

RUSSIAN ENGINEERING TEACHERS AS AN IMPORTANT PART OF IGIP

Alexander N. SOLOVYEV – Dr. Sci. (Education), Dean, General Secretary of the IGIP Russian Monitoring Committee, e-mail: soloviev@pre-admission.madi.ru

Vyacheslav M. PRIKHODKO – Dr. Sci. (Engineering), Prof., Corr. Member of RAS, President of the IGIP Russian Monitoring Committee, e-mail: prikhodko@madi.ru

Tat'yana Yu. POLYAKOVA – Dr. Sci. (Education), Prof., Vice-President of IGIP, e-mail: kafedra101@mail.ru

Zoya S. SAZONOVA – Dr. Sci. (Education), Prof., Director of the Centre for Engineering Pedagogy, e-mail: zoia.sazonova@gmail.com

Moscow Automobile and Road Constructing State Technical University (MADI), Moscow, Russia
Address: 64, Leningradsky prosp., Moscow, 125319, Russian Federation

Abstract. The paper highlights the milestones of the history of the International Society for Engineering Pedagogy (IGIP) from 1972 until now. Professor A. Melezinek was a founder of the society; he developed its structure that survived to the present time. Now his pedagogical ideas are being developed and revised to reflect the changes in the goals and contents of engineering education, new methods, means of training and control, modern communication capabilities. Global challenges, problems of sustainable development and construction of the so-called “Resilient Society” were the main topics of the last Annual IGIP conferences. Globalization has led to the organization of the International Federation of Engineering Education Societies (IFEES). IGIP was one of its founders in 2006. We discuss different aspects of cooperation between Russian technical universities and IGIP, which began in 1995. Regional IGIP conferences and round tables are one of the aspects of such cooperation. The importance of this interaction for the Russian scientific school of engineering education is emphasized.

Keywords: international cooperation in engineering education, International Society for Engineering Pedagogy (IGIP), A. Melezinek, Russian Monitoring Committee of IGIP, IGIP Training Centers

Cite as: Solovyev, A.N., Prikhodko, V.M., Polyakova T. Yu., Sazonova, Z.S. (2018). [Russian Engineering Teachers as an Important Part of IGIP]. *Vysshee obrazovanie v Rossii* = Higher Education in Russia. No. 1 (219), pp. 38-45 (In Eng., abstract in Russ.)

Introduction

The international society for engineering pedagogy IGIP was established in Austria 45 years ago [1]. Its founder, Adolf Melezinek, was a professor at the University of Klagenfurt. He had the idea that graduates of technical universities did not have sufficient pedagogical knowledge and skills, and therefore were not well suited for teaching at higher education institutions. On the other hand, graduates of teacher training universities did not have enough professional knowledge in the field of engineering. A. Melezinek is the author of the book “Engineering pedagogy”, which has been translated and published in many countries. In fact, this book is recognized as a textbook for teachers of technical universities. It is an exposition of necessary knowledge and expertise on methods of teaching, psychology, and organization of laboratory classes and the usage of technical means of education.

The ideas of Professor A. Melezinek soon found their followers in many European countries, whose systems of higher education were similar the German one. Annual scientific-pedagogical conference, organized by IGIP, started attracting an increasing number of participants from many

countries of the world. The reports presented at the plenary and sectional meetings of these conferences are not only developing the ideas of A. Melezinek, but also reflect the radical changes in the goals and contents of engineering education, methods, means of training and control, communication capabilities and address the equation "What is engineering pedagogy?" on the whole [2; 3].

Cooperation between Russian technical universities and IGIP began in 1995. Moscow Automobile and Road Construction State Technical University (MADI) was the first Russian technical university, involved in the activities of IGIP. This article gives a brief summary of the evolution of engineering education in Russia and other countries based on the long-term cooperation experience, materials of International conferences and print media. We believe that some of the reforms are positive, but others contain potential risks.

IGIP traditions, innovations and international relations

In short, IGIP is based on three main solid principles that remain unchanged during the 45 years of its existence: (1) The development of a coherent system for the training of engineering universities' teachers at certified "IGIP Training Centers" (TC) that work according to a standardized program named "IGIP Curriculum"[4]. (2) After studying at a TC such a teacher may be certified and awarded the title "International Engineering Educator – ING-PAED IGIP". The names of the certified teachers are listed in the corresponding IGIP Register. (3) Every year annual scientific symposia are held.

The Executive Committee is IGIP's governing body. The IGIP International Monitoring Committee (IMC) deals with certification procedures and maintains the IGIP Register. The idea of A. Melezinek was to organize in each partner country the so-called National Monitoring Committee (NMC). The functions of NMC are as follows: (1) Recommending the applicants for the award of the ING-PAED IGIP title to IMC. (2) Helping national Training

Centers to be accredited by IMC. (3) Promoting and coordinating other IGIP activities in the country. This idea still works but during the 46th IGIP International Conference (September 2017, Budapest) it was reported that there was just one IGIP Monitoring Committee, namely the International one, and only it should have the functions mentioned above. Therefore the National Monitoring Committees do not have these functions and should rather be called the IGIP National Branches. Nevertheless, below we are still using the old name because the changes have not yet been implemented at the IGIP official Web site.

There are a few societies dealing with engineering education in the world. They share similar problems and team up to overcome them. In 2006 the IGIP leaders were among those who established the International Federation of Engineering Education Societies (IFEES). Twice (in 2014 and 2015) the traditional IGIP Annual Conference was held as a part of the World Engineering Education Forum (WEEF) under the auspices of IFEES [5–7]. An interesting detail is that the American Society for Engineering Education (ASEE) is a member of IFEES but stands apart from its fora (a small number of participants from the United States). It appears that ASEE is trying to be on its own holding numerous annual conferences making their own program (in the foreground are the methodological, financial and organizational issues in American engineering education). At the conference, which was held in Seattle (Washington, USA) from 14 to 17 June 2015, there were about 5000 delegates from a large number of American technical universities (colleges) and a small number of participants from other countries. For example, there were five participants from Russia (members of IGIP).

The establishment of IFEES, as well as the organizational convergence of such societies, seems reasonable in the context of the ongoing processes of globalization. There are different approaches to the definition of these processes and the classification of their forms. During the last decades the evolution of these processes

gains high rate due to the improvement of transport communication, the introduction of new media and communications, international division of labor in major modern industries [8].

At the beginning of the 46th IGIP Annual Conference on the 27th of September 2017 there was a workshop on Engineering Pedagogy by the President of the IGIP MMC Tiia Ruutmann, professor of the Tallinn University of Technology, Estonia. She gave an overview of the changes in the theory and practice of engineering pedagogy in recent years. In the written report she and her university colleagues proposed some new ideas on developing the fundamentals of engineering pedagogy [9].

The history of IGIP activity in Russia

During the last 25 years since the collapse of the Soviet Union there were significant changes in the system of higher technical education in Russia. These changes were due to the changes in the socio-economic situation, regulatory framework and public policy in the country. After the fall of the so-called Iron Curtain international cooperation between Russian and foreign technical universities began. Engaging in cooperation with the IGIP was a correct and timely decision. In 1995 the IGIP Russian Monitoring Committee (RMC) was formed. Its leaders work in MADI. The RMC activity is described in detail in [10]. The first Russian IGIP Training Center was organized at Bauman Moscow State Technical University in the same year.

Essential fact: only three years later, in 1998, the Annual Symposium of the IGIP was held in Moscow, at MADI. The Moscow Symposium attracted a large number of foreign and Russian participants and contributed to the spread of the ideas of IGIP in Russia. Nowadays 15 certified Training Centers for engineering education (more than in any other country) are acting in Russia with the support of RMC. Since 1995, the number of the technical university's teachers with the title ING-PAED IGIP in Russia has exceeded 400. Three more of the IGIP Annual Symposia (with the organizational support of the RMC) were held in Russia: in 2003 in St. Pe-

tersburg, in 2008 in Moscow, in 2013 in Kazan. Cooperation with IGIP, participation in the IGIP International Conferences help embedding the Russian scientific engineering school into the world educational space, establishing business and scientific contacts with the foreign colleagues [11].

Regional conferences are a useful IGIP tradition, which allows discussing features of education systems in several nearby countries. In Russia, this tradition began in 2001, when the first methodological seminar on engineering pedagogy was held at MADI. Since then its permanent organizer is Z.S. Sazonova. In 2011 the seminar became a regional IGIP conference. Almost every year other Regional IGIP conferences are held at Russian technical universities (in Moscow, Kazan etc.). Conferences usually end with round tables aimed at discussing topical issues of Russian education [12]. In particular, contacts with European colleagues enable Russian technical universities to be involved in Tempus Projects' Consortiums. This is undoubtedly a positive example, but foreign experience is not always creative and has both a positive effect and a potential threat.

Cooperation of Russian and foreign engineering pedagogy schools

During the last two decades, Russian engineering education experienced significant changes:

1. The transition to the multilevel ("Bologna") system of higher education has been realized.
2. In September 2013 the Law on Education entered into force in the Russian Federation.
3. New educational standards for higher education (HE) were adopted.
4. The active development of professional standards started. Therefore, the HE standards must correspond to them.

Active and meaningful participation of Russian teachers of engineering universities in the IGIP International conferences favored the establishment of working contacts between them and their foreign colleagues. These contacts cer-

tainly contribute to the teachers' awareness of the new achievements in higher education worldwide. The importance of international contacts increased when the Russian Federation signed the Bologna Declaration in 2003 and the Russian Government decided to join the creation of the European Higher Education Area (EHEA).

For example, the content of the speeches and discussions at the conferences about the experience of other countries that had already joined the Bologna Process some years before Russia shows that it is necessary to thoroughly analyze this experience before putting into the practice of Russian education. One can still encounter discussions in the literature both about the practicability of the "Bologna" terminology, its understanding and its interpretation in the Russian language, and the analysis of the possible consequences of introducing the "Bologna" innovations in the Russian higher education system. Let us consider the two "Bologna" problems [13].

1. A large number of publications in scientific and pedagogical literature were devoted to a discussion of the adequacy of translation into the Russian language and the use of the terms "competence" and "competency". The competence approach prevails now in higher education, but still we saw no practical guidance on how to assess the formation of certain competencies during the training process.

2. Socio-economic consequences of the transition to the system of higher education "bachelor – master" (4+2 years) from the traditional one – "engineers" (5 years). Starting from 2015, we have a massive bachelor graduation in Russia (those students who studied 4 years). Technically, they can be employed in the industry at the same positions as former engineer graduates but, for example, legally they cannot be teachers in higher education institutions. In many European countries the graduations of bachelors in the technical disciplines took place earlier and there are publications about the complexities of their employment.

Let us now consider problems that are not directly connected with the Bologna process.

1. The problem-oriented and project-organized (PBL) method of teaching has been introduced in a few technical universities all over the world. It has many supporters [14; 15]. Analysis of their activities shows the progressiveness of this method only under certain favorable conditions. First, we are talking about cooperation with enterprises, which are interested in the results of the projects, ready to suggest real ideas, and willing to finance them. Second, students must be well motivated for project work. Third, professors have to be provided with special methodology. A new modification of this method is the CDIO ideology put forward by the professors of the Massachusetts Institute of Technology (MIT). MIT is a leading technical University in the USA that has both a vast industry support and outstanding students. The Russian authors of scientific and pedagogical articles discuss the CDIO ideology [16]. The obvious limitations of the applicability of this ideology in any education institution is summed up above for project-organized methods.

2. The so called "student-centered approach" is actively discussed at international engineering education conferences. It seems that this teaching paradigm has come to Russian educational system from abroad, but it is well known that methods of active students' participation in the educational process were developed in Russia as early as in the 1920-ies. Of course, moving from teaching to learning is a positive idea. In such situation the main task of a teacher is to motivate students.

3. The problem of "Sustainable Development" and "Global Challenges" are widely discussed at international conferences on engineering education [7]. The search for solutions of the problem of "Sustainable Development" and responses to "Global Challenges" have led to "Engineering Education for a Resilient Society". We encountered this term first during the World Engineering Forum WEEF held on 20–24 of September 2015 in Florence (Italy). There is no dictionary where we can find the translation of the English word "resilient" into Russian with

the appropriate meaning (“word to word”). The idea of the discussion in Florence was that we must pay significant attention to the elaboration of the proper goals of engineering education and to the modification of its content if we wish to construct a society adaptable to the global challenges. It is quite evident that we are to include in the Engineering Study Programs such subjects as Philosophy, Economics and Ecology. These subjects are traditionally included in the curriculum of Russian higher technical schools. The question is not only how to teach them but how to make them applicable to engineering. The professional public accreditation of study programs according to the ENAEE requirements requires that the questions of sustainable development be considered in the graduation projects.

Conclusion

The international division of labor, intensive exchange of information, the need to enhance the competitiveness of industrial production, as well as the existing competition at the international market for higher education set high demands on the quality of engineering education. Its improvement is possibly based on international experience exchange, participation in international societies, conferences, etc. We believe that the cooperation with IGIP has had a significant impact on the creation and development of the Russian scientific school of engineering pedagogy. The results of the activities of the participants of this academic school can be considered as a significant contribution to the dissemination of innovative methods of teaching engineering subjects.

References

1. Prikhodko, V.M., Polyakova, T.Y. (2015). *IGIP. Mezhdunarodnoe obschestvo po inzhenernoi pedagogike: proshloe, nastoyashee, budushchee* [IGIP. International Society for Engineering Education: Past, Present, Future]. Moscow: Tekhpolygrafsentr Publ., 143 p. (In Russ., abstract in Eng.)
2. Senashenko, V.S., Verbitsky, A.A., Ibragimov, G.I., Osipov, P.N., et al. (2017). [Engineering Pedagogy: Methodological Issues: Round table discussion]. *Vysshee obrazovanie v Rossii* = Higher Education in Russia. No. 11 (217), pp. 137-157. (In Russ., abstract in Eng.)
3. Prikhod'ko, V.M., Sazonova, Z.S. (2014). [Engineering Pedagogy as the Base for Training of Modern Engineers and Academic Staff of Technical Universities]. *Vysshee obrazovanie v Rossii* [Higher Education in Russia]. No. 4, pp. 6-12. (In Russ., abstract in Eng.)
4. Prikhod'ko, V.M., Solov'yev, A.N. (2013). Training of International Engineering Educators According to the New IGIP Curriculum. *2013 International Conference on Interactive Collaborative Learning (ICL)*. 978-1-4799-0152-4/13 C2013 IEEE 25-27 September 2013, Kazan National Research Technological University, Kazan, Russia, pp. 299-305.
5. Hoyer, H.J., Cheng, S. (2015). [World Engineering Forum 2015 in Dubai]. *Vysshee obrazovanie v Rossii* = Higher Education in Russia. No. 3, pp. 33-40. (In Russ., abstract in Eng.)
6. Auer, M.E., Zafoschnig, A. (2015). The participation of IGIP in the 2014 WEEF. *Vysshee obrazovanie v Rossii* = Higher Education in Russia. No. 3, pp. 40-45.
7. Prikhod'ko, V.M., Solov'yev, A.N. (2015). [What Should Be the Modern Engineering Education (Thinking of Global Forum Participants)]. *Vysshee obrazovanie v Rossii* = Higher Education in Russia. No. 3, pp. 45-56. (In Russ., abstract in Eng.)
8. Ivanov, V.G., Pokholkov, Y.P., Kaybiyaynen, A.A., Ziyatdinova, Y.N. (2015). [Developing Engineering Education for a Global Community]. *Vysshee obrazovanie v Rossii* = Higher Education in Russia. No. 3, pp. 67-78. (In Russ., abstract in Eng.)
9. Ruutmann, T., Lohmus, M., Sell, R., Stoun, I., Pihel, M. (2017). Self-Evaluation of Pedagogical Competencies of Academic Staff in the Context of Career Management. *ICL2017 – 20th International Conference on Interactive Collaborative Learning 27-29 September 2017, Budapest, Hungary*, pp. 821-831.
10. Prikhod'ko, V.M., Petrova, L.G., Solov'yev, A.N., Makarenko, E.I. (2011). [Activity of the IGIP Russian Monitoring Committee]. *Vysshee obrazovanie v Rossii* = Higher Education in Russia. No. 12, pp. 39-47. (In Russ., abstract in Eng.)
11. Prikhod'ko, V.M., Petrova, L.G., Solov'yev, A.N., Makarenko, E.I. (2011). [Importance of

- the Institution of International Cooperation for Integration of the Russian Higher Technical Education in the Global Education Area]. *Vestnik TGU* [Herald of the Tver State University, Series "Pedagogy and Psychology"]. No. 4, pp. 141-151. (In Russ.)
12. Sazonova Z.S. (2015). [Methodological Seminar MADI-IGIP as a Form of Engineering Pedagogy Development: History and Prospects]. *Vysshee obrazovanie v Rossii = Higher Education in Russia*. No. 2, pp. 30-39. (In Russ., abstract in Eng.)
 13. Senashenko, V.S. (2017). [On the Reforming of National Higher Education System]. *Vysshee obrazovanie v Rossii = Higher education in Russia*. No. 6, pp. 5-15. (In Russ., abstract in Eng.)
 14. Ivanov, V.G., Shageeva, F.T., Galikhanov, M.F. (2017). [Continuous Training of Engineers for Innovative Economy in the Research University]. *Vysshee obrazovanie v Rossii = Higher Education in Russia*. No. 5 (212), pp. 68-78. (In Russ., abstract in Eng.)
 15. Sanger, Ph. A. (2017). Development of Technologies and Innovations in a Modern University: International Multi-Disciplinary Student Teams Solving Real Problems for Industry. *Vysshee obrazovanie v Rossii = Higher Education in Russia*. No. 11 (217), pp. 49-53.
 16. Isaev, A.P., Plotnikov, L.V. (2016) ["Educational Engineering" in the Context of the Implementation of the CDIO Ideology]. *Vysshee obrazovanie v Rossii = Higher Education in Russia*. No. 12 (207), pp. 45-52. (In Russ., abstract in Eng.)

The paper was submitted on 10.12.17

Accepted for publication 22.12.17

РОССИЙСКИЕ ПРЕПОДАВАТЕЛИ ИНЖЕНЕРНЫХ ВУЗОВ ЯВЛЯЮТСЯ ВАЖНОЙ ЧАСТЬЮ IGIP

СОЛОВЬЕВ Александр Николаевич – д-р пед. наук, декан факультета довузовской подготовки, генеральный секретарь Российского мониторингового комитета. E-mail: soloviev@pre-admission.madi.ru

ПРИХОДЬКО Вячеслав Михайлович – д-р техн. наук, чл.-корр. РАН, проф., президент Российского мониторингового комитета IGIP. E-mail: prihodko@madi.ru

ПОЛЯКОВА Татьяна Юрьевна – д-р пед. наук, проф., вице-президент IGIP. E-mail: kafedra101@mail.ru

САЗОНОВА Зоя Сергеевна – д-р пед. наук, проф., директор Центра инженерной педагогики. E-mail: zoia.sazonova@gmail.com

Московский автомобильно-дорожный государственный технический университет (МАДИ), Москва, Россия

Адрес: 125319, Москва, Ленинградский проспект, 64

Аннотация. В данной работе мы попытались на основе личного участия и анализа литературных источников кратко проследить развитие Международного общества по инженерной педагогике (IGIP), расширение его международных связей, а также эволюцию круга его научных интересов. Обращено особое внимание на роль российских технических университетов в развитии IGIP, а также на влияние сотрудничества с IGIP на модернизацию образовательного процесса в них в рамках вхождения в международную образовательную среду.

Сорок пять лет назад, в 1972 г., профессор Университета города Клагенфурта А. Мелецинек организовал Международное общество по инженерной педагогике (IGIP). Его идея: снабдить выпускников технических вузов необходимыми педагогическими знаниями и навыками. Им же предложена тройная система общества:

– сертифицированные Центры инженерной педагогики IGIP (Training Centers), где обучение преподавателей должно вестись по стандартизированному учебному плану,

- ведение Регистра IGIP, куда заносятся фамилии преподавателей, которым присвоено звание «Международный преподаватель инженерного вуза»,
- ежегодное проведение конференций (симпозиумов), на которые выносятся обсуждение проблем инженерной педагогики.

Вопросами аккредитации (сертификации) Центров инженерной педагогики (ЦИП), а также аттестации преподавателей занимается Международный мониторинговый комитет (ММК) IGIP. Активность членов общества проявляется на ежегодных научно-педагогических конференциях, организуемых IGIP. Тематика докладов, представляемых на этих конференциях, девизы конференций отслеживают существенные изменения в целях и содержании инженерного образования, а также в методах, средствах обучения, контроля и коммуникации. Глобализация рассматриваемых проблем сделала необходимым сотрудничество существующих сегодня в мире обществ по инженерному образованию. IGIP явилось одним из инициаторов создания Международной федерации обществ по инженерному образованию (IFEES) в 2006 г. В 2014 и 2015 гг. традиционные ежегодные конференции («симпозиумы») IGIP становились частью Международных форумов по инженерному образованию (WEEF), проводимых под эгидой IFEES. О них можно прочитать в обзорных статьях, опубликованных в журнале «Высшее образование в России». Так, Форум WEEF, который состоялся 20–24 сентября 2015 г. во Флоренции, проходил под девизом: «Engineering Education for a Resilient Society». Смысл этого термина, отражающего международный тренд, состоит в том, что инженерное образование должно содействовать созданию общества «устойчивого развития», адаптивного по отношению к «глобальным вызовам». Обзорный доклад, фиксирующий состояние инженерной педагогики в наши дни, сделала на конференции 2017 г. президент ММК Т. Рюютманн, профессор Таллиннского политехнического университета.

Московский автомобильно-дорожный государственный технический университет (МАДИ) был первым российским техническим вузом, который в 1995 г. году активно включился в деятельность IGIP (на его базе в том году был создан Российский мониторинговый комитет IGIP (РМК IGIP). При активном содействии РМК к настоящему времени в России создано 15 сертифицированных центров инженерной педагогики (больше, чем в какой-либо другой стране), а количество аттестованных за эти годы инженеров-педагогов в России превосходит 400 человек. Массовое участие в международных конференциях благоприятствовало установлению рабочих контактов между российскими преподавателями инженерных вузов с их зарубежными коллегами, что не только способствовало расширению кругозора и знакомству с достижениями мировой высшей школы, но и предоставило возможность обмена студентами, преподавателями, а также участия в Темпус-проектах.

Международное разделение труда, интенсивный обмен информацией, необходимость повышения конкурентоспособности промышленного производства, а также существующая конкуренция на международном рынке услуг высшего образования предъявляют сегодня повышенные требования к качеству инженерного образования. Его совершенствование возможно в том числе и на основе международного обмена опытом, участия в работе международных обществ, организуемых ими конференций и т.д. Мы считаем, что сотрудничество с IGIP оказало значительное влияние на создание и развитие в России научной школы инженерной педагогики.

Ключевые слова: инженерное образование, инженерная педагогика, А. Мелецинек, Международное общество по инженерной педагогике (IGIP), Российский мониторинговый комитет IGIP, Центр инженерной педагогики IGIP

Литература

1. Приходько В.М., Полякова Т.Ю. IGIP. Международное общество по инженерной педагогике: прошлое, настоящее, будущее. М.: Техполиграфцентр, 2015. 143 с.
2. Сенашенко В.С., Вербицкий А.А., Ибрагимов Г.И., Оситов П.Н. и др. Инженерная педагогика: методологические вопросы (круглый стол) // Высшее образование в России. 2017. № 11 (217). С. 137–157.
3. Приходько В.М., Сазонова З.С. Инженерная педагогика – основа профессиональной подготовки инженеров и научно-педагогических кадров // Высшее образование в России. 2014. № 4. С. 6–12.
4. Prikhodko V.M., Solovyev A.N. Training of International Engineering Educators According to the New IGIP Curriculum. 978-1-4799-0152-4/13 C2013 // IEEE 25–27 September 2013, Kazan National Research Technological University, Kazan, Russia. 2013 International Conference on Interactive Collaborative Learning (ICL). P. 299–305.
5. Хойер Х., Ченг С. О всемирном форуме по инженерному образованию в Дубае // Высшее образование в России. 2015. № 3. С. 33–40.
6. Аиер М.Е., Zafschnig A. The participation of IGIP in the 2014 WEEF // Высшее образование в России. 2015. № 3. С. 40–45.
7. Приходько В.М., Соловьев А.Н. Каким быть современному инженерному образованию? (Размышления участников форума) // Высшее образование в России. 2015. № 3. С. 45–56.
8. Иванов В.Г., Похолоков Ю.П., Кайбияйнен А.А., Зиятдинова Ю.Н. Пути развития инженерного образования // Высшее образование в России. 2015. № 3. С. 67–78.
9. Ruitman, T., Lobtus, M., Sell, R., Stout, I., Pibel, M. Self-Evaluation of Pedagogical Competencies of Academic Staff in the Context of Career Management // ICL2017 – 20th International Conference on Interactive Collaborative Learning 27–29 September 2017, Budapest, Hungary, 2017. P. 821–831.
10. Приходько В.М., Петрова А.Г., Соловьев А.Н., Макаренко Е.И. О деятельности Российского мониторингового комитета IGIP // Высшее образование в России. 2011. № 12. С. 39–47.
11. Приходько В.М., Петрова А.Г., Соловьев А.Н., Макаренко Е.И. Значение международного сотрудничества вузов для интеграции российского высшего технического образования в мировое образовательное пространство // Вестник ТвГУ. Сер. «Педагогика и психология». 2011. Вып. 4. С. 141–151.
12. Сазонова З.С. Методологический семинар МАДИ-IGIP: история и перспективы // Высшее образование в России. 2015. № 2. С. 30–39.
13. Сенашенко В.С. О реформировании отечественной системы высшего образования: некоторые итоги // Высшее образование в России. 2017. № 6. С. 5–15.
14. Иванов В.Г., Шагеева Ф.Т., Галиханов М.Ф. Преемственная подготовка инженерных кадров для инновационной экономики в исследовательском университете // Высшее образование в России. 2017. № 5 (212). С. 68–78.
15. Sanger Ph. A. Development of Technologies and Innovations in a Modern University: International Multi-Disciplinary Student Teams Solving Real Problems for Industry // Высшее образование в России. 2017. № 11 (217). С. 49–53.
16. Исаев А.П., Плотников Л.В. «Учебный инжиниринг» в контексте реализации идеологии CDIO // Высшее образование в России. 2016. № 12 (207). С. 45–52.

Статья поступила в редакцию 10.12.17

Принята к публикации 22.12.17