



## **AEER accreditation of educational programs: quality assurance aims and requirements**

**Mrs. Kseniya K Tolkacheva, Tomsk Polytechnic University, Association for Engineering Education of Russia**

Member of the Association for Engineering Education of Russia responsible for AEER international cooperation activities. PhD in Pedagogical Sciences, graduate degree in "Mathematical Methods in Economics". Also holds a Management degree. Her research focus is in Quality Assurance, active learning and international academic mobility. Has experience in coordinating several TEMPUS projects as well as organizing joint international partnerships in educational and research areas, including national and international projects, organizing conferences, seminars, workshops and training courses.

**Prof. Yury P Pokholkov, Tomsk polytechnic university, Association for Engineering Education of Russia**

**Dr. Sergey B. Mogilnickiy, Tomsk Polytechnic University**

**Ms. Maria Yurievna Chervach, Tomsk Polytechnic University**

**Prof. Jose Carlos Quadrado Mr P.E., Instituto Superior de Engenharia do Porto**

José Carlos Quadrado is a full professor with tenure of the Instituto Superior de Engenharia de Lisboa (ISEL) and is currently under external management assignment in Instituto Superior de Engenharia do Porto (ISEP), Portugal. He is currently the immediate past-President of ISEL and the Vice-President of ISEP. He has a BSc in Energy and Power Systems, a diploma degree in Electrical Engineering, Automation and Industrial Electronics from ISEL, a MSc and a Doctor degree in Electrical Engineering and Computers from Lisbon Technical University. He also holds the Habilitation degree (Aggregation) in Electrical Engineering from Beira Interior University.

Holds the position of immediate past-President of the International Federation of Engineering Education Societies (IFEES) and the position of past president of the Ibero-American Engineering Education Association (ASIBEI). Currently he is a President-Elect of the Latin American and Caribbean Consortium of Engineering Institutions (LACCEI) and a member of the board of the European Society for Engineering Education (SEFI). He is also a past-Vice President of SEFI. He leads the Portuguese Observatory on European and Latin-American University management strategy best practices (TELESCOPI Portugal) and is the past-President of the Portuguese association of engineering rectors and deans (APDI2E).

He was a member of the general assembly of the European Network for Accreditation of Engineering Education (ENAE), and has been actively supporting the development of accreditation agencies in Central Asia and Latin America. Being a member and senior member of several engineering societies and engineering education societies in several continents, he is also a visiting professor in many universities around the world and board member of several technological societies.

He holds over 100 international publications (including journals and chapters of books), several patents and some international technical prizes and scholarships, and also held the position of editor and editor-in-chief in some journals. Up to now he has also developed several international engineering projects in the fields of renewable energy, fuel cells, electrical vehicles, intelligent control and engineering education.

**Abstract.** The article addresses problems of quality assurance in higher engineering education, analyses best international practices in the field, as well as the ways to solve outlined problems. The article indicates that professional accreditation of educational programs is considered as one of the key tools for quality assurance and assessment. Main aims and objectives of professional accreditation, as well as benefits for graduates of accredited programs in building their professional engineering career are described.

Best practices and results of professional accreditation of educational programs in the field of engineering and technology conducted by the Association for Engineering Education of Russia (AEER) are presented in this paper.

**Keywords:** quality assurance, engineering education, AEER

## 1 Introduction

The consistent growth of industrial production, research and development that has taken place in many countries over the past decade disclosed lack of highly qualified specialists competent to work with modern technologies, able to design, develop and implement competitive technologies, and focus on innovative professional activity within the real market economy. In the context of rapidly growing globalization and Russian accession to the WTO the trend for drastic technological modernization of Russian economy and transition to the sixth wave of innovation as top priorities for the current decade requires training of future professionals with new competences. Lack of qualified engineers today is the core obstacle for innovative development of prioritized sectors of the country's economy –those that have acquired sufficient investment over the past few years.

One of the key factors of successful economic growth is the sufficient enhancement of human resourcing in organizations and enterprises that develop and utilize breakthrough technologies. Such improvements become possible only with further development of the national system of higher engineering education. In order to meet the modern challenges it is crucial to ensure introduction of new approach to solving key civilization development problems in XXI century. The list of main priorities of the nation's sustainable socio-economic development includes improvement of quality of life, economic growth, science, technology, education, healthcare, culture, ecology and responsible resource management [1]. A new paradigm of engineering education is being developed. Its specific feature is the transition from "knowledge transfer" learning and teaching methods to the practice-oriented continuous education based on fundamental theoretical contents. Therefore, Russian higher education faces a challenge of providing quality assurance and world recognition of Russian educational system, particularly through training of elite specialists and teams of professionals based on the outcome based approach [2].

## 2 Quality Assurance Tools

The quality of specialists' training in higher education institutions is assured through quality of educational programs and learning and teaching methods, resourcing (including financial resources), level of interaction with strategic partners, efficiency of Quality Management Systems, and quality of pre-university training (newcomers background). Universities all over the world develop their own systems for quality assurance of education based on their programs, information and material resources, methodological framework, human resources, management system and specific requirements from stakeholders (society, individuals and state).

An important role in terms of Education Quality Management Systems is given to the tools to assess the quality of training specialists in HEIs. Different approaches to the assessment of the quality of education are exploited on a global scale: the reputational approach, the student outcome approach, and the total quality (management) approach.

The reputational approach is based on expert (peer review) evaluation method to assess the quality of educational programs and educational institutions as a whole. The student outcome deals with qualitative assessment of outcome indicators of student achievements.

The total quality (management) approach is based on the principles of Total Quality Management (TQM) and the requirements for the Quality Management Systems set by the International Organization for Standardization (ISO), as well as on standards and recommendations of the European Network for Quality Assurance (ENQA) and other international organizations.

In this paper we will focus more on the reputational approach.

The mechanism used within this approach is the accreditation of educational organizations as a whole and educational programs in particular. There are various systems of accreditation, both in governmental (conducted by authorized government bodies) and public (professional, non-governmental) accreditation. It is worth noting that nowadays the modern trend lies in the root of the foreground development of professional accreditation of educational programs. The emphases are put on the development and improvement of such accreditation and its criteria. For instance, one of the main principles of the Bologna declaration is the principle of primary development of professional (non-governmental) accreditation of educational programs [3].

Professional accreditation of educational programs is the process of quality assessment of the program's execution. Accreditation is conducted in line with the rules and criteria developed by professional community (associations, unions) and volunteering experts. Professional accreditation of educational programs is an independent (non-governmental) system for quality assessment of specific educational programs and training activity of educational establishments that train future specialists in the specific fields. Such accreditation is conducted by volunteering experts, professionals of specific fields, representatives of industry (employers) and representatives of academic community. Professional accreditation is a way to ensure accountability of HEI and its educational programs to stakeholders (university entrants and their parents, students, employers, governmental bodies, society as a whole), i.e. existing quality standards meet stakeholders' requirements and expectations.

### **3 Aims and Objectives of Professional Accreditation**

Professional accreditation is aimed at assuring and assessing the quality of educational programs. The system of professional accreditation allows getting considerably quick response to the problems and changes of labor market and business requirements, as well as encourages the development and improvement of education and engineering education in particular, through a system of quality assessment criteria and in line with the requirements from society.

Thus, professional accreditation of educational programs serves the society in large, professional associations, employers, governmental bodies and other stakeholders (including university entrants and their parents) and helps to determine those higher educational institutions and educational programs that meet the accreditation criteria. This implies that the quality of such educational programs is guaranteed through a successful external independent assessment conducted by experts from a professional organization that has not been influenced by any administrative (governmental) bodies managing the system of education. Further on, the certificate verifying successful results of professional accreditation creates added value for an educational program: in a number of countries (USA, Canada, Japan, Great Britain, etc.) a person, who has graduated from an accredited educational program has an opportunity to apply for a status of "professional engineer" that, in its turn, opens new horizons for his/her career development. Students of such educational programs gain specific benefits during their years of study as well: in a number of countries they are able to apply for specific national or regional scholarships. All this underlines "market value" of the accredited educational programs.

For educational institutions and all stakeholders of the educational process professional accreditation provides an opportunity to receive qualified consult and proper methodological basis on terms and conditions of educational programs' development and implementation, introduction of new programs and profiles, improvement of existing programs.

Another important benefit for many educational institutions is the opportunity to state their readiness to compete for the leadership in their field. This can be done by demonstrating their adherence to the quality of educational service and can be confirmed through inclusion of the accredited programs to the existing registers (national and/or international).

During accreditation process HEIs receive valuable recommendations on ways how to improve their educational programs. The recommendations are based on the experience of reviewing experts and represent world's best practices and expertise. This provides extra opportunity to enhance HEI's competitiveness and, therefore, improves competitive advantages of its graduates on both national and international intellectual labor markets.

One more important objective of any national system of professional accreditation is to assure the acknowledgement of high quality of national HEIs and their programs on international level. This problem is addressed through harmonizing and ensuring compliance of existing accreditation criteria and its methodological, juridical and organizational elements with similar documents and guidelines of foreign accreditation bodies and international unions and associations.

The combination of all above mentioned factors allows the system of professional accreditation to sufficiently stimulate the processes of development and improvement of specialists' training.

#### **4 Accreditation by the Association for Engineering Education of Russia**

One of the main fields of the Association for Engineering Education of Russia (Association, AEER) activities is the professional accreditation of engineering educational programs. The Association has been working on the development of professional accreditation system of educational programs in Russia since 2002 [4]. In compliance with the Federal Law of the Russian Federation No. 272-FZ of December 29, 2012, "On Education in Russian Federation", AEER is authorized by the employers' community to conduct professional accreditation of educational programs in the field of engineering and technology within a wide range of educational profiles. According to this law such accreditation is given in support of the recognition of quality of education and competence level of those graduates, who have completed an educational program in a specific educational institution that meets the professional standards and labor market requirements.

Compliance with the AEER criteria provides quality assurance and stimulates continuous improvement of HEIs' educational programs. The AEER criteria correspond to the Bologna Declaration and serve for Bachelors', Masters' and Specialists' degree programs (programs of the first and second cycle) [5]. The developed criteria are based on international best practices in the field of engineering education quality assessment. Programs accredited by AEER are included in the AEER register and the ENAEE register; they are presented to the Russian Federation Ministry of Education and Science Federal Service for Supervision in Education and Science; they are published in media and on the official AEER and ENAEE websites.

The accreditation criteria are aimed at assessing learning outcomes that represent a composition of competences, knowledge, skills and attitudes, and methodological culture. They are acquired by students within the study process and are based on the requirements from the professional society. Educational program can be accredited only if it fully corresponds to the criteria mentioned above.

In case of successful accreditation each Bachelor or Master degree program is awarded two certificates (the AEER certificate and the EUR-ACE® label). For the programs of Specialist degree three certificates are awarded: the AEER certificate, the EUR-ACE label certificate, and the certificate recognizing the substantial equivalency with the requirements of Washington Accord.

AEER is the only Russian organization that is authorized to award the EUR-ACE® label to the accredited engineering programs of the first and second cycles and to award certificates recognizing substantial equivalency with the requirements of Washington Accord to programs of the Specialist degree. These certificates are international and are acknowledged in all countries-signatories of Washington Accord and ENAEE members.

During 2003-2014 the AEER Accreditation Center has accredited over 300 educational programs in Russian and foreign universities [6]. Representatives of the Ministry of Education and Science of the Russian Federation, as well as international accrediting and engineering organizations have taken part in the AEER accreditation process as observers. More than 230 programs have been awarded the EUR-ACE® label.

AEER accredited programs are run at leading Russian universities. These programs have high ranking in intra-university ratings. Information about these programs is published in the annual guide "Best educational programs of innovative Russia". Graduates of the accredited programs are in high demand among employers and, most of the time, show positive dynamics in terms of their career development.

AEER is currently working in collaboration with the RUSNANO Fund for Infrastructure and Educational Programs on a joint project on development of a system for accreditation of educational programs in the field of nanotechnology. All the materials for accreditation are developed with regard to the professional standards of this scientific field. 17 educational programs (in the field of metrology and nanoelectronics) of 9 universities (including 1 federal university and 4 national research universities) have already received positive decision within the accreditation process completed at the pilot stage of the project.

In 2014, according to the international requirements, the Association for Engineering Education of Russia has developed and successfully tested accreditation criteria for programs of secondary (vocational) education in the field of engineering and technology. The pilot accreditation has taken place in several colleges of Tomsk.

## 5 Conclusion

With an aim to improve the quality of training of competitive and in-demand graduates it is important to:

- Continue accrediting best educational programs by national and international organizations, that conduct professional accreditation, such as AEER;
- Set agreements between leading industrial corporations and accreditation agencies in Russia;
- Develop and spread the practice of taking into account the results of professional accreditation when conducting state assessment of HEIs;
- Attract all interested parties into the discussion of engineering education quality improvement.

## References

1. Ursul, A.: National Security Strategy of Russia and Education for Sustainable Development. *J. Otkrytoe obrazovanie*. Iss. 4, 63–73 (2009)
2. Pokholkov, Yu.P., Rozhkova, S.V., Tolkacheva, K.K.: Practice-oriented Educational Technologies for Training Engineers. In: International Conference on Interactive Collaborative Learning, ICL, pp. 691–620 (2013)
3. Birnbaum, R.: The Life Cycle of Academic Management Fads. *J. of Higher Education*. Vol. 71, 1, 1–16 (2000)
4. Pokholkov, Yu. P., Chuchalin, A.I., Mogilnitsky, S.B.: The national accreditation system for higher education institutions in Russia. *J. Higher Education in Europe*. Vol. XXVII, 3, 217–230 (2002)
5. Gerasimov, S., Tomilin, A., Tsoi, G., Shamritskaya, P., Yatkina, E., under redaction of Chuchalin, A.: Criteria and Procedure of Professional Accreditation of Educational Programs in Field of Technology: Information Publication. Tomsk Polytechnic University, Tomsk (2014)
6. Accreditation Center of the Association for Engineering Education of Russia, [http://aeer.ru/en/acc\\_center\\_eng.htm](http://aeer.ru/en/acc_center_eng.htm)