document all procedures, so that changes in people in charge do not imply difficulties.
- A program adapted to the ECTS system
This should be easy if the program has been designed as described before, when dealing with quality level 0.
- An specification of resource requirements
The ISO norm requires the specification of resource requirements. This may include the number of class hours, number of work hour for students, hardware and software required for lab work, etc.
- An identification of clients and suppliers, with the specification of mechanisms to establish their requirements and their level of satisfaction

Conclusions

The quality principles, tools and methods have been well accepted in many areas of the university organization. As an example, the Castelldefels School of Technology has the ISO certificate of quality for the design and organization of its educational programs.

That means that all members of the administrative and direction staff should be ready to be audited.

However, more resistance is found when considering the adoption of quality principles in the context of teaching delivery (for instance, many teachers refuse to consider their students as clients of their work).

The authors of this paper are involved in a project that pretends to facilitate the adoption of quality principles in the process of teaching delivery, in a way that can be seen as affordable by teachers. To that purpose, we have presented a model based on two steps towards the ISO standard. To achieve the quality level 0, which is the first step in our model, a subject must include 5 elements: a definition of learning objectives, a program describing the activities to achieve the learning objectives, a system for teaching assessment, a well documented continuous improvement process and a web page that documents the quality level of the subject. To define this level of quality, we have avoided the quality terminology, but the proposed elements represent a determined step in the right direction, since these elements include key aspects of the quality culture: setting objectives, measuring and continuous improvement.

The second step (quality level 1), still to be defined, will take the subject much closer to the ISO standard, since teachers will be asked, for instance, to identify their clients and suppliers, and to design instruments to assess their requirements and level of satisfaction.

The project is in a phase of model definition and documentation. It is expected that a large number of subjects, teachers and students will benefit in the next future from this effort.

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