

Experience gained from the application of basic quality assurance procedures in a Greek university engineering department

A.M. Stamatelos*

University of Thessaly, Department of Mechanical Engineering, Volos, Greece

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During the last decade, significant funding has become available to Greek public universities to support the convergence to the common European space of higher education. In a number of departments, this funding was wisely invested in the development of a quality culture, covering not only the educational process, but also the services offered by the department's administration and technical support staff. This paper presents the design and implementation of a quality-oriented studies' reform plan in the Mechanical Engineering Department, University of Thessaly in the period 2002–2008. Based on the successful experience from its application, a significant part of the personnel and students have become acquainted with basic quality assurance procedures and performance evaluation. Experience and lessons learnt from this effort are reported and discussed in this paper.

Keywords: Bologna process; engineering education; quality culture; university reform

1. Introduction

The revolution in higher education marks the significant transformation of Western society in the beginning of the twenty-first century (knowledge society) (Drucker 1993, Crosier *et al.* 2007, Terry 2008). In Greece, the public university sector was slow in following this process, which was especially revolutionary in other European countries, following the Bologna Declaration in 1999. The government tried to reduce the gap by intensive legislative measures, introduced in the period 2005–2007, but lacked adequate preparation and support. Thus, it is not surprising that the overall progress in meeting the Bologna goals is much slower than one would deduce by reading the official reports (Rauhvargers 2007). As regards quality assurance, the guidelines of ENQA (2005) state that:

Each university should formulate a policy and procedures for the quality assurance in their programs and commit themselves to the development of a quality culture. To this end, a strategy should be devised with a role for students and other stakeholders.

(UTH 2004)

*Email: stam@uth.gr

As of 2007, the evaluation procedures pertaining to higher education institutions are coordinated and supported at a national level by the Hellenic Quality Assurance Agency for Higher Education (HQAA) (Greek Republic 2005). A Quality Assurance Unit is now established in every higher education institution, with the initial task to coordinate and support the evaluation procedures.

In 2007, HQAA started to organise internal and external audits on university departments, on a voluntary basis. The number of departments engaged, which was low during 2007, increased significantly during 2008 and about 10% of all university departments in Greece had submitted their self-assessment reports by the middle of 2009. However, the newly established HQAA, suffering from important organisation, staff and financial support problems, failed to keep up with its original target of completing about 100 external evaluations per year (HQAA 2009). The lack of understanding of quality principles by a significant part of the academic, technical and administrative personnel seems to be the basic reason of the delay in implementing evaluation procedures (Stamatelos and Stamatelos 2009). Many pieces of information and data, values of indices, etc. required for the compilation of the self-evaluation reports, are not collected in electronic databases on a regular basis; thus, their compilation is laborious and the resulting values of evaluation indices cannot be readily checked for possible errors or bias.

It is an interesting fact that the Greek Ministry of Education has invested significant funding during the last decade to support the reform in the higher education curricula. Most of the faculties considered this funding as a financial support to their general activities. Only a limited number of departments invested this funding opportunity in the further development of quality systems that they had previously started by their own initiatives, involving a critical mass of faculty, students and staff in the process. This is the case of the Department of Mechanical Engineering, University of Thessaly, a new department (Stamatelos *et al.* 1993) with relatively young professors – already acquainted to a certain extent with quality assurance procedures.

The faculty members, students and staff who were deeply involved in the reform programme (about 30 people in total) opted to ensure a lasting value to the reform procedures. To this end, special emphasis was given to the simplification and computerisation of quality procedures and the design and compilation of electronic databases. The experience gained from the application of basic quality principles and practices to the department in the period 2002–2008 is briefly presented here. Detailed reports can be found in the programme's website (Stamatelos 2009).

2. Relevant literature

Quality assurance systems in higher education are nowadays applied all over the world, even in the developing countries. In this regard, the question is no more whether quality assurance is needed in higher education, but to what extent the quality assurance system in a given country is functional (Bazargan 2007). In the middle of the 1980s when the European countries started to consider quality assurance frameworks in higher education: 'the US already had a long tradition of accreditation and quality assurance. Since then, almost all European countries have established national quality assurance systems in higher education' (Crosier *et al.* 2007). However, academics all over the world, despite their commitment to academic quality, continue to resist the wide application of quality assurance processes within their universities. A number of reasons for this behaviour are reported: issues of distribution and exercise of power; differences in defining and understanding quality; concerns about the effectiveness of quality assurance processes; increased bureaucracy introduced to the system; etc. (Anderson 2006).

According to a UK study (Hoecht 2006), although academics agree on the importance of quality in higher education, some of them argue that the type of quality management currently established in the UK comes with high opportunity costs and will not necessarily achieve real improvements in teaching and learning. In other words, the shift from informal quality systems, based on local

practices and a significant amount of trust and professional autonomy in the early 1990s to a highly prescribed process of audit-based quality systems of today, is not univocally justified.

According to a European survey (Billing 2004), there is no general model of quality assurance, but most elements of a general model are valid in most countries. Indeed, experience from university life points to a number of essential elements that should exist in every model of quality assurance, even in the most simplistic one. The next sections discuss which quality elements are considered essential. Even the mission of the department is understood in different ways by different faculty members. In the case of this department, a mission statement was finally agreed in 2008 focusing on the following objectives:

- To produce new fundamental and applied knowledge and know-how, through systematic research.
- To promote critical thinking aimed at enhancing the knowledge, skills and capabilities of its students and researchers through inspired teaching.
- To provide high-level services and consulting at a local, national and international level.
- To succeed in the competitive contest for research funding and human resources.
- To ensure the quality of all types of services that it provides and to reward its staff for its efforts in the best possible way.

The incorporation of a ‘quality’ component in the mission statement was an important outcome of the department’s quality policy in the period 2000–2008. The executive management consists of a chair and laboratory heads. The operational techniques and activities used in the department to fulfil the requirements for quality are understood as the quality control system. In an engineering school, such as this department, quality principles are already familiar to students and staff. This was an advantage compared with other departments (Stamatelos and Stamatelos 2009).

3. Design of the reform plan

This university and department are only about 20 years old. Thus, one cannot profit from a long tradition that could protect from severely deflecting from the course, in the process of changing to meet common European goals. The lack of tradition also affects the degree of interconnection with the regional stakeholders. One should take into account the above boundary conditions, in order to understand better this approach. The curriculae reform was designed along the following lines, which reflects a strategy towards the development of a quality culture:

1. Reinforcement of the laboratory skills of the students and integration of case studies in all courses.
2. Training in the use of modern computational tools, introduction of new subjects and teaching modes.
3. Development of an inclusive diploma study plan (course credits – weekly student load – interdependence of courses – integration in course cycles).
4. Support of all courses via the development of functional web pages, including course material, a variety of references, books, foreign language bibliography, software, technical rules, professional regulations and directives.
5. Establishment of a quality assurance office (QAO), to coordinate and support the continuing development of teaching, research and service quality standards, indices and self-evaluation processes and also to develop and maintain a network for regular contacts and feedback reception by the alumni.

The initial proposal was evaluated by external evaluators invited by the Ministry of Education and received the highest grade among all proposals from Greek engineering university departments (2002).

4. Main results obtained

The main results obtained from the project's work packages are briefly described below.

4.1. *Amplification of laboratory studies*

This task aimed at a reinforcement of laboratory skills and the integration of case studies from industry into the courses. Measurement and testing equipment and capabilities in the laboratories and laboratory involvement of the undergraduate students was increased. Case studies from the cooperation with industrial partners were inserted in certain courses, to attract students' interest. The best qualified PhD candidates and staff of the department were selected to participate in this effort.

4.2. *Training in the modern computational environments and tools*

This task aimed at the enrichment of the course content in industrial software, the reinforcement of student knowledge and skills in informatics, the development and use of new teaching methodologies and the introduction of new courses in modern areas of mechanical engineering. This resulted in the modernisation of the courses and the increased incorporation of computational skills. The students are now better acquainted with the commercial software that they will encounter later in their job environment.

4.3. *Inclusive 5-year diploma curriculum*

The integrated diploma studies' plan was updated and supported by a course database with analytical syllabus, estimation of students' workload, interdependences of courses and directions of specialisation. This material was of fundamental importance in the redesign of the curriculum to be compatible with the Bologna Process cycle structure. The 5-year diploma is a first post-graduate degree (Master's degree). Currently, the department does not award an intermediate Bachelor's degree; however, it is possible, in principle, to award a Bachelor's degree based on the successful completion of the first 3 years (180 ECTS (European Credit Transfer System Units)). Significant feedback for the reform of the studies was supplied by the alumni and colleagues from abroad. The undergraduate students were cooperative in the reform (see Figure 1).

4.4. *Support of the curriculum via the courses' web pages*

This task involved the development and adaptation of educational material, in the form of electronic books, software, regulations and technical standards, which were made accessible to the students via the course web pages.

A main web page was designed for each undergraduate course, with analytical syllabus and descriptions covering the requirements of the ECTS handbook. In addition, the expected weekly hour workload allocation for each course is divided among lectures, laboratory, take home exams, laboratory and computer projects and self-study. The course web pages constitute an essential

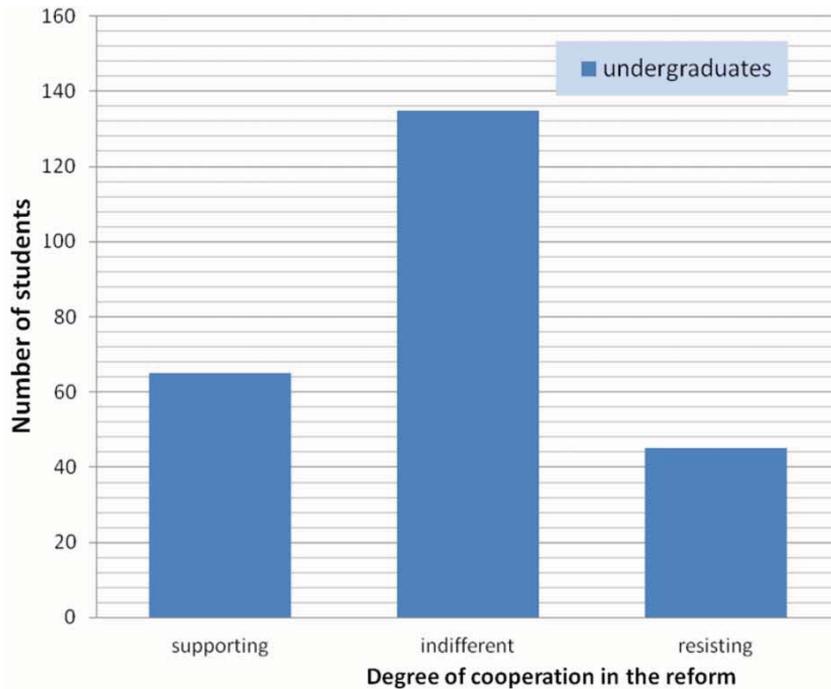


Figure 1. Degree of cooperation of undergraduate students in the reform.

teaching reference tool, although less than 50% of the courses are adequately supported by inclusive web pages. The students gain an in-depth understanding of the structure of their courses, and the importance and interconnection between the associated engineering skills, by studying the courses' web pages. On the other hand, certain faculty members find them very useful in gaining a better understanding and enhancing cooperation with their colleagues who are teaching related subjects.

5. Basic quality assurance procedures adopted

This task contains various quality culture activities supported by the QAO, established in 2002. The office is managed by a faculty member, who reports to the department chair and the council. The most important quality assurance tasks carried out are listed below.

5.1. Job descriptions and analysis

In this department, there has been constant pressure from the administrative staff to hire additional staff for every new task assigned. In most circumstances, careful observation of the job revealed that this was due to inefficient planning of the job and/or lack of computer skills by the staff. Also, certain faculty members tended to assign tasks to general support staff without clear guidelines. Frequently, the task execution faced significant delays that led to conflicts between faculty and staff members. In 2003, job descriptions for administrative and technical staff began to be compiled. The job description for each workplace was a short description of the main duties of the person and the required level of education and skills. Simple job analysis was done in a few cases, especially concerning the administrative staff of the department's secretariat. These measures

resulted in more efficient use of the existing personnel, as well as to the smarter hiring of new staff. Job analysis soon indicated that most of the administrative staff possessed insufficient computer skills. For this reason, regular internal seminars were organised for the use of office-related software. All new administrative and technical support staff hired since the year 2000 held at least a Bachelor's degree and this positively influenced administration efficiency (Taylor and Harris 2004). Job analysis of technical and administrative support staff also resulted in a certain restructuring of duties of existing personnel. This was successful only wherever the personnel positively responded. Unfortunately, a number of faculty members with insufficient management experience or understanding continue to be ineffective in motivating employees (Herzberg 1987). In at least one case, an employee applied for a job change to another department.

5.2. *Design and implementation of a fully paperless instructor evaluation procedure*

Traditionally, instructor evaluations were based on the filling of photocopied forms, containing a lot of questions with answers that could not be quantified for statistical processing. In order to improve the situation and speed up the processing, a reliable, web-based instructor evaluation procedure was designed and adopted, based on the completion of a one-page electronic form with numerical answers and only little space left for comments. The results are emailed to each academic staff member after the end of the exams, in the form of average and standard deviation in each evaluation question, compared to the average and standard deviation of the total population of courses of the same semester. An annual award of excellence to the best instructor is based on these results. As regards the low performers, when they happen to be hired personnel, their 3-year contract is not renewed. If a regular faculty member continues to perform at a low level, they are urged to shift to a more familiar course.

5.3. *Design and implementation of a computerised procedure for processing grades*

The grade records for all courses are processed every semester and histograms that present the distribution of grades for each course are produced. Grading histograms for selected courses are correlated from time to time with the distribution of the respective instructor evaluation grades from the students, in the frame of internal quality audits.

5.4. *Students and alumni relations*

Initially, the alumni were approached in order to receive feedback for improvements in the curriculae (2002). Their response was enthusiastic and led to the organisation of successful alumni conferences (2005 and 2007). Alumni conferences are now scheduled every 2 or 3 years. An alumni database is available in MS Access format and an alumni website with links to the business websites of a large number of alumni is maintained (http://www.mie.uth.gr/n_apofittoi.asp). These links have proved helpful to the graduating students in their quest for jobs, as well as to the undergraduates when they are seeking positions for practical training.

The traditionally smooth cooperation with the student's union deteriorated during the student protests of the period 2006–2007. Two conferences were organised in cooperation with the students' committee, to inform students on the recent developments in European universities. The curricula reform regarding training in modern computational environments and tools was communicated by means of a 1-hour video, where a number of doctoral students presented modern computational tools and laboratory techniques as applied to their thesis work (http://www.mie.uth.gr/n_sygxrona_ergaleia.asp). Finally, in order to increase understanding by the students of the administrative procedures, an extensive guide describing all student-related

procedures in the department and the university was compiled and placed on the department's website.

5.5. Staff management information system

Continuing efforts to increase the effectiveness of administrative staff were hindered by the lack of a reliable management information system. In 2006, a staff information system in the form of a staff intranet was implemented, where important information and useful documentation is uploaded (decisions taken by the department's council, electronic reporting of staff absence, electronic assignment and monitoring of technical staff tasks, processing of job descriptions for technical and administrative staff, organising staff development seminars, etc.). This activity allowed interested staff members to have regular access to a reliable business information system. However, the problem remains that about 50% of the faculty and staff do not regularly access the intranet.

Another useful application incorporated in the staff intranet was a web-based application and chart for the scheduled absence of staff, which depicts the leaves of absence of all personnel in a Gant-type chart with a colour code. This application significantly increased the transparency of the system of leaves of absence, which was a constant source of conflicts. It also increased the efficiency of faculty/staff cooperation. The system faced significant difficulties during the first year of its operation (2006). A number of staff members steadily refused to declare their dates of absence in the intranet. Today, about 80% of the staff routinely use the system. However, the faculty members are not happy about declaring their own absence in the same system.

5.6. Writing down of procedures

A new topic was introduced in the general assembly's discussion list, entitled 'standardisation and improvement of procedures'. This motivated input from several faculty members, which suggested new ideas to simplify and improve various academic or administrative procedures. For example, the basic procedures for purchasing equipment and maintenance services and consumables were written down. Also, a procedure was developed for monitoring the monthly electrical energy and natural gas consumption in the department. In addition, some basic selection procedure for hiring administrative personnel for the department's secretariat was agreed.

Working rules have been developed for certain staff categories, such as the electronics staff of the department, which was in constant pressure with various formal and informal task requests, ranging from the development of novel electronic devices to the repair of home appliances.

5.7. Students' time allocation studies

The QAO also carried out a wider scope of studies of sociological interest. One such study was carried out in 2006 in a sample of eight male and two female students (two from each semester), each of which maintained records of how he/she spent his/her time on a daily basis. The daily distribution of hours among 23 types of activities, categorised in the following seven main categories, was recorded:

- University (course attendance, study, laboratory projects and case studies, homework, exams).
- Unavoidable time intervals dead times (intervals between the courses, transportation to and from the department).
- Eating in the students' dining hall, at home or in restaurants, internal/external errands, shopping, housekeeping.

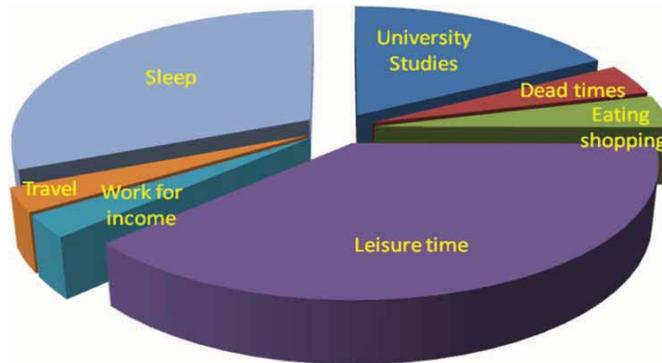


Figure 2. Typical distribution of weekly hours allocated by the students of the sample to the seven main categories of activity. For details, see text.

- Leisure time management (hobbies, sports activities, reading, television, video games, reading, entertainment with friends at home, going out with friends to the cinema, theatre and concerts).
- Working for additional income to support their studies.
- Travelling for holiday or leisure, including visiting their families.
- Sleeping.

A typical distribution of weekly hours allocated to the various activities by the specific sample of students in the spring semester 2003–2004 is presented in Figure 2. Obviously, the average hours allocated to university studies at that time was inadequate. Students, especially during the first 2 years of their studies, did not work hard at their university tasks. Instead, they allocated about twice as much time to leisure activities of various types, in the pleasant environment of the Greek town of Volos and the vicinity. This study helped with a better design and application of the undergraduate studies reform.

6. Lessons learnt

During the first years of its operation, the QAO, although strongly supported by the department's chair, faced resistance in the implementation of several of the above tasks. Even today, after 6 years of operation of this office, less than 50% of the staff seem to adequately understand its role and significance.

6.1. Success stories

Out of the various efforts coordinated by the QAO aiming at the establishment of a quality culture in the department, the following are considered successful:

- The very establishment of a QAO on a departmental level can be considered a success (according to the present author's knowledge, no other department in Greece has a similar office).
- A significant number of courses are adequately supported by course websites. The students make good use of the course websites' content and regularly visit them for new material and announcements.
- Instructor evaluation procedure: after its successful application in the department for eight semesters, it was extended to the rest of the university by the new rectorate (2009).

- Staff intranet and leave of absence information: successfully applied in the department since 2006, used by about 80% of staff, scheduled to be extended to the rest of the university by 2010.
- The department reacted positively to the first appeal by the newly established HQAA for higher education to arrange for a department evaluation procedure based on the national accreditation system. The self-evaluation started in October 2007 and continued for two consecutive semesters (2007–2008), aimed at the formation of a commonly accepted view of the quality of the academic work based on objective criteria and indices of general acceptance. The self-evaluation phase was completed in December 2008.
- The diffusion of the results of the reform to the students and staff, as well as to the faculties of similar departments of other Greek universities, has led to fruitful discussions and feedback that has added to academic pride. The students are assimilating the profits they get from the reform, which has also taken into account their feedback. This makes them more cooperative in the next steps.

6.2. *Procedures abandoned – errors reported*

The following tasks and activities, although initiated with enthusiasm, are finally idling or have been abandoned:

- The computer application for the recording of tasks assigned by faculty members to general technical support staff, which was started in 2005, aimed at the establishment of transparency in the assignment of tasks to the general technical support staff. After 2 years of operation, it was abandoned by the faculty. On the other hand, no complaints are now filed on the performance of this category of staff.
- Job descriptions and procedures: despite the considerable effort allocated to the job analysis and continuing formation of the administrative staff, a small number of employees in this category insist on following ‘Old-fashioned’ work models. That is, they do not study or apply the quality procedures with precision, avoiding conforming to the department’s management information system.

6.3. *Tasks remaining to be done*

Currently, the QAO has only one staff member, plus the supervising faculty member who allocates a part of his time in the office activities. Several staff members are cooperating with the QAO, allocating a small part of their time (10–20%). A new employee initially hired for the QAO is now attached to the secretariat, where she is standardising forms and procedures. Students are also helping to extend standardisation and improvement of procedures to the full range of services supplied by the faculty.

The following activities are continuing under the supervision of the QAO:

- The writing down of procedures and compilation and standardisation of electronic or paper forms.
- Working rules extended to other job categories, provided that interested faculty and staff support the task.
- Fully automated production of grading histograms/statistics for all courses after each semester’s exams.
- Exploitation of the capabilities of MS Outlook – scheduling on a calendar basis, to automatically inform the secretary and chair on significant deadlines.
- Procedures of automatic updating of basic evaluation indices (e.g. publications, citations, etc).

- Development of a student portal application for their mutual exchange of information on the variation of weekly student workload based on the instructors' assignments (usually not well coordinated).

6.4. Resources and time allocated

All faculty members (20), about 10 permanent staff members, five staff members hired for the specific job, 20 undergraduates, 20 post-graduates and two post-docs were involved in this programme in the period 2003–2008. All the above people were financially rewarded for their time and effort. However, there were several people from each category who performed very enthusiastically, others who stayed indifferent and a few who resisted the effort. Indicative percentages of the degree of cooperation in three different staff categories are reported in Figure 3. The total work time allocated to the project by the above-mentioned staff and student categories can be estimated to the order of 300 work months.

6.5. Problems remaining

Improved computer skills are required by the administrative staff in order to efficiently carry out new tasks (e.g. writing Excel macros, OCR, etc). This would require intensifying the continuing education seminars and possibly new motivation for the able employees.

The relations between faculty and staff need significant improvement. Several able staff members are afraid to be involved in working groups with faculty members because of a bad experience in the past (lack of understanding, no clear instructions on how to do the work, bad estimation of workload, etc.).

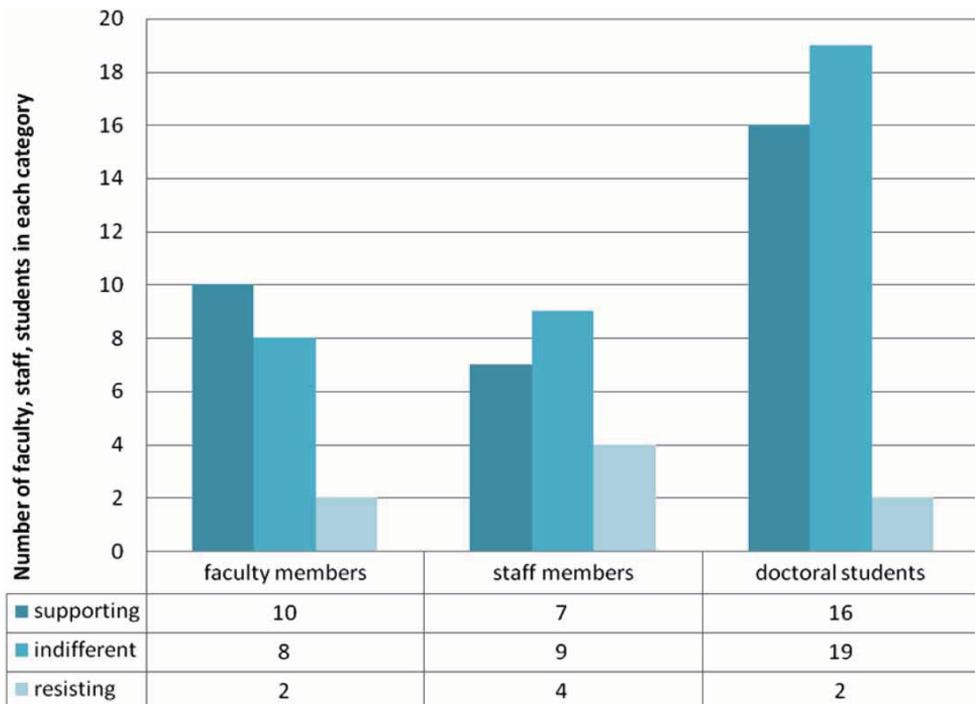


Figure 3. Response of the faculty, staff and doctoral candidates to the quality policy.

A certain difficulty is recorded from part (about 20%) of the faculty to observe rules. Although the General Summit's decisions are now widely diffused, administrative staff of the secretariat are not well qualified to understand their complexity. Faculty members, on the other hand, are not eager to read the decisions, so sometimes decisions are taken on the same subjects. About 50% of the faculty still seem to be reluctant to follow the department's quality policy (Figure 3). Last but not least, transparency proved extremely difficult for further improvement. The strong public character of the Greek university remains a problem.

7. Conclusions

- The author's experience in the management of the reform of undergraduate studies in his department (2003–2008) is summarised. The programme was envisaged as a means to establish a quality culture.
- A QAO was established and evolved to a central pole of the reform.
- The quality measures adopted in the department improved certain aspects of teaching, by means of the course web pages and several simplified and standardised critical evaluation procedures.
- Improvement of job allocation of the administrative staff and continuing education aimed at improved computer skills significantly enhanced cooperation and staff productivity.
- A staff management information system was successfully introduced in the form of a staff intranet.
- Writing down procedures, simplification and standardisation of administrative and technical tasks is continuing at a slow but effective pace, despite the slow degree of transformation of staff attitudes.
- Some elements of the quality policy have now been gradually adopted by the whole university.
- Obviously, the quality system adopted is a simplistic one; however, it is believed that it contains all the essential quality system elements and can be applied with minimal effort and cost.

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About the author

Anastassios Stamatelos is a professor and head of the Laboratory of Thermodynamics & Thermal Engines at the University of Thessaly, Mechanical Engineering Department, Volos, Greece. He received his diploma and PhD in mechanical engineering from Aristotle University Thessaloniki. During the last 20 years, he has managed several applied R&D projects in close cooperation with industrial partners. He has served as department chairman and vice-chairman, (2003–2007), led a multi-year departmental programme of undergraduate study reform and established a departmental QAO in 2002.