

# Quality Technology and Educational Systems

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*Abstract:* – This paper shows how quality programs (quality technologies) can be successfully applied to educational systems (in our case, in engineering area). We show results that come from development and application of Quality Programs to engineering undergraduate programs from 2003 to 2005. Such programs ultimately aim at applying basic concepts of Total Quality to the structure and the operation of teaching activities, so as to visibly improve them. We carry out a critical analysis of such experiences, based fundamentally on recent reports given by those engaged in this question. It is important to say that this study has a practical perspective, since it uses a survey about the implementation of quality programs in Brazil. In many cases studied the quality programs adopted were considered to be failing. Although failure is to a certain extent hard to define for each case, there certainly is consensus that things did not work out. And in order to avoid similar situations it is worth investigating both failure and its causes. That is the topic of this study, which aims at building a checklist of practical suggestions to keep the mistakes observed from happening in the future.

*Key-words:* quality programs, educational institutions, results, failures, analysis.

## 1. Introduction

The main goal of the development and the application of Quality Programs to Educational Systems is to apply basic concepts of Total Quality to the structure of academic activities. The use of quality programs is mainly devoted to selecting practical actions to improve educational processes. These actions are custom made to the characteristics of the educational system they are directed to.

This paper is part of an important project that seeks to develop a critical analysis of such experiences, based on reports of people involved in these processes. It is also considered a model of this kind of program, which has been applied at the Federal University of Santa Catarina (Brazil) for 7 years.

An evaluation system is structured here. The system has monitored several engineering courses for a long period, and intends to study situations in which the obtained results were worse than expected (cases characterized as “failure” of the program application) focusing on the analysis of causes, circumstances, situations or accidental aspects which had contributed to it.

From the several considered topics, we concentrate in some productivity aspects of educational systems and we study what the quality programs have made to improve them. We present

the failure notion in the quality programs. Also some quality indicators are considered. These indicators can be used to evaluate the productivity of educational systems.

We also analyze who can evaluate a quality program of educational systems and what determines the quality program failures in education. As we have done in other opportunities, the failure causes in the quality programs applied to teaching institutions are organized in general classes, in order to relate them to the roots of the problems or to its more immediate meanings.

We still maintain four groups of causes to failure in quality programs but in another order of importance: (1) quality program management (39% of the situations); (2) administrative postures (31% of the situations); (3) the quality program structure (16% of the situations) and (4) human resources action (14% of the situations). For each group considered, the failures (or, at least, the weak results) were attributed to some causes that we study here.

## 2. The Study Environment

Several students and teachers of the Federal University of Santa Catarina, acting in Quality Management Area, have been working in training, technical and specialized consulting activities in

quality. They have, at the same time, carried out a research in, at least, 350 Brazilian organizations since 1999, in terms of quality programs these organizations have applied in the last seven years. Part of those activities have been developed in teaching institutions – all of them in the engineering area - which have been dedicating themselves to include quality programs in their academic programs. The relation between education and business is always interesting, as pointed out, for instance, by Munro and Rice-Munro [1].

In the study we consider in this paper we have included seven universities, seven higher level schools and six technical schools. The focus of the study is the undergraduate programs of engineering. In many of these cases, the quality programs applied were considered to be unsuccessful. In spite of a certain difficulty in characterizing what comes up as failure in each case, there is no doubt that the programs did fail, for there was a consensus that “things did not work out”. Aiming at avoiding the repetition of such situations, it is worth analyzing the failure itself as well as its causes.

The Quality Programs applied to the educational area has been an innovative action because of their specific characteristics (see, for instance, [2]). So the results they create must be visible, even in a short term. Because of their impact and amplitude, they must also be presented in an understandable form to everyone. Maybe the best way to facilitate this comprehension involves the presentation of results as numbers (quantitative way).

In the several studies we have developed, we always consider a critical point of the analysis of quality programs to determine who can evaluate the engineering undergraduate courses and what determines the quality program failures in education. In order to have a better idea of the failure causes in the quality programs of teaching institutions, we have applied a special classification to them. Therefore, the programs are organized in general classes, in order to relate them to the roots of the problems or to the more immediate meanings of such problems. For each group considered, the failure (or, at least, the weak results) was attributed to some causes that we study here.

The main results of this paper concern the correct and incorrect actions and also the correct and incorrect concepts adopted in engineering courses by quality programs. Such results will help teachers, educational policy makers and educational researchers to avoid wrong decisions and create effective productivity within educational systems.

### 3. Why Quality Programs Fail

There is a common point between industrial and services organizations and educational organizations in terms of quality programs. All of them want to know the answer for the same question: “why do they fail?” The data we have shows the same problem as the main one: to understand exactly what a failure is. The usual notion of failure refers simply to a situation in which we could not reach expected results or objectives. We have seen the same idea when desired benefits from some actions are not generated. This notion seems to be quite clear. It can be found in all the cases studied. A detailed report on this research and in similar researches can be found in [3].

The analyses of quality programs consider that the general and also the specific objectives of the programs play an essential part in their evaluation. As an historic element of evaluation, it can be observed that the first problem in quality programs applied to the educational process is the incorrect, inconvenient or inadequate definition of the objectives.

The empirical research in the educational organizations in the last three years (2003 to 2005) has detected four main errors and conceptual confusions:

(1) The objectives of the quality programs refer to long-term results and no immediate benefits are seen. Classical example: the program emphasizes some alterations of student or teacher’s behavior, like larger participation degrees in technical groups for quality improvement. The local culture, however, has never valued this participation and the educational system has never generated mechanisms to change this situation. So the common sense in the group of educational organizations we have studied is that this participation is not productive or, at least, is not useful to the relationship between teaching and learning. Occurrence in the educational institutions we have analyzed: 85%.

(2) The objectives are structured in a subjective way and so it is not possible to quantify them or express them as numbers. This seems to be a quite common situation in education in general. Example: we know that it is difficult to measure how much a group of students has understood the importance of some kind of knowledge. It is also difficult to define exactly what are communication degrees, content domain, class planning, relationship with students, clarity and objectivity or satisfactory answers to questions formulated by the students. But it is possible to define indicators that determine acceptance levels for these elements. Occurrence in the educational institutions we have analyzed: 70%.

(3) It is not possible to see the direct relationship between the results desired and the actions and guidelines chosen to generate them. Example: The changes made in the courses are not directly connected with the positions the students and teachers have suggested in the “problem analysis groups”. On the other hand, the actions taken “to alter” the educational program find an end in itself. Any action proposed, however, should have very well defined objectives. Occurrence in the educational institutions we have analyzed: 60%.

(4) The objectives were not feasible for the institution reality. In most cases, the feasibility depends on some resources and they are not provided. Example: Some institutions have altered the teaching methodology, by using advanced computational support. Nevertheless, the computer devices did not fit the chosen methodology. Occurrence in the educational institutions we have analyzed: 45%.

These results show that the first difficulty to be outlined is to define correctly the objectives of the quality programs. We have concluded, indeed, that if general or specific objectives are not correctly defined and considered, the quality program may lead to a situation that cannot be seen as a failure but, rather, the result of a mistaken or false expectation.

Another important point to take into account when defining failure in quality programs is consequence from the fact that we do not know the actual situation of the educational process or of the educational system. So, when selecting the quality program to be used, some important pieces of information are missing, or such information is not representative of the situation, or, finally, it is not enough to have an exact idea of the environment. In 11 educational institutions analyzed during this research (55%), the lack of information is the first deficiency we have detected (and often the most indispensable requirement).

At the same time, to other nine institutions (45%) there is too much information. It is possible to see, in these cases, no classification method used and no evaluation processes applied to the collected information. It seems that all information has the same relevance. Some problems observed: (1) bad information flow; (2) poor communication processes; (3) low level of representativeness of each piece of information and (4) the use of samples that are not adequate for the data.

## 4. The Main Difficulties of Quality Programs in Educational Organizations

The analyses of quality programs in educational organizations shows that the first difficulty is to define, exactly, what is the real environment that the quality programs are included in. If we cannot know exactly the area we are working, we cannot have correct information about the educational system, the educational process and, mainly, about who is involved – teachers, students and support people.

At the same time, we can observe that it is not easy to determine what the main general direction of the quality program is. So frequently we cannot know what the correct objectives in quality programs are.

It means that the evaluation process may be using incorrect information, may be including people that do not have importance in the process – or, at contrary, excluding important people – and may be using an incorrect general direction of acting. Those are the reasons why we decide to use a methodology that has considered the use of quality indicators, which are the basic elements of evaluation.

These indicators should have some characteristics. To the study of this paper, the following ones are critical: Precision (i.e., the indicators cannot allow double interpretations); objectivity (i.e., measurable indicators); viability (i.e., the indicators cannot require information that the system cannot have at this given moment or that is not available now); representativeness (i.e., the indicators must show the reality of the institution now); comprehensibility (i.e., clear indicators); wideness (i.e., the indicators allow a large visualization of the situation) and visibility (i.e., the indicators show visible and unquestionable results of the programs). These characteristics are described detailed in [4]. These points show an historical and critical action to evaluate quality programs: to define correct indicators.

Another important difficult to be minimized in the definition of the evaluation methodology structure is to select who can evaluate the quality programs. Considering basic quality concepts, we have defined the first principle of the quality program evaluation as follows: every evaluation of quality is centered on customer's satisfaction. In the case of quality programs used in educational institutions, or, in general, in educational systems, the first question to consider is who the real customer of the program is.

We have worked extensively in this point and it is possible to detect an historical mistake here. And we have determined that the main point here is to

determine three critical environments in educational systems: the in-line, on-line and off-line environments. The concepts of in-line quality, on-line quality and off-line quality are the ones defined by Paladini [3] and Taguchi [5].

Most of the programs consider the students as customers of the process. Actually, the students are the “*raw material*” to whom all the efforts of the systems are directed. *Raw material* here means: the students are the elements under transformation during the educational process. So we consider the students as a part of the *in-line* quality process. Being the main support of educational systems, teachers are included in *off-line* quality environment.

So the main point to consider defining who is the real customer of educational systems is to define the *on-line* quality environment. It is necessary to establish the real customers of the educational system. We consider that the customer is society as a whole. In fact, the actual objective of universities is to shape good professionals to society.

Therefore, society can evaluate the educational process results. In terms of quality programs, the role of society is evaluating the results of the efforts for the improvements of educational systems as a whole. We consider a serious mistake not to include alumni in the evaluation process, as well as the companies, organizations and, finally, the working environment where the alumni are acting now.

## 5. Structure of the Evaluation Process

This study was carried out in twenty educational institutions. Engineering undergraduate courses were the main kind of educational process we have analyzed, during the years 2003, 2004 and 2005.

The quality programs in these institutions have between eight to ten years. They started by 1996/1998 as a set of actions to improve engineering courses in order to get students with better quality process, a better grade to the courses in national evaluation agencies and a consistent image of the institution name in the region or the country as a whole. Also the optimal use of the resources of the organization is the goal of these programs.

To each organization, four courses were selected. We have applied evaluation indicators to these courses, with the characteristics described above. These indicators have pointed the failure causes in the quality programs of the educational institutions we have studied.

This research was developed according to the same structure we have used in former researches. This structure has four main steps: (1) first we

applied some data collection techniques. We considered students, teachers and other elements in the educational system. At the same time, we have studied the environment where former students from those institutions are working now. Finally, we interviewed different areas of society. (2) Statistical treatments were applied to the data collected, i.e., we organized the information and gave a quantitative approach to the educational system evaluation. (3) All the conclusions were tested in the same institutions where the data had been collected. (4) The final conclusions were tested in other institutions and then we have extrapolated them. As a result of step 4, we organized in general classes the causes of failures in quality programs applied to educational systems. Hence it was possible to relate quality programs to the roots of the problems or the more immediate contexts of such problems. Three groups of causes have been identified: (1) Quality program management; (2) Human resources management and (3) General management (it means the effective management actions). For each considered group, the failure (or, at least, the weak results) was attributed to the following elements (with the number of observed cases):

### Group 1: Quality program management.

Failure Element: The program was intended mostly to generate expectations rather than to generate real and practical results. Observed situation: The real goal of the School Administration was to promote its own actions and the quality program itself – not the results. So the program generated a large expectation, without having any concrete action to create concrete benefits for teachers or students. Occurrence: 75% (it means 60 courses, in 15 out 20 institutions).

Failure Element: The quality program requests some resources but they are not feasible. Observed situation: We have observed the lack of qualified teachers, adequate devices for computational area, a simple information flow. We should consider yet the lack of other kinds of resources, such as teachers' answers in terms of creativity, responsibility, dedication or participation. Occurrence: 70%.

Failure Element: The program does not listen to people directed included inserted in it. Observed situation: Some changes in the courses have been made by the High Administration. The teachers' positions about the changes are not considered. So they stay out of the process. Two positions are adopted by the teachers then: indifference or aggressiveness. In the first case, they refused to collaborate; in the second, they boycotted the program. Both situations are fatal for quality programs. Occurrence: 65%.

Failure Element: In a similar way of the last failure element, the decision about the quality program actions comes from the Administration. They do not want to listen to anyone. They do not accept suggestions. Observed situation: It seems that the program has “a big boss”. Teachers and students did not want to take part in a program which they did not agree. In fact, we noticed that the Administration’s actions (without considering any other action suggested, e.g., by the teachers) inhibited participation and restricted personnel's involvement. The natural consequence of the process is an attempt of sabotage against the program. Occurrence: 60%.

Failure Element: The structure of the program did not reach its own objectives. Observed situation: The structure of the program could not generate an integrated action of involved people. At the same time, it was not possible to create an integrated view of the different areas of the courses. Thus, missing a positive integrated action, there is constant conflict among teachers of different areas or of different centers. We have pointed out in former researches that it is normal to have different points of view but it is not acceptable that this divergence hinders the quality process. The same process is observed here. Occurrence: 55%.

Failure Element: The quality program did not attribute a correct role to the teachers or to the students. Observed situation: In the most common situation, teachers and students have tasks to do. But nobody explains why these tasks should be done. Occurrence: 45%.

Failure Element: The different steps of the program were not correctly applied. Observed situation: A mistaken schedule was planned allowing too much time for simple activities (simple changes of the content of some courses) or, conversely, too little time for complex activities (curricular integration in the new structure of the courses). The first case leads to idleness; the second, to incorrect or unsatisfactory outcomes. In both cases, the results are poor. These situations have been observed for a long time now. Occurrence: 35%.

Failure Element: Lack of participation of the High Administration of the school in the program. Observed situation: The High Administration agreed with the program. They say the program is very important to the institution’s survival. But they did not take part of it or they did not give support to it. Absence in events of the program (seminars, meetings, congresses etc.) and indifference to some positive results obtained were cases where the poor participation of the Administration in the efforts for quality could be noticed. The idea that the program is unimportant therefore prevails. An old notion must

be considered here (and always): “the example should be set by the top”. Occurrence: 25%.

### **Group 2: Human resources management**

Failure Element: Several restrictions to teachers, support people and students actions. Observed situation: It is still a common practice to prohibit teacher to discuss salaries or student to discuss a certain issue under the excuse that they do not have enough qualification for such area. Occurrence: 85%.

Failure Element: A formal, effective and practical motivation process is missing. Observed situation: Situations like underpayment or unsatisfactory benefits to the teachers and support people. Occurrence: 70%.

Failure Element: Lack of visible acknowledgment of people’s efforts. Observed situation: Lack of a simple comment (“you have done a good job”) or the lack of concrete benefits (such as awards, for instance). Occurrence: 65%.

Failure Element: There is no adequacy of the activities designed to some teachers, support people or students. Observed situation: To ask for evaluations with many statistics and complex number for people acting in human and social areas. Occurrence: 45%.

Failure Element: The idea that people always know what to do. Observed situation: The High Administration of the educational institution does not see reasons to train teachers. Of course, they are undoubtedly competent. However in their specific areas and not in quality tools or improvement concepts. Occurrence: 35%.

### **Group 3: Effective Management Actions**

Failure Element: The real objective of the program is not to produce quality. Observed situation: The Administration of the institution seems to want to produce quality, when actually other objectives were in mind. The real objective of the institution was just to reduce costs. Occurrence: 75%.

Failure Element: The Administration understood that the program would not require investments. Or the program would not bring costs for the school. Observed situation: The program began to fail when the administration did not provide funds for the teachers’ qualification, or to the purchase of computational devices or material to keep the laboratories functioning. Occurrence: 55%.

Failure Element: Fast results were expected. Observed situation: Immediate improvement of the involved people – teachers, students, and support people – it means: everybody. Occurrence: 45%.

Failure Element: The quality program seems to show that to get good quality indicators is very easy. Observed situation: The High Administration says that everybody can produce good quality in all their activities. It is enough to want and to begin – making anything.... It means: there is no quality tool required to produce quality. Occurrence: 35%.

Failure Element: The Administration associated quality with some specific factor and gave to it the maximum importance. Observed situation: The quality seemed to depend just on the good student selection or teachers' care in preparing their classes better. Occurrence: 30%.

## 6. Conclusions

It is important to have in mind that the results portrayed in this paper refer to twenty Brazilian educational organizations, from 2003 to 2005 and are specific to engineering courses (technological area). So the quality program evaluation above and also the conclusion below are related to this area and institutions. Therefore, they might not be applicable to other courses. But it seems that the results – in terms of quality programs applied to educational processes – can be valid for other universities.

In broad terms, it is possible to summarize the causes of failures in some general items. First, we have to consider that it is important to understand exactly what a failure means. In many cases, the failure is consequence of objectives that are defined in an incorrect way. So the first evaluation to do is the objectives evaluation. And that the first difficulty to be outlined is to define correctly the objectives of the quality programs. We state (and highlight) again that if general or specific objectives are not correctly defined and considered, the quality program may lead to a situation that cannot be seen as a failure. It is, in reality, a set of mistakes or false expectations. Another conclusion we can observe is that the failure in quality programs is not in the program itself but it comes from the fact that we do not know the actual situation of the educational process, the educational system or the environment we are working in.

So it is possible to confirm, with these results, some conclusions we have observed some years ago. In fact, a quality program cannot be successful if the idea of quality is not correctly understood and a quality program cannot be successful if we invest in general concepts but we neglect the way to make them feasible.

Another important conclusion to point out is the following: Technical concepts of quality management are not known by teachers or students of any area.

So, the quality program has to show them the correct concepts of quality. Here, we have detected a conceptual failure that has to be eliminated because it always has critical consequences for quality programs in any kind of institution. As a result of that, we have historically observed several troubles in quality programs management: poor understanding of the importance of quality; lack of priority for subjects that are really important (for example, the correct definition of who is the customer of the program); lack of a clear perception that quality depends on a number of factors (multiplicity of items) and not on a single item which was emphasized; lack of resources; lack of investments in adhesion, motivation, formation and personnel qualification (this involves teachers as well as the whole supporting staff involved in the course). Typical techniques of quality included here are showed in [6], [7], [8] and [9]. So the main objective of the quality programs in educational institutions is the same objective considered in industrial or services organizations: to make clear what is quality. It means, for instance, what we can expect and what we cannot expect from quality programs, in any area or organization.

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