Some Underestimated Aspects of Quality Assessment in Engineering Education

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1. INTRODUCTION

Over the last decade, systems of external quality assessment and accreditation have been developed in many countries. These systems take into account many aspects of higher education, including curriculum objectives and requirements, teaching methods and techniques, training of student's skills through laboratory and design experience, use of computers, oral and written communication, qualifications and teaching load of academic staff, facilities and their availability, administration procedures, information system and counseling, admission procedures, internationalization of the curriculum, student performance, competence of graduates, and internal quality assurance procedures.

There are, however, some features of the system of study, namely, diversity and flexibility, which - in our opinion - have an essential impact on the quality of education, but are rather rarely brought into discussions on quality assessment. In this paper, we define diversity and flexibility of the system of study and show a strong relationship between these features and the quality of education. A flexible system of study at our institution - the Faculty of Electronics and Information Technology, Warsaw University of Technology - is used as a vehicle to illustrate the existence of this relationship.

It is quite difficult to represent the diversity and flexibility using quantitative indicators. Nevertheless, we formulate a number of criteria that could be used to decide whether a system of study is sufficiently flexible. Additional criteria that do not directly affect flexibility of the system, but either constitute necessary conditions for effective functioning of a flexible system of study or are associated with flexibility-dependent mechanisms of quality assurance, are also formulated. We believe that such criteria should be included into procedures of internal and external quality assessment - existing ones and those under development.

2. DIVERSITY AND FLEXIBILITY OF THE SYSTEM OF STUDY

In this paper, we consider an institution of higher education (university, college, faculty, school, department) which is fully autonomous in defining curricula and is primarily responsible for the organization and management of the education process. A system of study at such an institution is characterized by a number of features, including degree programs, major field of study and areas of concentration for each degree program, courses offered, curriculum requirements (degree requirements), and academic regulations and procedures.

Flexibility of a system of study means, in general, that each student has a lot of freedom in design of his/her education path. As higher education institutions, following the trend in the manufacturing and service sectors of the economy, start to move from "mass production" to "mass customization", flexibility should be considered as a primary feature which make it possible to customize the studies, i.e. "to deliver education as it is needed by the individual".
To be flexible, the system must be characterized by a sufficient level of diversity, i.e., it must offer the student a variety of opportunities. Diversity is a necessary condition for flexibility, but it is not a sufficient one. The crucial question regarding flexibility is whether or not each student is allowed to take advantage of the available options. Essential features of a diverse and flexible system of study include:

- **wide offer of programs**
  The programs of study and continuing education are designed to meet as effectively as possible the needs of intended students, i.e., the students are allowed to design education paths of different duration, leading to different diplomas or certificates. There are programs suitable for full-time students and part-time students with different educational background (high school graduates, 2-year college graduates, B.S. holders, M.S. holders).

- **possibility to decide on the length of education path in the course of study:**
  The students can decide on the length of their education paths in the course of study, taking into account their capabilities, financial status, and other relevant factors, without being required to make difficult and restrictive choices at the time when they apply for admission or at the very beginning of the period of study.

- **possibility to choose one of many available specializations:**
  The students admitted to the institution are offered a wide range of specializations to choose from. However, they are not required to commit to any specific area at the very beginning of their program; instead, they are provided with an opportunity to select the field of study and, subsequently, the area of concentration, as they become more acquainted with the discipline.

- **possibility to pursue an interdisciplinary program:**
  The students admitted to the institution are allowed to pursue interdisciplinary programs by taking for full credit courses offered by other departments within the same institution or even courses offered by other institutions. Clearly, to offer interdisciplinary studies, a credit transfer system must be adopted by the institution.

- **large, diversified and well-structured course offer:**
  The students are provided with a large and diversified offer of courses. Some courses intended for a large number of students are offered in two or more versions that differ slightly with regard to the range of topics covered and also, possibly, with regard to the student load (number of credit points). The course offer is well-structured, i.e., courses are classified into some number of subject areas; this makes it easier for the students and their advisors to review the course offer when designing individual programs of study.

- **freedom in design of an individual program of study (course selection):**
  The curriculum requirements are formulated so that, regardless of the selected area of concentration, a certain number of restricted elective courses or free elective courses could be included in the individual program of study. This would allow the student to design a program of study that well matches his/her individual interests, preferences, and professional career objectives.

- **possibility to adjust the pace of studying to individual capabilities and preferences:**
  A full-time student is allowed, within certain limits, to decide on his/her workload (the number of courses taken) each term. This makes it possible for better students to complete their programs ahead of schedule. On the other hand, weaker students and those who take part-time employment are more likely to complete their programs, instead of being dismissed for inadequate progress or inferior performance in the courses taken.
Enhancing diversity and flexibility of the system of study can have an essential impact on the quality of education. In particular, an opportunity to design an individual program of study that best suits student's capabilities and professional career objectives enhances student's interest in the institution, its academic staff, courses it offers, and studying in general. Furthermore, the responsibility students take for their own education usually motivates them for more efficient learning which, in turn, results in better qualifications of graduates who enter the labor market. A more detailed discussion on the impact of diversity and flexibility of the system of study on the quality of education is presented in the following section.

3. IMPACT OF DIVERSITY AND FLEXIBILITY ON QUALITY OF EDUCATION: A PRACTICAL EXAMPLE

In this section, we first briefly describe the system of education at our institution - the Faculty of Electronics and Information Technology at Warsaw University of Technology. We focus primarily on those aspects of this recently restructured system which are related to its diversity and flexibility. We then show how these features contribute to the quality of education.

3.1. System of study at the Faculty of Electronics and Information Technology

The Faculty of Electronics and Information Technology is the largest teaching and research center at the Warsaw University of Technology. The Faculty has more than 2500 full-time students. They are served by 350 members of academic staff (220 of them hold the Ph.D. degree) and 200 members of technical and administrative staff.

Over the last few years, a significant effort has been taken to restructure the system of study at the Faculty. Students admitted before 1994 have followed the traditional pattern of university-level engineering education in Poland, i.e., they have pursued a five-year program leading to a degree equivalent to the Master of Science (Master of Engineering) in the selected field of engineering\(^3,4\). With the beginning of the academic year 1994/95, a new system of study was introduced. In what follows, we briefly describe those features of the system that most significantly contribute to its flexibility. A more detailed description of the system of study at our Faculty can be found elsewhere\(^8,11,12,13,19,20\).

The general structure of the studies is shown in Fig. 1. In the restructured system, instead of the traditional five-year program, the student has the following options:

- **first-level studies (undergraduate studies) available in two versions:**
  - (a) a 4-year program leading to the degree of "inçynier" equivalent to Bachelor of Science (Bachelor of Engineering),
  - (b) a 3-year program leading to the certificate of basic education in engineering; for a good student, such a certificate is sufficient to apply for admission to second-level studies;
- **second-level studies:** a 2-year program leading to the degree of "magister inçynier" equivalent to Master of Science (Master of Engineering); the candidates must hold the Bachelor's degree in engineering or related discipline or the certificate of basic education in engineering;
- **third-level studies:** a program leading to the degree of "doktor" equivalent to the Doctor of Philosophy; the candidates must hold the Master's degree in engineering or related discipline.

In this paper, we focus on the first- and second-level studies. A student admitted to the first-level studies, after 2 years of learning mathematics, science, basic electronics and computer engineering, selects his/her specialization (area of concentration). The third year is intended as an introduction to the selected area of concentration. During the last, fourth year of the first-level
studies, specialization-oriented courses are taken, followed by a comprehensive final design project. The second-level studies are also specialization-oriented, but include in addition advanced applied mathematics and science courses, as well as individual reading and research courses. The last semester is devoted solely to the preparation of the Master's thesis.

It can be seen that system offers the student a lot of flexibility in designing his/her education path. After 3 years of study, the student can leave the Faculty with a certificate of basic engineering education and take an employment (at that time he/she has enough knowledge and skills to get a reasonable job offer) or stay at the Faculty and either continue with the first-level studies (B.S. program) or apply for admission to the second-level studies (M.S. program). Another possibility is to continue education at other academic institution (students holding the certificate of basic engineering education in electronics and information technology are generally recognized as good candidates for pursuing advanced programs in many disciplines, for example, at business schools). After graduating with the B.S. degree, the student can leave the Faculty and take an employment or apply for admission to the second-level studies.

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Fig. 1. System of study - general structure
It can be seen that system offers the student a lot of flexibility in designing his/her education path. After 3 years of study, the student can leave the Faculty with a certificate of basic engineering education and take an employment (at that time he/she has enough knowledge and skills to get a reasonable job offer) or stay at the Faculty and either continue with the first-level studies (B.S. program) or apply for admission to the second-level studies (M.S. program). Another possibility is to continue education at other academic institution (students holding the certificate of basic engineering education in electronics and information technology are generally recognized as good candidates for pursuing advanced programs in many disciplines, for example, at business schools). After graduating with the B.S. degree, the student can leave the Faculty and take an employment or apply for admission to the second-level studies. The studies are offered in the broad field of Electronics and Information Technology. For both the first- and second-level studies, 12 areas of concentration are available, including Microelectronics, Optoelectronics, Biomedical Engineering, Software Engineering and Information Systems, Computer Control Systems, Computer Engineering, and Telecommunication Systems and Networks.

As mentioned before, after two years of study, each student is required to select one of the above areas for specialization. This decision determines, in particular, the general topic of the student's final design project or Master's thesis. Besides, each student is provided with an opportunity to receive a certificate of minor specialization in some other area. This is important because, due to limited capacity of advanced-level laboratories used for individual design or research projects, there are some restrictions on the number of students who can pursue their programs in each area of concentration. Thus, the student who is compelled to work on his/her final project or thesis in an area different from his favorite one, can always include in his/her individual program of study a specified number of courses from the preferred area and be awarded a certificate of minor specialization in that area.

There are almost 400 courses (including courses taught by instructors from outside the Faculty) offered at the Faculty each academic year, and a majority of these courses are actually taught. To facilitate systematic examination of the course offer by the students and their advisors, all courses have been grouped into so-called subject classes. Each subject class contains courses that cover a specific topical area, such as mathematics, digital signal processing, computer graphics, etc.

Each course offered at the Faculty is assigned several attributes, including the number of credit points (credit hours), a list of subject classes the course belongs to, and a list of prerequisite and corequisite courses. Basic courses, intended for all or most of the students, are frequently offered in two or more versions that may differ with regard to the range of topics covered and, possibly, also with regard to the student load (number of credit points).

To receive a degree, the student must satisfy the curriculum requirements (degree requirements), i.e., earn an appropriate number of credit points and, in addition, satisfy the distribution requirements. The distribution requirements are formulated using the names of topical areas (subject classes) rather than the names of specific courses; for each required topical area, the minimum number of credit points that must be earned by taking courses from the corresponding subject class is specified. Compulsory courses in each class can be specified, but in general, the mechanism of prerequisite and corequisite requirements is employed to ensure an appropriate sequence of courses taken by each student. In addition to being allowed to select courses within each relevant subject class (restricted elective courses), the student can (and should) include in
his/her program a certain number of courses selected from the entire course offer (free elective
courses).

The curriculum requirements are formulated for each area of concentration; the requirements
associated with basic subject classes are, however, common for all or most of the areas. To
obtain a degree, the student must satisfy the requirements for at least one area of concentration.
The requirements are formulated in such a way that the student can take quite a large number of
free elective courses. Thus, by carefully planning his/her individual program, the student can
obtain the degree in one area and a certificate of minor specialization in another. This way, a
large number of interesting patterns of education in the broad field of electronics and information
technology can be created. Besides, by taking a large number of free elective courses at other,
possibly nonengineering institutions, the students can pursue interdisciplinary programs.

To help the students design their individual programs of study, a model program of study, which
contains a list of recommended courses for each semester, has been developed for each area of
concentration. The students are, however, free to deviate from this model, as long as their
individual programs satisfy the curriculum requirements. Good students are even encouraged to
look for unconventional education paths.

The curriculum requirements developed and introduced in 1994 leave the students a lot of
freedom in designing their individual programs of study. Regardless of the area of concentration,
the number of compulsory courses does not exceed 9 - all other courses are restricted or free
electives. Even the model programs of study have on average 24% of "empty slots" for restricted
or free elective courses. A well-structured set of about 400 courses offered by the Faculty and a
possibility to take courses at other academic institutions make it possible for each student to
design an individual program of engineering or interdisciplinary studies that well matches his/her
interests and professional career objectives.

Another aspect of flexibility of the system of study at our Faculty is related to academic
regulations. The key regulation in this area is "the rule of flexible studying" which states that a
full-time student is allowed to decide on the distribution of workload during the period of study
(the number of courses taken each semester). Student's freedom in deciding on the workload in
each semester is only limited by the necessity to satisfy minimum performance requirements. At
the end of each semester, the student's progress is compared with minimum requirements
formulated in terms of the grade point average and the number of credit points earned from the
beginning of the study. The minimum requirements are formulated in such a way that the first-
level studies that nominally take 4 years must be completed in no more than 5 years. Similarly,
the second-level studies that nominally take 2 years must be completed in 2.5 years. The student
who does not satisfy the minimum requirements is dismissed from the program. These
regulations leave the student a lot of freedom in adjusting the pace of studying to his/her
capabilities and other relevant factors. In particular:

• a good student can earn his/her degree earlier than scheduled and immediately start his/her
  job career,
• a less capable student can take fewer courses per semester than his/her colleagues and thereby
  avoid a dismissal due to inadequate progress or inferior performance in the courses taken,
• a student can register for fewer courses than recommended and take a part-time employment,
• a good or even average student can submit an "empty" registration form and take a one-
  semester or even one-year "leave of absence" to take a full-time job without withdrawing
  from the program and loosing student rights and privileges.
It can be seen that the above described system of study at the Faculty of Electronics and Information Technology is characterized by a high level of diversity and flexibility. It must, however, be noted that extended diversity and flexibility could pose some problems in the functioning of the institution. Appropriate measures in the administration and management of the education process have therefore been taken to overcome potential difficulties. Also, the impact of flexibility of the system of study on the education quality has increased significantly after appropriate regulations and policies which take advantage of this specific feature have been introduced. In what follows, we briefly discuss these issues.

A flexible system of study requires quite a sophisticated organizational structure. Its effectiveness is critically dependent on usage of information technology. In particular, a computer network of appropriate size is necessary for effective functioning of an information, administration, and management system. At our Faculty, a network of more than 850 computers supports both educational and organizational activities.

The computer network forms a basis for development of a comprehensive information system. Such a system should provide the students and academic staff with 24-hours-a-day access to all necessary information related to the education process (course offer, course syllabi, course and examination schedule, detailed description of regulations and procedures, etc.).

The electronic information system is closely related to the integrated computer-aided administration system which supports administrative tasks related to education. At our Faculty, the ORACLE-based system supports student registration, monitoring of the student progress, course and examination scheduling, classroom assignment, publishing (printing of course catalogue, course schedule, course rosters, student progress records, certificates), administration of student housing and financial aid, and several other tasks.

With so many options available, even with an effective and easily accessible information system, the students might get lost if some form of advising by the members of academic staff are not provided. A special non-credit tutorial-type course, called "Orientation", taught by experienced instructors, has therefore been included in the curriculum for the first-, second-, and third-year students. Advising on how to design an individual program of study to take advantage of the available opportunities is part of this course. During the fourth year of first-level studies, each student is assigned an individual advisor who later also supervises the student's final design project. Individual advising also takes place throughout the entire period of the second-level studies.

The flexible way in which curriculum requirements are formulated makes it easy to continuously update and refine the curriculum. To stimulate this process, the work on the development of curriculum has been distributed. Each area of concentration has its coordinator - a professor individually responsible for the formulation of curriculum requirements and model program of study. Also, for each subject class, there is a person responsible for coordination of all courses in that class. The area coordinators and subject class coordinators are responsible for reacting promptly to advances in science and technology and to trends on the labor market. The Curriculum Committee only makes major decisions that involve several areas of concentration and coordinates the actions taken by area and subject class coordinators.

The freedom students have in selecting courses makes it possible to promote efficiency and quality through appropriate organizational and financial decisions. The elective courses that do not attract enough students are not run. The recently adopted rules make the distribution of funds among the six institutes comprising the Faculty less dependent on the number of courses taught by their employees and more dependent on the number of students enrolled in these courses.
Also, the teaching load of an individual instructor is calculated as a function of the number of students attending his/her courses, and the instructor receives extra payment when his/her teaching load exceeds a certain limit.

Flexibility students have in designing their individual programs of study makes it possible to introduce mechanisms that encourage good learning. These mechanisms include regulations that give good students higher priority when resolving conflicts that occur due to insufficient supply of some resources or services (such conflicts occurs, for example, when too many students attempt to register for an attractive course with a rigid enrollment limit or when too many students would like to have a particular member of the academic staff as their individual advisor).

3.2. Impact of diversity and flexibility on quality of education

The above described characteristics of the system of study, which are related to its diversity and flexibility, have an essential impact on the quality of education:

• A large number of available options allow each student to design an education path which best matches his/her interests, professional career objectives, capabilities, financial status, and other relevant conditions. To take advantage of the available options, the student must, however, become familiar with many aspects of the system of study. This enhances his/her interest in the Faculty, its academic staff, course offer, and studying in general. Furthermore, the student who is provided with an opportunity to pursue an individually designed program which reflects, to some extent, his/her personality, is usually well motivated to more efficient learning.

• An opportunity to design an individual program of study allows the student to be creative. At the same time, however, the student must assume full responsibility for his/her own decisions. Thus, the studies not only teach skills, but also develop student's personality.

• The new structure of studies allows us to deal with one of the most critical quality-related problems, caused by growing diversity in educational background and capabilities of the candidates admitted to the Faculty. Within the traditional system that offers only 5-year programs, we were faced with a choice between the two equally unattractive options: either (1) to maintain the rigid requirements for the M.S. degree and dismiss from the program a large percentage of students who are not able to meet these requirements, or (2) to relax the requirements for the M.S. degree. With the new system, where only a certain fraction of students entering the Faculty are expected to pursue the second-level studies, we can protect the "quality mark" associated with the M.S. diploma.

• The key decisions regarding the duration of study and the level of education (certificate, B.S. diploma, or M.S. diploma) are made not at the beginning of the study or before, but much later, when the student knows his/her capabilities and other factors that affect his/her education path. Thus, by making a mature decision regarding the level of education, the student can maximize the likelihood of completing the selected program. The completion rate increases also due to providing less capable students with an opportunity to take each semester fewer courses than recommended for an average student.

• A provision for adjusting the workload (the number of courses taken each semester) to individual speed of learning allows less capable students to perform well in all the courses taken, and thus take full advantage of the educational services.

• The rule of flexible studying makes it possible to eliminate some strange situations, having a negative impact on the quality of education, that occur quite frequently in less flexible systems. For example, under traditional regulations, a student who has received a failing
grade in one course is "conditionally registered" for the next term in which he/she is required to take this course once again, in addition to all regularly scheduled courses. This means that a less capable student is faced with a larger workload than his/her more capable colleagues - a hard and frustrating situation that frequently results in poor performance, and consequently, in student's withdrawal or dismissal from the program. In the flexible system, where the student can adjust the workload in each semester to his/her capabilities, such situations are obviously less likely to occur.

- The freedom students have in designing their programs of study inevitably leads to potential conflicts due to insufficient supply of some resources or services. Such conflicts are resolved by taking into account the performance of the competing students (their position in the ranking, determined by the grades received in all the courses taken). This obviously motivates students to good learning. It should, however, be mentioned that special measures have been adopted to minimize the frustration of the students who have lost in a competition for critical resources. For example, a student who is not admitted to pursue the program in his/her favorite area of concentration, can still take courses he/she is primarily interested in and earn a certificate of minor specialization in that area.

- With a large and attractive course offer, the students might be tempted to take more courses than necessary to satisfy the curriculum requirements. Registration for extra courses normally requires a payment. Good students are, however, allowed to take some number of extra courses free-of-charge (the number of such free-of-charge courses depends on the student's performance, but even the students with a relatively low grade point average have a chance if they perform very well in the recently taken courses). This regulation motivates all the students to good learning.

- For cost-efficiency reasons, courses selected by fewer than 6-8 students are normally not run. Thus, with a large and diversified course offer and the level of freedom students have in designing their individual programs, not all courses offered by the members of academic staff are actually taught. In fact, only about 50% of advanced-level courses intended for the students who have already selected their specialization attract enough students to be run. This way, outdated or poorly taught courses are naturally eliminated.

- With a lot of freedom the students have in designing their individual programs of study, the number of students who register for attractive, newly introduced or modernized, and well-taught courses is much higher than for other courses. With the rules regarding financial policy that favor the institutes and individual instructors teaching courses with high enrollment, a competition takes place which motivates the members of academic staff to offer high-quality courses that could attract a large number students. Clearly, appropriate measures must be taken to eliminate a possibility of attracting more students by more lenient grading.

- Good students working toward the M.S. degree can be very helpful in carrying out research projects supervised by their advisors, and are therefore highly demanded. As the students have a lot of freedom in seeking their individual advisors, and the best students normally choose those who offer the best education services (interesting topic, best facilities and best advising), a competition for good student takes place between the groups and individual members of the academic staff, having a positive impact on the quality of education.

4. DIVERSITY AND FLEXIBILITY OF THE SYSTEM OF STUDY IN QUALITY ASSESSMENT PROCEDURES

As demonstrated in the preceding section, diversity and flexibility of a system of study significantly affect the quality of education, and therefore should be taken into account in the process of quality assessment. Clearly, it is quite difficult to represent these features, in particular
the flexibility, using quantitative indicators. Nevertheless, we can formulate a number of criteria that could be used to decide whether the system of study is sufficiently diverse and flexible. These are:

- existence of several programs of study of different duration, leading to different diplomas or certificates, and suitable for full-time students and part-time students with different educational background;
- existence of continuing education programs;
- availability of a wide spectrum of specializations (areas of concentration);
- possibility to design the education path incrementally - decisions regarding the length of study (highest certificate or degree sought), the choice of specialization etc., can be taken not at the beginning of the study, but much later;
- existence of large, diversified, and well-structured course offer;
- formulation of curriculum requirements (degree requirements) using credit points and subject classes, rather than the names of specific courses;
- possibility to include a reasonably large number of both restricted and free elective courses in the individual program of study;
- existence of a credit transfer system;
- support for interdisciplinary programs - courses offered by other institutions can be taken for full credit;
- possibility to adjust the workload (the number of courses taken) in each term to individual capabilities and preferences.

There are also some other criteria that do not directly determine the diversity or flexibility of the system, but constitute necessary conditions for effective functioning of a diverse and flexible system of study. These include:

- existence of a computer network of appropriate size;
- availability of a comprehensive computer-based information system providing the students and staff with 24-hours-a-day access to all necessary information related to education;
- availability of various forms of counseling, including individual advising by the members of academic staff;
- existence of an integrated computer-aided administration system supporting all administrative tasks related to education.

Another type of criteria that do not directly determine or affect the diversity or flexibility of the system, but should be mentioned here, are those associated with flexibility-dependent mechanisms of quality assurance. These include:

- effective procedure for continuous updating of the curriculum;
- fund allocation policies that take into account course enrollment figures and other mechanisms which stimulate competition among organizational units and individual members of academic staff;
- mechanisms that encourage students to good learning, including regulations that give good students higher priority when resolving conflicts which occur due to insufficient supply of some resources or services.

5. CONCLUSION

Our experiences with the restructuring of the system of engineering education at the Faculty of Electronics and Information Technology, Warsaw University of Technology, indicate that there exists a strong relationship between the diversity and flexibility of the system and the quality of
education. This relationship becomes even stronger if appropriate regulations and policies regarding the organization and management of the education process are introduced.

An improvement in the quality of education resulting from the transformations of the system of study has had a significant impact on the position of the Faculty of Electronics and Information Technology on the market of institutions that offer university studies in Poland. Despite diminishing interest in engineering studies among secondary school graduates, a growing interest in our Faculty has been observed since the time when the major changes were introduced - over the last two years, the number of candidates who applied for the studies at the Faculty has increased by almost 50%. We have also observed higher motivation to efficient learning, resulting in improved performance of the students. The grade point average for the group of 300 students who entered the Faculty in the academic year 1994/95 (the first group admitted to the restructured program), was - at the end of their second year of study - significantly higher than that of the students who entered the Faculty earlier.

Enhancing the diversity and flexibility of the system of study and introducing regulations and policies that reinforce the impact of these features on education quality is, however, not a simple operation - it can pose a number of problems in the organization and administration of the institution. Transformations of the system of study aimed at enhancing its diversity and flexibility must therefore be accompanied by appropriate changes in the administration and management of the institution.

Some of the proposed ideas on how to improve the quality of education through an enhancement of the flexibility of the system of study may be specific to our Faculty. Nevertheless, we believe that the issues discussed in this paper reflect, to some extent, general problems encountered in engineering education.

Although some concepts related to diversity and flexibility of the system of study are frequently referred to in discussions on the quality of engineering education, in most introduced or proposed systems of quality assessment the significance of these factors is generally underestimated. As we believe that an enhancement of flexibility of the system of study should be the first step in any systematic program aimed at improving the quality of education at an academic institution, most of the criteria proposed in this paper, that could be used to decide whether or not the system is sufficiently diverse and flexible, should be included in both internal and external quality assessment procedures - existing ones and those under development. It must however be noted that the criteria listed in Section 4 are related to many other aspects of quality in higher education and, within a particular quality assessment procedure, they can be grouped quite differently, even without explicitly mentioning the concepts of diversity and flexibility.

References


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