

NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
“KYIV POLYTECHNIC INSTITUTE”

**THE METHODOLOGY OF ASSESSMENT
FOR QUALITY ASSURANCE OF MASTER'S PROGRAMS
AT NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
“KYIV POLYTECHNIC INSTITUTE”**

Report at the framework of Tempus project “IEMAST”

**ESTABLISHING MODERN
MASTER-LEVEL STUDIES
IN INDUSTRIAL ECOLOGY**



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The project is designed to create a base for preparing engineers capable of working on technological design of industrial and urban systems, industrial processes and consumer products taking into account environmental problems and given social and economic restrictions in Azerbaijan, Belarus, Kazakhstan and Ukraine.

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Report at the framework of Tempus project “IEMAST”
(Establishing Modern Master-level Studies in Industrial Ecology)



Kyiv
NTUU “KPI”
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1. QUALITY ASSURANCE OF MASTER'S PROGRAMS AT NTUU "KPI": purpose, actuality, requirements

The main purpose of educational activities at National technical university of Ukraine "Kyiv Polytechnic Institute" (NTUU "KPI") is a quality assurance of master's education and their recognition in the labor market both in Ukraine and abroad. NTUU "KPI" provides training, guided by the needs of the labor market, the requirements of European quality assurance system, the relevant national system of licensing and accreditations, holds a leading position among the universities according to national and international rankings. That's why NTUU "KPI" has the status of a research university. Our university is traditionally one of the best local educational and research institutions in Ukraine.

The actuality of quality evaluation of the master's program. Training of specialists in the field of industrial ecology requires multidisciplinary approaches. This way is important for specialists in the field of information, especially in the modern ecological, economic and social conditions. Different specialists in technological design of industrial and urban systems, engineer systems have to be armed with deep knowledge on modern environmental and economy problems.

Deficit of specialists, the insufficient level of education, and considerably low skills of workers and teaches in the field of industrial ecology are main problem that essentially reduces the growth of net production, the profit of environmental business. That is the problem, which has constantly generates an attention by many specialists, different organizations, and Ukrainian government.

General requirements for methods for quality evaluations of master's educational programs in framework of Tempus project "IEMAST" have to have:

- Formalized methods allowed quantitatively and qualitatively evaluate education process by general criteria to create a computer database. These methods have to use the Internet or Local university network for collecting and processing the achieved data;
- Optimized number of indicators, which have to characterize objectively the training quality at higher schools in order to requirements of the labor market;
- Broad involved group of participants (staff, students, employers) for different reviews of training quality based on a social opinion poll;
- Developed normative and methodological support for complex monitoring of training quality;
- Conceptual issues of European practices for evaluation quality in education process in frameworks of Bologna process.



2. HISTORICAL EXCURSUS IN FORMATION OF EUROPEAN PRACTICE IN TRAINING EVALUATIONS IN BOLOGNA PROCESS

At the end of the twentieth century, the globalization and integration processes the world, European economies stimulate necessity for developing “Standards and Guidelines for Quality Assurance in the European Higher Education Area”. That is why the European Association for Quality Assurance in Higher Education (ENQA) was found in 2000¹.

ENQA-2000 has developed standards and guidelines for requests received in the Berlin Communiqué (September 2003) signed by countries joined the Bologna Process².

Ukraine

Ukraine officially joined the “Bologna process” at the conference in Bergen (Norway), May 19, 2005. This process does not introduce for Ukraine completely identical education systems of European countries. The greatest achievement of the Bologna process is creation of conditions for each country to compare their educational systems, and ability to declare that education in every country is unique, original, deeply national educational system. Bologna process is the integration process for identification process of national educational systems in the European context. Ukrainian version of “Standards and Guidelines for Quality Assurance in the European Higher Education Area” is shown in website: <http://www.enqa.eu/indirme/esg/ESG%20in%20Ukrainian.pdf>

The basis for the creation of “Standards and Guidelines for Quality Assurance in the European Higher Education Area” has an idea that has been presented in the following documents:

- “European pilot project to assess the quality of higher education” (1994-1995);
- Recommendation of Council of 24 September 1998 on European cooperation in quality assurance in higher education (98/561/EC)³;
- Bologna Declaration by June 19, 1999⁴.

ENQA-2000 distinguishes two levels for control the quality of education, namely:

1. **Internal control** (quality assurance procedures in higher education schools).
2. **External control** (ranking definition in higher education schools). This control deals with defining of specific integrated factor of higher education, which is

¹ <http://www.enqa.eu>

² www.bologna-bergen2005.no/Docs/00-Main_doc/050221_ENQA_report.pdf5

³ Official Journal of European Communities (1998). Recommendation of Council of 24th September 1998 on European cooperation in quality assurance in higher education [Electronic resource] (98/561/EC), L 27G/56, G7.1G.1998. – see for detail: <http://www.enqa.eu/wp-content/uploads/2013/06/Recommendation-of-the-Council-98.561.EC-of-24-September-1998.pdf>

⁴ http://www.ehea.info/Uploads/Declarations/BOLOGNA_DECLARATION1.pdf

the ranking of higher education schools. This factor has to be defined primarily in mutual levels of training programs and universities inside Bologna region.

The basis for developing standards of *internal control* was historical experience of English and German models for quality evaluating in education, which was based on internal self-assessment of education quality under the leadership of accreditation agencies.

According to researches by Hrykova E.M.⁵, the United Kingdom in the 90 years of the twentieth century was established multi-level system of accreditation of universities and their educational programs with primary role of government Quality Assurance Agency (QAA)⁶. A number of British universities estimate an evaluation of educational programs of other educational schools using QAA criteria. For example, in 1992 the Open University (OU) created the structure The Open University Validation Services (OUVS), which deals with accreditation of educational institutions and validation (ratification) of educational programs in higher schools including countries outside the United Kingdom.

In Germany, the internationalization of education and the transition to a multi-educational system led to the creation of a number of accreditation organizations⁷. In 1998 the Accreditation Council for program evaluation of training masters and bachelors was found in Germany by decision of Ministers of Education of Land Assembly. The Council has developed minimum standards and criteria for accreditation agencies. Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics worked actively in Germany. This agency accredits educational programs in engineering, computer science, natural sciences and mathematics. Moreover, there are other agencies in various fields of training in higher education system⁸.

The basis for the development of standards of *external control* model was historical experience in quality evaluation of education in the USA. According to researches⁹, these rankings of higher education schools have obtained a wide distribution in different countries in 1983. The list of 50 better universities in the USA was published in largest weekly newspaper "US News & World Report"¹⁰. To define the ranking of universities authors take into account the reputation of the university, the success of the employment of graduates, student selection and other criteria. Currently, institutional and specialized (in the area of training) rankings were published in the USA by many publishing: "Time", "Newsweek", "Money",

⁵ Hrykov E. M. European, national and institutional contexts of the quality management of higher education in Ukraine [Electronic resource]. – Input regime: http://virtkafedra.ucoz.ua/el_gurnal/pages/vyp2/upravlenie/hrykov.pdf (in Ukrainian).

⁶ www.qaa.ac.uk

⁷ See ref.5

⁸ The European Association for Quality Assurance in Higher Education. – input regime: www.enqa.eu. [Quality Assessment and Quality Development in German Universities with Particular Reference to the Assessment of Teaching. - Bonn, HRK, 2000. - 41p. <http://v1.uklo.edu.mk/quality/den110705.pdf>

⁹ Pohlkov Yu., Chychalin A., Mogilnitskiy S., Boev O. Promote and assess the quality of higher education / Higher education in Russia. – 2004. – N2.– p.12-27. (in Russian)

¹⁰ <http://www.usnews.com>

“Business Week”, “Wall Street Journal” and others. Here authors select different criteria based on the cost of educational services with modern equipment, the access to information resources in the Internet, the evaluation of educational institutions by corporate recruiters and others. Well known Barron's publication classifies universities in six categories in competitiveness, namely: most competitive, highly competitive, very competitive, competitive, less competitive and noncompetitive. However, the ranking of “US News & World Report” is still the most popular in the United States.

The most comprehensive international ranking system in the world is Shanghai ranking system (Academic Ranking of World Universities) and Times ranking system (THE-QS World University Rankings).

Shanghai ranking system (or rather “Ranking of World Class Universities”) was found in June 2003 at the Institute of Higher Education of Shanghai University (China). All universities were included in this ranking system, in which Nobel Prize winners and holders of the highest award in mathematics were studied or worked. Shanghai ranking system includes researchers and universities/institutions, which are often cited in well known scientific journals in the world.

Times ranking system or THE-QS World University Rankings was published first in 2004, and always consists of 200 universities. Unlike Shanghai ranking system, it uses not only objective, but also subjective indicators, namely: assessment by colleagues in the academic institutions and assessment by employers. Evaluation of research activity, which is almost fully determined by Shanghai ranking system, has in fact the fifth part of the total “weight” of Times ranking system.



3. BASIC CONCEPTS OF EUROPEAN STANDARDS AND RECOMMENDATIONS FOR INTERNAL QUALITY ASSURANCE IN HIGHER EDUCATION SCHOOLS

• ***General policies and procedures*** to ensure the establishment and functioning of the European Higher Education region fundamentally depends on whether the educational institutions at all levels at NTUU “KPI” can to carry out the following requirements:

- Training programs have to have clearly defined learning outcomes to be achieved;
- Readiness, willingness and ability of teaching staff to provide teaching and to create all necessary conditions that would help students to achieve the highest quality results;
- Availability of full, timely and tangible recognition of the contribution to the future work by the staff that demonstrates excellence, higher professional knowledge and experience.

- ***Basic Principles***

- Higher schools have the primary responsibility for the quality of educational services and how this quality is ensured;
- Need to develop and to improve the quality of educational programs for students and stakeholders;
- Assistance of financial and social transparency in applying of external professional support in educational processes;
- Necessary to develop processes, using which universities can demonstrate own transparency and accountability, including an accountability for public and private investments, and so on.

- ***Appointment***

- Improve the education that students receive at higher education schools in the European region;
- Help for higher education schools to ensure and to improve the quality level of their work based on own autonomy;
- Make external quality assurance more transparent and understandable to all stakeholders (parents, employers, investors, etc.).

- ***Problems***

- Stimulate the development of higher education institutions that support active research and educational activities;
- Form a support for higher education and other relevant institutions to create their own traditions in quality assurance issues;
- Inform higher education institutions, students, employers and other stakeholders about processes occurring in the higher education and results in this area to raise the level of their expectations;
- Promote an establishment of a general belief system to provide the higher education and quality assurance in the European Higher Education region.

Recommendations for procedures of internal quality assurance

It is expected that the policy statement has to include:

- Relationship between teaching and research work in the universities;
- Establishment strategy for quality and standards;
- Organization of quality assurance;
- Responsibility of departments, faculties and authorized persons for ensuring higher quality;
- Involvement of students in quality assurance issues;
- Implements of policy, monitoring and review in quality assurance issues.



4. GENERAL WAYS OF REALIZATIONS OF EUROPEAN STANDARDS OF INTERNAL QUALITY ASSURANCE AND TRAINING PROGRAMS IN HIGHER EDUCATION SCHOOLS

Internal quality assurance of education and training programs involves the implementation of the sixth main directions.

1. Approval, monitoring and periodic review of training programs and theses

It is assumed that quality assurance programs include the following basic steps, namely:

- Development and publication of explicit formulations of expected learning outcomes;
- Careful attention to the construction of educational qualification program: list of subjects, their organization and content;
- Availability of appropriate media and electronic resources;
- Formal procedures for program approval by authority, which does not carry out the teaching of this program;
- Monitoring of a progress and achievements of students;
- Regular periodic reviewing of programs (involving external experts);
- Regular communication with employers, labor market specialists and other relevant organizations;
- Student's activities in quality assurance of education.

2. Evaluation of the quality of students

Requirements for student's assessment procedures should to:

- be designed such requirements, which are able to determine an extent of achieved learning outcomes and other program objectives;
- correspond of their purpose. In other words, procedures have to provide diagnostic, current or final control;
- have clear and published criteria for grading;
- made by people, who understand the role of assessment in students gaining knowledge and skills related to their future qualification;
- take into account all possible consequences of examine regulations;
- have clear rules governing cases of student absence due to their illness or other serious circumstances;
- ensure adequate security testing process and its correspondence to declared institution procedures;
- be subject to administrative reviews, which control an accuracy of declared procedures.

3. Quality assurance of teaching staff

Requirements for teachers:

- Teachers have to have at least a basic level of competence.

- Teachers have to transfer for students the knowledge and understanding of the studied subject for different situations.
- Teachers have to have an access to information how others specialists evaluate their work.

Arrangement improving the quality of teaching staff:

- have to create conditions and opportunities both to control, and to improve professional skills;
- have to create conditions for poor teachers to improve their professional skills.

It is necessary to have mechanisms for removal teachers from their positions, who continue to demonstrate their professional failures.

4. Scientific and methodological support for students

Apart from own teachers, students apply a different resources to assist their learning. These resources include university library, computers, and individual assistance of various kinds of consultants. Educational resources and other support mechanisms should be readily accessible for students, developed in according to their needs, and have to able to respond to a feedback support for students, who are using these resources.

Institutions have to constantly track, review and improve the effectiveness of support services available for students.

5. Organizational and informational support for quality assurance of institutions

Self-knowledge is the starting point for an effective quality assurance. It is important that higher education schools had many procedures to collect and analyze the information about their own activities. Otherwise, universities will not know what institutions works well, and what institutions needs additional attention.

An information system, which monitors quality and corresponds to the educational process, will depend on local conditions. It is expected that these information systems have to reflect at least:

- Achievement of students and their indicators of student's possibilities;
- Graduates opportunities to get a job / employment results;
- Students satisfaction of training programs that they are studying;
- Effectiveness of teaching;
- Logistical, scientific and methodological resources and their price;
- Key indicators of higher education schools.

6. Publicity of the information

Institutions should regularly publish the latest, unbiased, objective information (both quantitative and qualitative) about training programs that they are offering. This information may also include a feedback support from former students and their employments.



5. LEGAL FRAMEWORK OF FORMATION OF EUROPEAN PRACTICE OF INTERNAL QUALITY ASSURANCE FOR HIGHER EDUCATION IN UKRAINE

Basic principles and mechanisms of European practice in the quality assurance and training programs in national universities have defined in the new Law of Ukraine “On the higher education”¹¹, which was accepted by Verkhovna Rada of Ukraine (07.01.2014) in according to main provisions of Bologna process. This law is based on the Constitution of Ukraine and international treaties of Ukraine in the education.

Chapter V of this law defines the procedures and measures of implementation of the internal quality assurance, including:

- Definition of the main principles and procedures for the quality assurance;
- Monitoring and periodic reviewing of educational programs;
- Annual evaluating of higher education applicants, academic teaching and pedagogical staff of higher education schools, and the regular publishing of results of such assessments in the official website of the university, in information boards and in any other ways;
- Providing further training of scientific and teaching staff.
- Providing the necessary resources to the educational process, including independent self-guided work of students at each educational program.
- Ensuring of information systems for the efficient management of the educational process.
- Providing a publicity of information about educational programs, higher education degrees, and qualification levels.
- Ensuring an effective system of prevention and detection of plagiarism in academic papers of university employees and higher education teachers.
- Other procedures and activities.

According to the Law mentioned before, the internal quality assurance have evaluated by the National Agency for Quality Assurance of Higher Education or independent organizations accredited by this Agency. National Agency is a regular collegiate authority that realizes the state policy in the area of the quality assurance in Ukraine.

Also, we can note that mechanisms of European practices in the quality assurance and training programs in national universities have defined in the “Strategy for Higher Education Reform in Ukraine 2020”¹².

¹¹ <http://zakon2.rada.gov.ua/laws/show/1556-18>

¹² Strategy for Higher Education Reform in Ukraine upto 2020 (project) [Electronic ewsources]. – http://www.mon.gov.ua/img/zstored/files/HE%20Reforms%20Strategy%2011_11_2014.pdf (in Ukrainian)



6. IMPLEMENTATION OF THE EUROPEAN PRACTICE OF INTERNAL QUALITY ASSURANCE AND MASTER'S PROGRAMS IN NTUU “KPI”

According to Bologna Declaration the University community of NTUU “KPI” understands that the main function of key factors for the quality assurance performs:

- Initial training level of students admitted to the university;
- Accordance of training programs with the education purpose;
- Required qualification of teachers and support staff;
- Accordance of existing logistical, financial and information resources and educational environment task with learning process, the content of the training programs offered by the higher school;
- Organization of educational process, which most adequately meets modern tendencies of the national and world economy, national and world education;
- Accordance of graduate students with main task of educational background.

Following requirements of the Ukrainian economy for today, the NTUU “KPI” as the research university training, bases on the knowledge triangle (Fig.1):

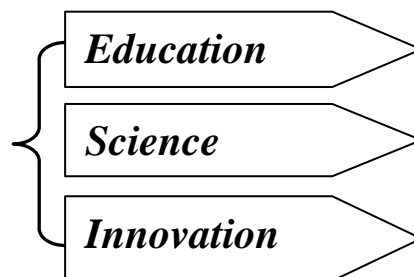


Figure 1. Knowledge triangle of educational system at NTUU “KPI”

Quality of training includes five main components shown in Figure 2.

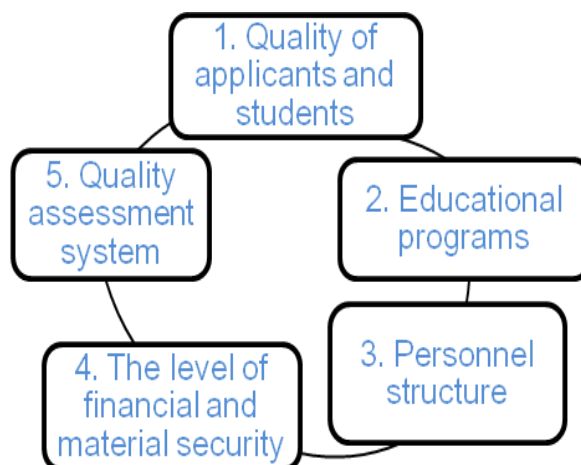


Figure 2. The main components of quality education at NTUU “KPI”

According to the report “Improving the training of specialists – time requirement” by the first Vice-Rector Yu. Yakymenko in the Academic Council at NTUU “KPI”, our national education corresponds to international standards of the education. The high level of education at NTUU “KPI” is provided, in particular:

- Introduction of the system of self-examination (Rector's control, state accreditation, monitoring, surveys of employers, etc.);
- Double degree programs;
- Students' participation in international events (Olympics educational competitions, international schools, national education competitions);
- Cooperation with domestic and foreign universities, international accredited organizations, etc;
- Implementation of the internal system of the quality assurance of education.

An important moment of educational activities at NTUU “KPI” is *the complex monitoring of training quality* (bachelors and master levels).

Complex monitoring carried out in four directions (fig.3).

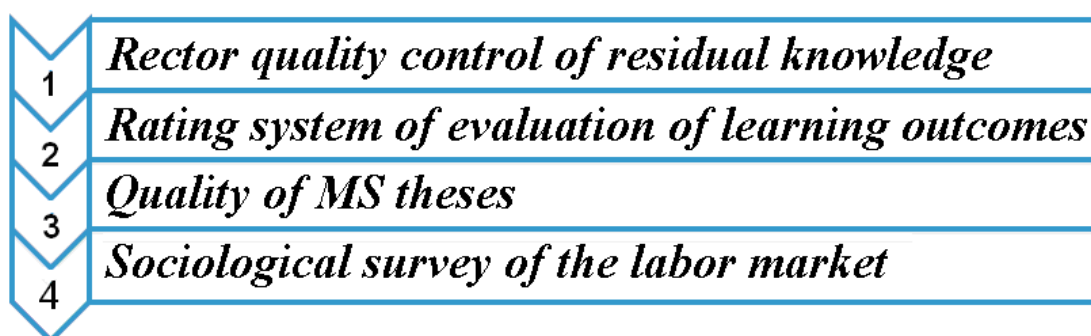


Figure 3. Main direction of complex monitoring of training quality

First direction. Main quality criteria of residual knowledge were determined by results of the rector control, which checks in following groups of disciplines:

- Fundamental;
- Professional;
- Special;
- Information technology;
- Foreign languages.

In addition, the coefficient of residual knowledge is determined according to results of Rector monitoring and students marks on the discipline at the last exam session.

Second direction. The base of the Ranking System of Evaluation (RSE) of learning outcomes consists of a past-operating control, and a summation of ranking

points for teaching and learning activities of every student during studying the subject. Requirements for RSE and methods of their determining are described in the notice of ranking system for evaluating learning outcomes of students¹³. The cover of this document is shown in figure 4.

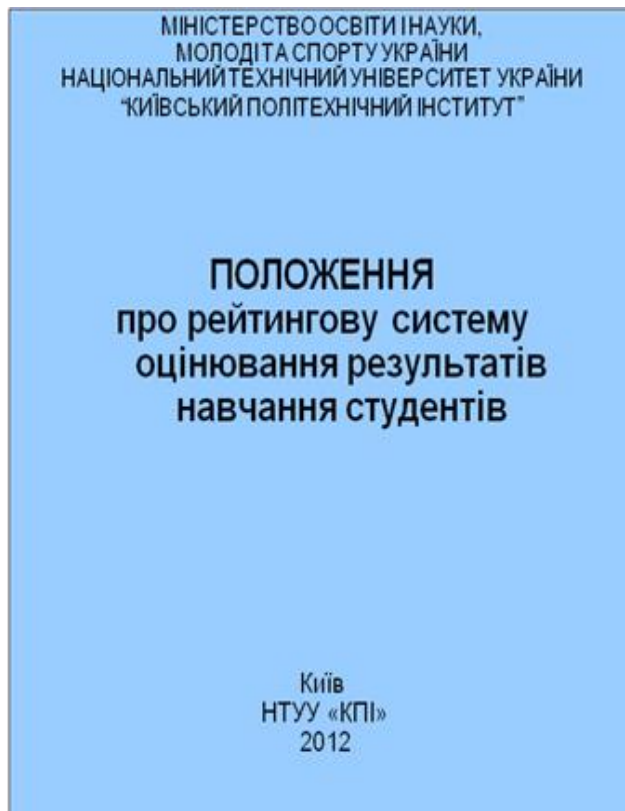


Figure 4. Cover of the notice of the ranking system for evaluating learning outcomes of students (in Ukrainian)

The RSE is an important element of European Credit Transfer System (ECTS).

The purpose of RSE is to:

- Intensify the learning process and improve the training quality;
- Increase a motivation of students for active, conscious learning, systematic independent work during the semester and responsibility for learning activities;
- Form a permanent feedback service to each student and timely adjustment of their educational activities;
- Ensure competition and clear competition in the education process;
- Improve the objectivity during the evaluation of students training;
- Reduce psychological, emotional and physical overloads during examinations.

¹³ <http://kxtp.kpi.ua/common/rso-2012.pdf>

The strategies of the RSE for disciplines, which establish peculiarities of credit ranking modules, methods of their calculation and principles of their applying, are discussed and accepted in the meeting of departments and faculties at the beginning of the education year. The strategies are announced to students during education season, and are remained unchanged in this period.

The Strategies of the RSE is places an appendix in working education program for every discipline.

Third direction. The main criteria of the quality of theses are:

- Number of diplomas with honor;
- Number of theses recommended for implementation;
- Number of theses for business;
- Results of university competition and independent examination.

Criteria take into account participation of masters in preparing scientific papers, in national and international conferences, and the number of publications in scientific journals. The number of prospective students and graduate student in NTUU “KPI” are analyzed by specializations and published in a special edition (fig. 5).

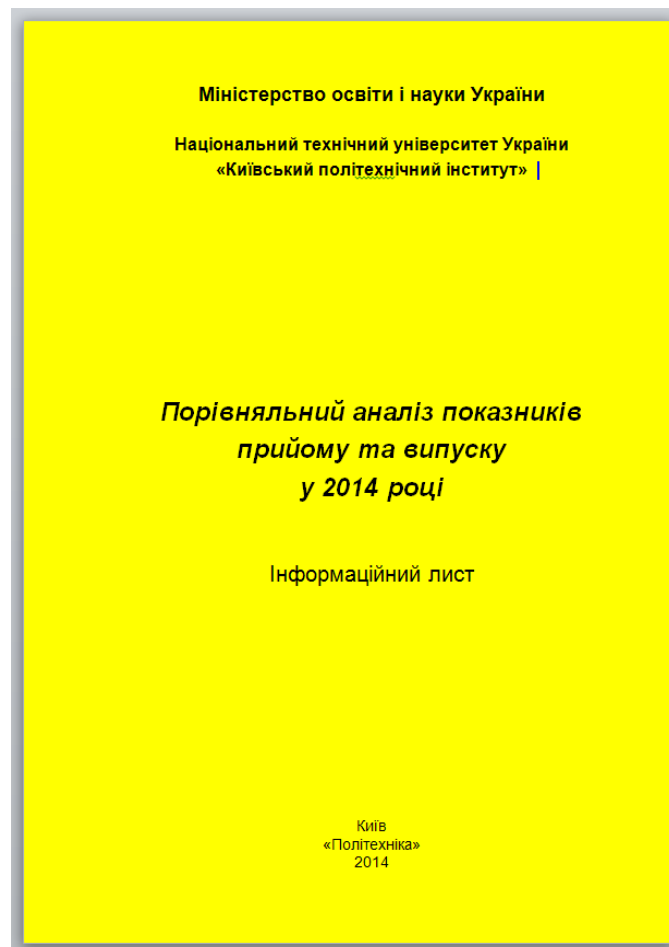


Figure 5. Cover of the special edition with comparative analysis of reception and release factors in 2014 (in Ukrainian)

The main purpose of this analysis is the special information to provide for leaderships of the university, faculties and departments, to help them make the necessary corrective measures addressed to overcoming weaknesses and ensuring the high level of training quality of future professionals in the framework of sufficiently high concurrence in educational services and labor markets.

Numerical values of reception and release factors, a rank or ranking are calculated for each structural unit (institute, faculty) and their specialties. There are two ranking indicators for prospective students, and three ranking indicators for graduate student.

Indicators of prospective students

- *Coefficient for application competition* (K_{app}) is determined by the ratio of the number of applications of prospective students (N_{app}) for first priority to the number of reception student N_{re} by government order (the reception plan):

$$K_s = \frac{N_{app}}{N_{re}} . \quad (1)$$

- *Coefficient for prospective students* (K_{pr}) is defined as the ratio of the total number of prospective students (N_{pr}) to the number of prospective students by government order (N_{gov}):

$$K_{pr} = \frac{N_{pr}}{N_{gov}} . \quad (2)$$

- *Coefficient for applying license order* (K_{lic}) is determined by the ratio of the total number prospective students (N_{pr}) to the number of licensed places (N_{lic}) approved for training direction for each graduating department in the university (due to the Rector's order № 4-254 by June 25, 2014):

$$K_{lic} = \frac{N_{pr}}{N_{lic}} . \quad (3)$$

This coefficient is not the rating indicator. It means that the coefficient does not take into account during definition the total indicator.

Indicators of graduate student

- *Coefficient for number of requests for graduates* (K_{req}) is determined by the number of documented requests (N_{req}) and the total number of graduating students (N_{gra})

$$K_{req} = \frac{N_{req}}{N_{gra}} . \quad (4)$$

- Coefficient of labor arrangement (K_{arr}) is defined as the ratio of number of documentally employed graduates (N_{gra}) trained by state order to the total number (N_{reqgov}) of graduating students (except additionally permitted students for state attestation)

$$K_{arr} = \frac{N_{gra}}{N_{ragov}}. \quad (5)$$

- *Results of the defense of theses* are determined by the rank estimation taking into account:

- Diplomas with honor;
- Diplomas recommended by State Examination Commission for implementation in industry, research works, educational process and so on;
- Theses are carried out for an order of external organizations or scientific works of departments in the university.

Each rating index was determined by rank, which is characterized by the location of the structural unit (specialty, studying direction) in the ranked on this indicator array.

To calculate the total reception and release factors and the complex indicator it is necessary to calculate the sum. Then the place of the structural unit in the University is defined taking into account the value of total indicator.

Fourth direction. Social polling of labor market is held to determine following criteria:

- Level of special training;
- Level of practical training;
- Level of experience in modern information technologies and software products;
- Level of foreign language;
- Level of readiness to learn, ability to assimilate the new knowledge in the achieved profession.

Directorship of NTUU “KPI” in cooperation with experts of Scientific Research Centre of Applied Sociology “Socio+” in the frameworks of annual “Fair of professions” carries out social poll to determine the main problems in the interaction of universities with the labor market.

For example, meeting “The Fair of jobs” (fig.6) was held at NTUU “KPI” (October 30, 2014). This event gathers representatives of industries, business leaders and companies and representatives of the administration and all the educational departments of the university with the aim of developing partnerships between NTUU “KPI” and the business for the long term¹⁴.

¹⁴ See <http://kpi.ua/en/node/9384#sthash.zFJRTbJD.dpuf> or <http://kpi.ua/en/node/9384>



Figure 6. Meeting “The Fair of jobs” at NTUU “KPI”

In general, the strategy, the policy and procedures of internal quality assurance at NTUU “KPI” have official status and available to the public. University also tries to involve students and other stakeholders in the process of the quality assurance.

When provisions of the law on higher education comes into effect, especially provisions related with the autonomy of universities, then the scientific and methodological commissions NTUU “KPI” achieves more and more important role in the educational process.



7. METHOD OF SELF-EVALUATION FOR QUALITY OF MASTER’S PROGRAMS OF TEMPUS PROJECT “IEMAST”

The basic technique for method of self-evaluation is the statements printed in Sections 4 and 5 in ranking system for evaluating learning outcomes of students¹⁵. These statements have allowed, on the one hand, to form criteria for the quality evaluation of the master program in order to European Standards and Guidelines, and, on the other, to take into account national peculiarities of the internal quality assurance and training programs in framework of the regulatory environment in Ukraine.

Self-evaluation is carried out using a social poll of any participants in the educational process, including: students, graduating students and employers. The aim of self-evaluation is studying preconditions and risks in the quality of master training

¹⁵ See reference 14

in the field of industrial ecology, including:

- Quality assurance of the teaching staff;
- Student's satisfaction of the quality of training courses;
- Student's motivation to the self-knowledge;
- Introduction of innovative teaching methods;
- Availability of the information and a logistical support in the educational process;
- Graduates opportunities to get a job (results of employment assistance).

Questionnaire for students, graduating students and employers are the main way to collect information to be analyzed. These questionnaires were developed by participants of Tempus project "IEMAST" together with specialists from the Research Center of Applied Sociology "Socio+".

Questionnaire for students, graduating students and employers are given in the Appendix I.

The publicity of information during self-evaluation was provided by following actions:

- Announcement of the social pool for students, graduating students and employers was placed on the website of the Department of Automatic design of energy processes and systems (section "IEMAST Ukrainian"¹⁶). Questionnaires were available there for printing, reviewing and filling.

- Questionnaire for students was filled separately for eight courses modified in framework of the Tempus project "IEMAST". These questionnaires were carried out anonymously in order to minimize the impact of teachers on objectivity the evaluation.

- Questionnaire was carried out using modern media resources. In particular, questionnaires were developed in Google-forms to be filled by students¹⁷, graduating students¹⁸ and employers¹⁹. The example of the questionnaire for masters at the website Google-forms are shown in figure 7. Information about the necessity filling for these groups of respondents was disseminated through social networks.

- Participants of the project have asked to fill the questionnaire in Google-forms at the annual graduates mix held on January 17, 2015.

- General statistical analysis of the respondents for different groups in the form of charts and summary tables presented on the website Google-forms, including: students (Masters)²⁰ graduating students²¹, employers²².

¹⁶ https://docs.google.com/forms/d/14-0pwK46RIMzEmROJEYnG0v2_KP3iEyQgDCP7VR0XV4/viewform

¹⁷ https://docs.google.com/forms/d/1sQy9lF0eeu_RO5vvqBWq3DRT4K9lJktH8CuGb5bx-g/edit#

¹⁸ https://docs.google.com/forms/d/14-0pwK46RIMzEmROJEYnG0v2_KP3iEyQgDCP7VR0XV4/viewform

¹⁹ https://docs.google.com/forms/d/1JkSdI2X4fM4tDJIZ5_KfpYT4kujnDa91k8H7ZC63WRs/viewform

²⁰ [https://docs.google.com/forms/d/1sQy9lF0eeu_RO5vvqBWq3DRT4K9lJktH8CuGb5bx-](https://docs.google.com/forms/d/1sQy9lF0eeu_RO5vvqBWq3DRT4K9lJktH8CuGb5bx-g/viewanalytics#start=publishanalytics)

[g/viewanalytics#start=publishanalytics\)](https://docs.google.com/forms/d/1sQy9lF0eeu_RO5vvqBWq3DRT4K9lJktH8CuGb5bx-g/viewanalytics#start=publishanalytics)

²¹ https://docs.google.com/forms/d/14-0pwK46RIMzEmROJEYnG0v2_KP3iEyQgDCP7VR0XV4/viewanalytics

²² https://docs.google.com/forms/d/1JkSdI2X4fM4tDJIZ5_KfpYT4kujnDa91k8H7ZC63WRs/viewanalytics



8. SWOT-ANALYSIS OF PROMOTION EFFICIENCY OF TEMPUS PROJECT “IEMAST” BY INTERNAL METHOD FOR QUALITY ASSURANCE OF MASTERS

Matrix SWOT-analysis is presented in table 1.

Table 1 - Matrix SWOT-analysis

STRENGTHS	WEAKNESSES
<ol style="list-style-type: none"> 1. Improving the scientific methods of the quality training of masters according to the requirements of European standards. 2. Raising interest of masters to research activities in the field of industrial ecology. 3. Increasing an interdisciplinary approach to masters training for IT-disciplines. 4. Advancing teaching and learning methodology with the element of a teamwork method. 5. Increasing the quality of theses. 6. Job placement for graduating students of IT-specialties in the field of industrial ecology and energy. 	<ol style="list-style-type: none"> 1. Absence of an interest of many teachers to modify their educational programs and courses as a result of changes in labor market requirements and standards of the quality assurance. 2. Low level of academic mobility of students and teachers. 3. Outdated logistical support. 4. Increasing the distance between teaching process and the science. 5. Weak relation of the educational process with business production. 6. Difficulty to find the work and getting the first job. 7. Insufficient training of graduating students to enter in the labor market. 8. Low motivation of students in the quality education.
OPPORTUNITIES	THREATS
<ol style="list-style-type: none"> 1. Appearance of new educational technologies. 2. Implementation of progressive legislative technologies based on the European practice of the internal quality assurance of higher education in Ukraine. 3. Improvement an international integration of partner countries' students and teachers through mobility between European Universities, and participation in International Seminars. 4. Dissemination of IEMAST project posters in NTUU "KPI" campus. 	<ol style="list-style-type: none"> 1. Low level of the education quality in Ukrainian universities in comparison with world level. 2. Deterioration of scientific and technical areas in framework of financial and economic crisis. 3. Disparity between the education structure and the requirements of labor market. 4. Absence of the formation process of sponsorship traditions for higher education. 5. Isolation of educational content from international standards for most specialties. 6. Formalization of any scientific activity. 7. Discrepancy of national codification of educational programs and educational qualifications (achievements) in accordance with International Standard Classification of Education). 8. Dependence of structural units, absence of real autonomy. 9. Significant contribution to the instability of higher education has demographic crisis.

STRENGTHS

● Applying an experience of European universities [in particular, KTH (Stockholm, Sweden) and UPC (Barcelona, Spain)] and financial support for the project allows us *to improve the scientific methods of the quality training of masters according to the requirements of European standards*, including:

- Have developed Temporary industry standards of higher education in Ukraine for preparing masters in the field of industrial ecology based on “Black box for course” method.
- Have designed the methodology to improve selected courses in order to contribute to Master Program on Industrial Ecology with recommendation of Bologna Team and Higher Education Standards (HES) of Ukraine.
- Have developed new lectures, laboratory and practical work in environmentally oriented courses based on Training Courses of teachers at European Universities and opinion of research employers in environmental and energy industries.
- Based on financial support, it was published 2 scientific and educational books:
 - 1) Collective monograph “The economic security of the state: strategy, energy, information technology / Edited by Lukyanenko C. O., Karaieva N.V. – Kyiv: Publishing LLC “Lubchenco Yuri”, 2014. – 468 p. (in Ukrainian and Russian);
 - 2) Textbook by Karaieva N.V., Vojtko S.V., Sorokina L.V “Risk-management of Sustainable power industry” – Kyiv, 2013. – 380 p. (in Ukrainian);

● *Raising interest of masters to research activities in the field of industrial ecology*. Positive impacts of the Tempus project “IEMAST” is to increase interest of masters to research activities, as evidenced by the values of the following indicators (see for detail table 2): Number of masters involved in the scientific researches, Number of published scientific works by masters, and Number of masters who continued own education in postgraduate training programs.

During period 2013-2014 Masters actively participated in scientific researches on the following topics:

- Budget researches (registration number N2638p) “Automate monitoring of geological environment in the zone of nuclear power plants”.
- Initiative researches “Geo-Informatic System Technology in environmental researched”.
- Initiative researches “Mathematical modeling of dynamic systems and processes”.

Table 2. Results of the evaluation of the internal quality assurance for masters training in 2013-2014 years

Criteria and indicators of quality	2013	2014
Number of trained masters, including:	49	53
– by government order	43	45
– by contract	6	8
Defend theses with marks, %:		
– “excellent”	68	74
– “good”	27	23
– “satisfactory”	5	3
Diplomas with honors, rate to the total number, %	24,8	35,3
Number of theses recommended for implementation / rate to the total number, %	49 / 100	53 / 100
Number of theses made for business or state orders / rate to the total number, %	49 / 100	53 / 100
Number of masters involved in the scientific researches / rate to the total number of masters, %	12 / 24,5	21 / 39,6
Number scientific works published in:		
– articles in journals and collected works	10	17
– abstracts in conferences	68	104
Actual job placements of graduates / rate to the total number, %	81	72
– by specialty	64	53
– not by specialty	17	19
Number of masters who continued own education in postgraduate training programs	3	6
Number of graduates, who found the job in the design of IT-technologies for environmental and energy industries	4	9

• **Increasing an interdisciplinary approach to masters training for IT-disciplines.** From our point of view, an important factor in rising of master’s interest for IT-specialties for research activities in the field of industrial ecology is a specification of purposes and objectives modified disciplines to solve different environmental problems of sustainable development and industrial production. For example, for the question “*How often do you clear understand aims and problems of course in the context of decision of ecological problems of steady development of society and industry?*” about 70% of respondents answered “yes”, about 6% answered “no”, and only 24% answered “not at all”. The responses for this question for different disciplines are shown in figure 9 below.

The responses to this question for each modified discipline (question 6) you can find in separate xls-file added to the current report.

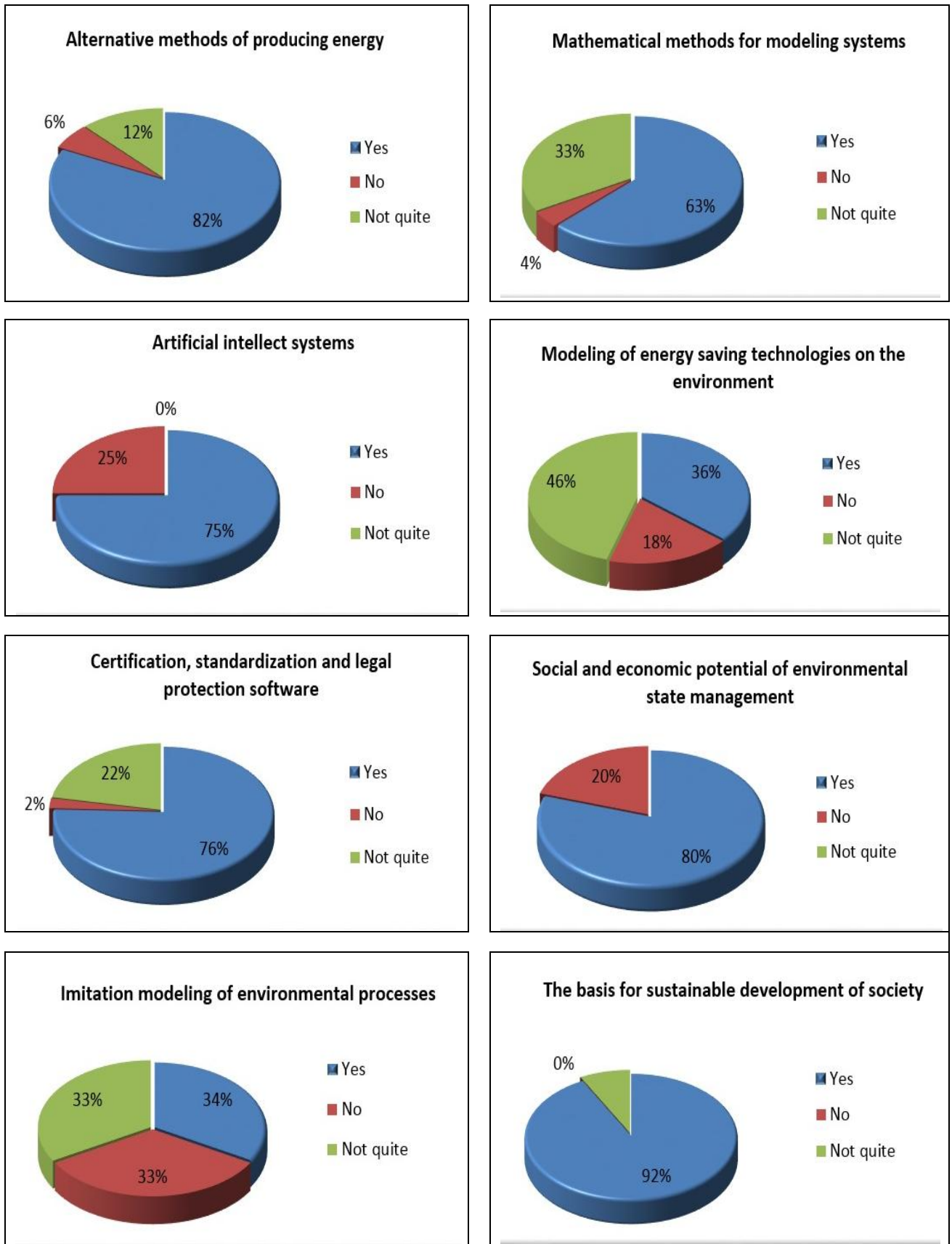


Figure 9. The distribution of responses by different disciplines

• **Advancing teaching and learning methodology with the element of a teamwork method.** The total results of respondent's (students) answers for all courses for the question "What methods of collective work are used during the study of the course?" are presented in figure 10.

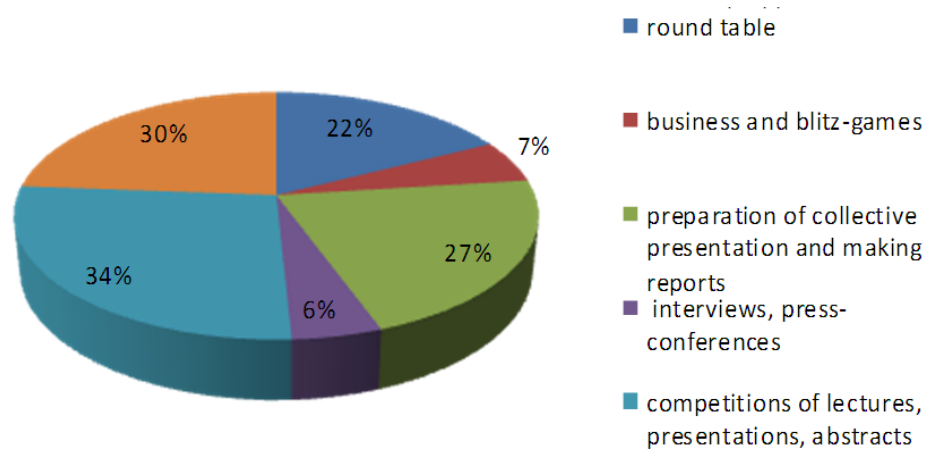


Figure 10. Total diagram of responses for disciplines

Also, only 4% of respondents (graduating students) for the question "What failures do you consider most substantial in your professional education?" answers "Absence of skills in participating during collective decisions".

• **Increasing the quality of theses.** The data in table 1 indicates increasing the percentage of defended graduation theses with honors in 2014 in comparison with 2013.

• **Job placement for graduating students of IT-specialties in the field of industrial ecology and energy.** The results of answers (graduating students) for questions "Indicate the branch of activity, in which you have found the job" are presented in figure 11.

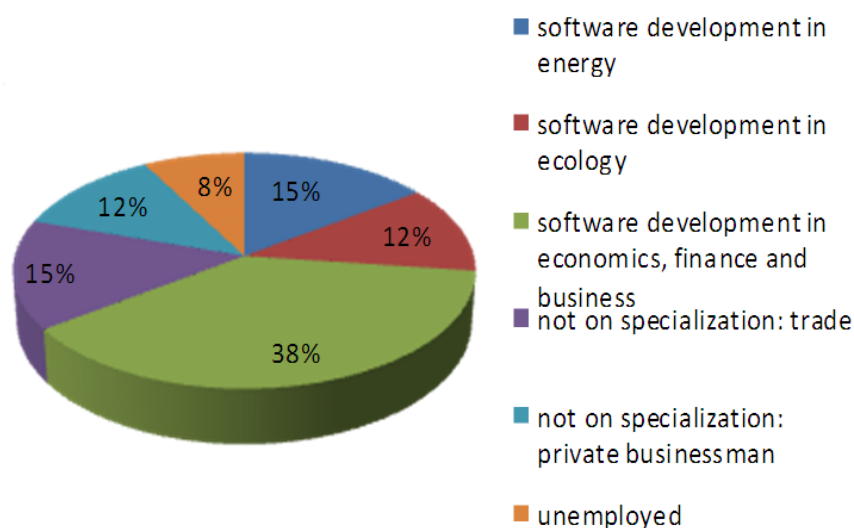


Figure 11. Responses to the question of graduating students for the question "Branch of activity, in which you have found the job"

WEAKNESSES

As for weaknesses, we can indicate the following issues:

- ***Absence of an interest of many teachers to modify their educational programs and courses as a result of changes in labor market requirements and standards of the quality assurance.*** The main reason of this threat is, firstly, the absence of intellectual copyright for developed course. It is important that Copyright laws is in force at the Universities in Sweden. Secondly, the dynamic changes in the educational plans, which are taking place in recent years in Ukraine due to the reform of higher education, leads to the occurring of new disciplines instead of the previous ones. It means that courses developed by lector in one year may already be unsuitable for next year, or this course can be transferred to another lector.

- ***Low level of academic mobility of students and teachers.*** Most of Ukrainian professors have not an experience in teaching at universities in other countries. That deals with weak international relations of Ukrainian universities, and inconsistency of educational content in universities in the world. One of the main factors of this threat is the low level of foreign languages in Ukraine. So, for the question “*What failures do you consider most substantial in your professional education?*” about 43% of respondents (graduating students) answered “*Low level of skills in foreign languages*”. For the question “*What shortcomings in professional preparation reduce quality of working of the graduating students, accepted at your enterprise for last few years?*” about 45,8% of respondents (employers) also answered “*Low level of skills in foreign languages*”.

- ***Outdated logistical support.*** The level of depreciation of educational equipment in 2010 was 62.5%. In the previous years the actual value of educational equipment had not changed. This trend affects negatively on the training quality of masters. So, for the question “*What factors has most negatively influence on quality of studying the course?*” about 23% of students answer “*Low level of the modern logistical support of lectures, lessons*”, and about 58% answer “*Absence Wi-Fi equipments at the department*”. It is important that we are talking in this case about training in the department deals with IT-technologies.

- ***Increasing the distance between teaching process and the science.*** This situation is explained by a dominant high system of teaching hours for lectors, structure of educational planes, and by the absence of necessary equipments for scientific research.

- ***Weak relation of the educational process with business production.*** There are several reasons to explain this weakness. The main reason is an absence of such traditions in Ukraine, which are forming the education system in Ukraine based on a non-real (“phoney”) state and business orders for specialists.

• ***Difficulty to find the work and getting the first job.*** There are some differences between the official data and poll data for this problem. For example, data in table.1 indicates a discrepancy (contradiction) between indicators on number of theses recommended for implementation and theses made for business or state orders (where masters are already working) and factual job placement of graduates. The most popular methods of job searching for graduating students are applying internet resources (46%), and recommendations of friends, colleagues, partner (23%).

• ***Insufficient training of graduating students to enter in the labor market.*** In this situation many employers need to provide additional or corporate training. Employers within the self-evaluation in Tempus project “IEMAST” for question “*Estimate, please, general level of professional preparation of the graduating students recruited on your enterprise for the last year, using 5 points scale*” give the following distribution: middle – 13%, good – 30%, high – 57%. There are some differences in answers for similar questions for graduating students, namely: middle – 23%, good – 50%, high – 27%.

At the same time it should be noted that the highest trust level in the domestic labor market has graduating students from National Technical University of Ukraine “KPI” and Kyiv National University by Taras Shevchenko. According to the polls for employers we can see that Ukrainian companies agree to give work positions for graduating students from NTU “KPI” (15%) and graduating students from Kyiv National University by Taras Shevchenko (12%) even without work experience²³.

• ***Low motivation of students in the quality education.*** We can see that for the question “*What factors has most negatively influence on quality of studying the course?*” about 15.3% of respondents (students) answer “*Weak motivation to know more new in the course at more deep level*”.

OPPORTUNITIES

As for opportunities, we can separate the following issues:

- ***Appearance of new educational technologies.***
- ***Implementation of progressive legislative technologies based on the European practice of the internal quality assurance of higher education in Ukraine.***
- ***Improvement an international integration of partner countries’ students and teachers through mobility between European Universities, and participation in International Seminars.*** For example,
 - Participation in the Second international scientific conference “High technologies is the pledge of sustainable development” (May 23-24, 2013, Almaty, Kazakhstan) organized by National Technical University by K.I.Satpaev.

²³ See reference 12.

For example:

- 1) Karaieva N.V. Socio-environmental choice criteria strategic goal of sustainable development in Ukraine / Proceedings of the Second international scientific conference “High technologies is the pledge of sustainable development”, May, 23-24, 2013, Almaty. – Almaty: KazNTU by K.I.Satpaev, 2013. – Vol.2 – p.78-81.

– During October, 21-22, 2014, the Sixth scientific workshop with international participation “The Economic Security of the State and Scientific and Technological Aspects of its Provision” was held at the National Technical University of Ukraine “KPI”. The workshop was organized by the Heat and Power Engineering Department at NTUU “KPI” with support of the Tempus-project IEMAST²⁴. The monograph “The economic Security of the State: Strategy, Energy, Information Technology” was presented in this workshop. The book is intended for a wide range of experts in economics, energy and science, for teachers and students of higher education schools.

- ***Dissemination of IEMAST project posters in NTUU “KPI” campus.***

More detailed mechanisms of European practices in the quality assurance and training programs have defined in the “Strategy for Higher Education Reform in Ukraine 2020”²⁵.

THREATS

The main external risk to the effective continuation of Tempus project “IEMAST” deals with negative tendencies, that is typical to the modern higher education in Ukraine. According to the data presented in “Strategies for Higher Education Reform in Ukraine 2020” and the results of self-evaluation we would like to indicate main dangerous tendencies, which make this way impossible due to increasing the level of the training quality in the field of industrial ecology. In particular:

- ***Low level of the education quality in Ukrainian universities in comparison with world level.*** In the ranking table in Global Competitiveness Index (The Global Competitiveness Report²⁶) Ukraine during 2014-2015 ranked 76th place among 144 countries (for comparison, the same place was, respectively: 2013-2014 – 84th / 148 countries, 2012-2013 p. – 73rd / 144 countries, 2011-2012,. – 82th / 142 countries, 2010-2011. – 56th / 139 countries).

“The state of higher and professional education in general” (Higher education and training) – 40th; (for comparison the same place was, respectively: 2013-2014 – 43rd, 2012-2013 p. – 47th, 2011-2012,. – 51st, 2010-2011. – 66th); including:

²⁴ See more at: <http://www.iemast.info/web/page.aspx?refid=42&newsid=151198&page=1>

²⁵ See reference 12.

²⁶ <http://www.weforum.org/issues/global-competitiveness>.

- “5.02. Coverage by higher education” (Tertiary education enrollment, gross in %) is 13th (10th, 10th, 7th, 8th, respectively);
- “5.03. The quality of the education system in general estimation” is 72nd (79th, 70th, 62nd, 56th, respectively);
- “5.04. Quality of math and science education is 30th (28th, 34th, 36th, 42nd, respectively);
- “5.05. Quality of management schools” is 30th (28th, 34th, 36th, 42nd, respectively);
- “12.04. University-industry collaboration between business and researches” is 62nd (77th, 69th, 70th, three last values, respectively);
- “12.06. Availability of scientists and engineers” is 105th (46th, 25th, 51st, three last values, respectively).

Data The Global Competitiveness Report shows that the quality criteria for higher education in Ukraine are quite heterogeneous. Ukraine is among the first 10-15 countries in the world in quantitative terms (the number of population who have the higher education). However, as for the business higher education, Ukraine has the place in the second hundred in the world. We would like to add that Ukraine moves up to 88th place in 2014.

● ***Deterioration of scientific and technical areas in framework of financial and economic crisis.*** The number of orders for scientific and technical researches, professional community and material resources for researches and developments are decreased for today. As the result, the impact of science in the country is dramatically reduced. For example, in 2013 the rate of total research investments for science in gross domestic product (GDP) was only 0.77%, including 0.33%²⁷ financed from state budget. Today almost the halves of the national universities have not research structures.

● ***Disparity between the education structure and the requirements of labor market.*** In particular, employers consider that too much graduating students at the labor market with business/economical education (about 57%), and about 55% graduating students with juridical education. Moreover, they indicate that the labor market needs specialists with technical education (about 44%) including IT-specialists (about 12%), builders (about 17%).

● ***Absence of the formation process of sponsorship traditions for higher education.*** The low statement of the Ukrainian economy forms the low level of the profit of Ukrainians. Such situation does not stimulate the formation process of sponsorship traditions in the country.

²⁷ Main indicators of higher educational institutions in Ukraine at the beginning of the educational season 2013/14. Statistical Bulletin. - Kyiv: State Statistics Committee of Ukraine, 2014. - 165 p. (in Ukrainian).

- ***Isolation of educational content from international standards for most specialties.*** This situation leads to the low of autonomy level for Ukrainian universities. Higher educational schools have to orientate oneself on the national standards. There is an absence of relations of national higher educational schools with universities in other countries. Moreover, educational staff in national universities has a limit participation in international projects for developing educational programs, educational planes.

- ***Formalization of any scientific activity.*** Teaching staff has a sufficiently high level of teaching loads. The absence of necessary individual interest stimulates to a formal activity of teaching staff to the science.

- The low factor of academic mobility of students, teachers and researchers is the ***discrepancy of national codification of educational programs and educational qualifications (achievements) in accordance with International Standard Classification of Education (ISCE 2011, ISCE 2013).***

- ***Dependence of structural units, absence of real autonomy.*** A concentration of the all power in rectors removes educational and scientific staff from decision processes of daily problems in university and leads to the centralization of university management.

- ***Significant contribution to the instability of higher education has demographic crisis*** in Ukraine, which takes in a force during few last years.

DISSEMINATION STRATEGY OF IMPROVING MASTER-LEVEL STUDIES IN INDUSTRIAL ECOLOGY

- ***Increasing academic mobility of students, teachers and researchers.***
- ***Increase of the English-language courses,*** forming of the English-language programs for master's degrees specialists.
- ***Improvement of financing mechanisms for modernization*** of material and technical base of the University.
- ***Improvement of the normatively legal providing of copyright lows*** for intellectual rights of teacher on the developed courses.
- ***Necessity to reducing the distance between universities, research institutes, industry and business*** in ecological problems.
- ***Increasing the role of education for students,*** involving of employers to the practical education.
- ***Involving internal and external stakeholders to develop new legal acts and teaching materials*** that can guarantee the stable development of the quality assurance

in the higher education.

- *Achieve a healthy and right competition in the education market* based on internal and external quality evaluation in the higher education.

- *Modernization of contents of educational programs and courses* based on domestic and foreign researches.

- *Increasing an international cooperation* between universities inside Ukraine and abroad.

- *Involving conditions for effective communications "Higher Education – Researches – Innovations"*.

- *Encourage private investment in higher education and research.*

- Others.

APENDIX I

(Questionnaire for students, graduating students and employers)



Dear student!

Please, choose variants of answer, which are most inclined for you

Code and name of speciality: _____

Name of course/discipline: _____

1. How do you estimate the professional level of teacher preparation of the course?

1.1. High 1.2. Middle 1.3. Insufficient

2. What informatively-technological facilities are used in an educational process?

2.1. Network media resources

2.2. Presentations

2.3. Documents and methodical materials in a paper kind

3. How often do you clear understand aims and problems of course in the context of decision of ecological problems of steady development of society and industry?

Yes No Not quite

4. Make attempt to define the deep and modern level of professional information at lectures and laboratory (practical) lessons you get:

Lectures:

- level satisfies fully;
- satisfies partly, want to know more new at more deep level;
- do not satisfy.

Laboratory (practical) lessons:

- level satisfies fully;
- satisfies partly, want to know more new at more deep level;
- do not satisfy.

5. What kind of the work at lessons seems for you most attractive:

- listen the lectures of teacher; participate in independent preparation of presentation and making report;
- listen reports of your friends, students; participate in joint developing of presentations, projects and their realizing.

6. What methods of collective work are used during the study of the course?

- round table; preparation of collective presentation and making reports;
- business and blitz-games; interviews, press-conferences;
- not almost used; competitions of lectures, presentations, abstracts.

7. What factors has most negatively influence on quality of studying the course?

- absence Wi-Fi equipments at the department;
- low level of the modern logistical support of lectures, lessons;
- weak motivation to know more new in the course at more deep level;
- insufficient professional level of the teacher.

Dear graduating student!

Please, mark the code of answer, which are most inclined for you

Code and name of speciality, year of graduates: _____

1. How do you estimate the professional level of education by 5 points scale:

1 – very low 2 – insufficient 3 – middle 4 – good 5 – high

2. Branch of activity, in which you have found the job

- on your specialization:

- 2.1. Software development in energy;
- 2.2. Software development in ecology;
- 2.3. Software development in economics, finance and business;

- not on your specialization:

- 2.4. Trade;
- 2.5. Private businessman;
- 2.6. Other.

3. Did you work during studies?

Yes No

4. What ways of communication, from your point of view, are most effective for search the job?

- 4.1. Applying the internet resources (labour internet exchanges);
- 4.2. Applying the vacancy list of employers in Higher School;
- 4.3. Applying presentations of enterprises in Higher School;
- 4.4. Applying recommendations of friends, colleagues, partner;
- 4.5. Your variant (describe briefly) _____

5. What failures do you consider most substantial in your professional education?

- 5.1. Failures are absent;
- 5.2. Absence of practical training;
- 5.3. Low level of practical skills in information technologies and software products needed for the work;
- 5.4. Low level of skills in foreign languages;
- 5.5. Absence of skills in participating in collective decisions;
- 5.6. Absence of practical skills in working with official documents;
- 5.7. Other (indicate briefly) _____

6. If you have some suggestions related with the improvement of the employment system of graduating students, describe briefly, please _____

Dear employer!



We would like to offer you, as to partner of NTUU “KPI”, to participate in questioning. Your frank answers will allow us to obtain important information for introduction of system changes in preparing of highly skilled specialists for your enterprise/organization.



Please, mark the code of answer, which are most inclined for you

- 1. How did your requirements to qualification of workers in the conditions of present economic crisis change at the hire of them for job?**
 - 1.1. Requirements to qualification rose.
 - 1.2. Requirements to qualification did not change.
 - 1.3. Requirements to qualification went down.
- 2. Note, please, what skills of working with offered software products are a necessity for specialists on your enterprise?**
 - 2.1. Work deals with standard office programs (Windows, Paint, MS Office, Internet Explorer, postal programs, file managers and others).
 - 2.2. Software development in the field of ecology.
 - 2.3. Forming and management of databases (Foxpro, MySQL, SQL Server, InterBase and others).
 - 2.4. Work deals with GIS-technologies.
- 3. Which collaborations with NTUU “KPI” referred below are most acceptable for you?**
 - 3.1. Organization of a practice work of NTUU “KPI” students on your enterprise.
 - 3.2. Acceptance of NTUU “KPI” graduating students on the work on your enterprise.
 - 3.3. Grant for university software, laboratory and other equipment.
 - 3.4. Recruit of NTUU “KPI” students to the trainings.
 - 3.5. Carry out joint research projects with the university.
 - 3.6. Financial support of talented students with the prospect to place in a job.
- 4. Specify, please, what directions of collaboration with NTUU “KPI” is more interested for your enterprise?**
 - 4.1. Training / retraining of your employees on the educational base of NTUU “KPI”.
 - 4.2. Participation of your enterprise in forming subjects of diploma thesis for students.
 - 4.3. Organization of laboratories in the departments for general preparation of specialists.
 - 4.4. Preparation of specialists with new specializations, which necessary for successful work at your enterprise. *Specify, which one* _____
 - 4.5. Your enterprise is not interested in the development of collaboration in new directions with NTUU “KPI”.
- 5. What, on your opinion, will induce you to more active collaboration with some higher schools?**
 - 5.1. Quality of preparation of graduating students at higher school.
 - 5.2. Tax deductions or grants at including to the work of young specialists.
 - 5.3. Previous experience with the graduating students of given higher school.
 - 5.4. High place of higher school in ranking of educational establishments.
- 6. What channels of communication used your enterprise to recruit to the work the graduating students?**
 - 6.1. Using of internet resources (Labour internet exchanges).
 - 6.2. Applying announcements about vacancies directly at higher schools.
 - 6.3. Applying presentations of your enterprise at higher schools.
 - 6.4. Applying recommendations of acquaintances, colleagues, partners.

7. What shortcomings in professional preparation reduce quality of working of the graduating students, accepted at your enterprise for last few years?

- 7.1. Such **shortcomings** are absent.
 - 7.2. Absence of working skills with standard ecological documents.
 - 7.3. Low level of skills in information technologies and software products necessary for the working.
 - 7.4. Low level of skills in foreign languages.
 - 7.5. Absence of skills in collective decisions.
 - 7.6. Absence of skills in initiative and creative thinking.
 - 7.7. Others. Specify, that exactly _____
- _____
- _____

8. What specialists, on your opinion, it is mainly necessary to prepare in higher Schools for your enterprise/organization?

- 8.1. Specialists of “wide specialization”.
- 8.2. Specialists of “narrow specialization”.
- 8.3. It is difficult to answer.
- 8.4. Others _____

9. Say, please, whether the young specialists-graduating students from NTUU “KPI” working on your enterprise?

- 9.1. Yes
- 9.2. No _____ → go to n.11

10. Estimate, please, general level of professional preparation of the graduating students recruited on your enterprise for the last year, using 5 points scale:

- | | | | | |
|----------|--------------|----------|----------|----------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| very low | insufficient | middle | good | high |

11. What branch of activity does your enterprise/organization belong to?

- 11.1 software development in energy;
- 11.2. software development in ecology;
- 11.3. software development in economy, finances and business;
- 11.4. trade;
- 11.5. businessman;
- 11.6. other.

12. If you have some suggestions in relation to the improvement of preparation of graduate specialists, please, indicate them below _____

Business Card of your organization

Name of your organization _____

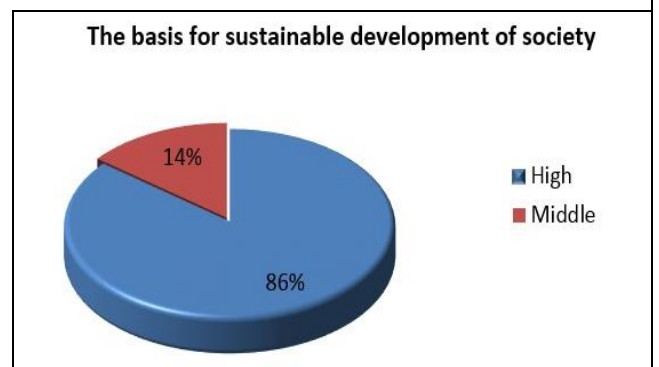
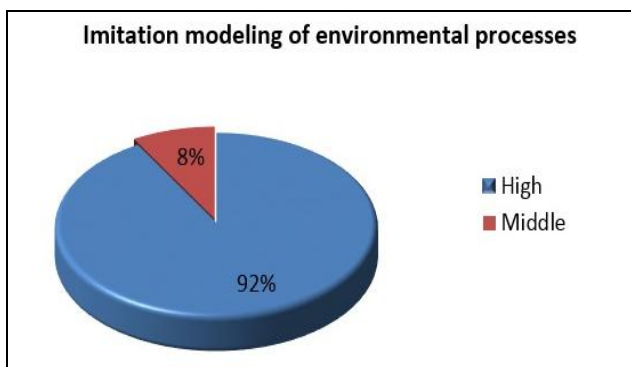
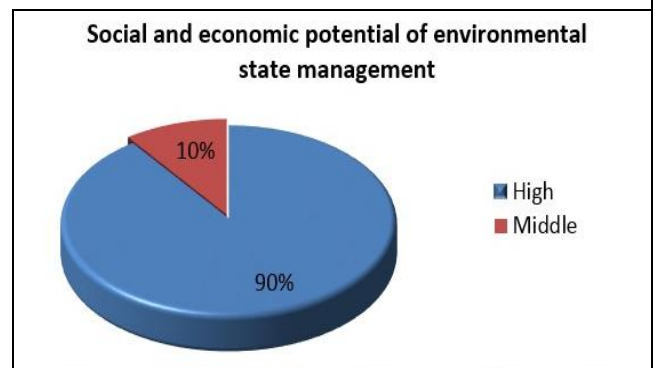
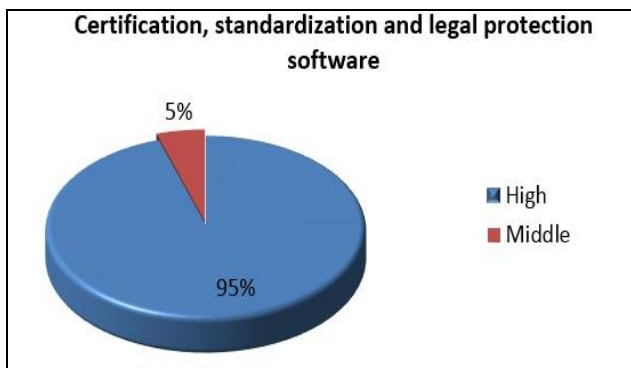
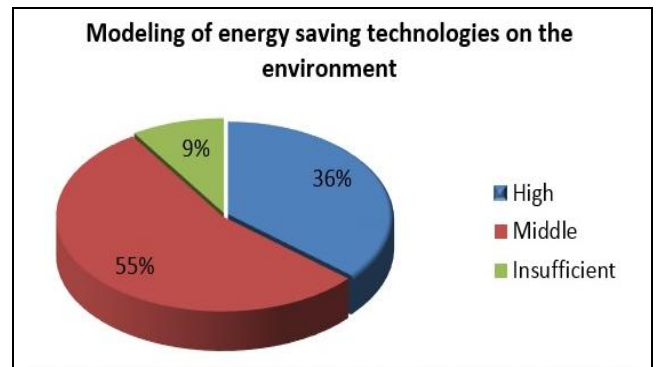
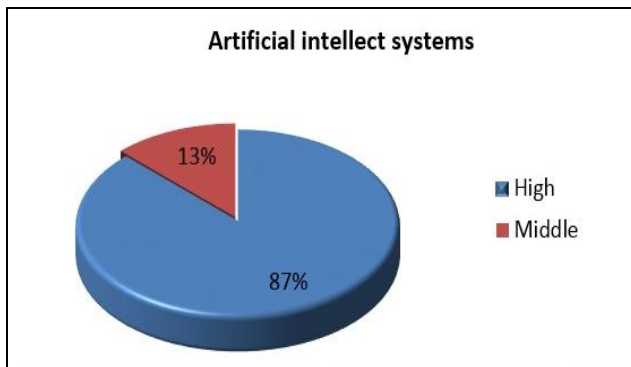
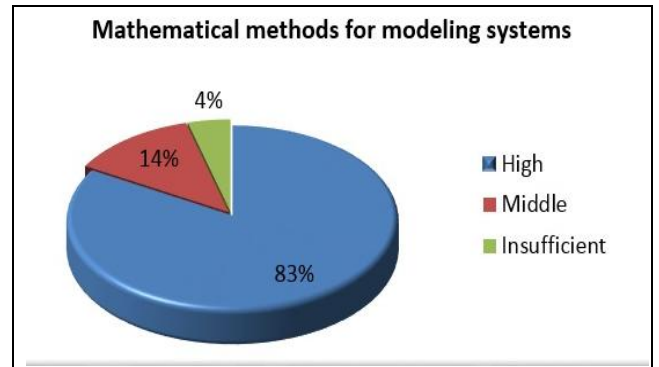
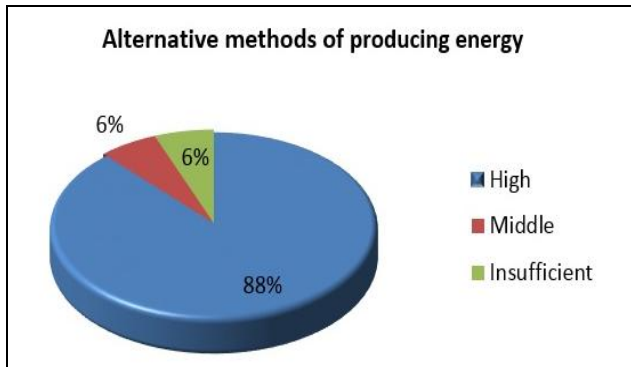
Your family name, first name _____

Tel.: (_____) _____

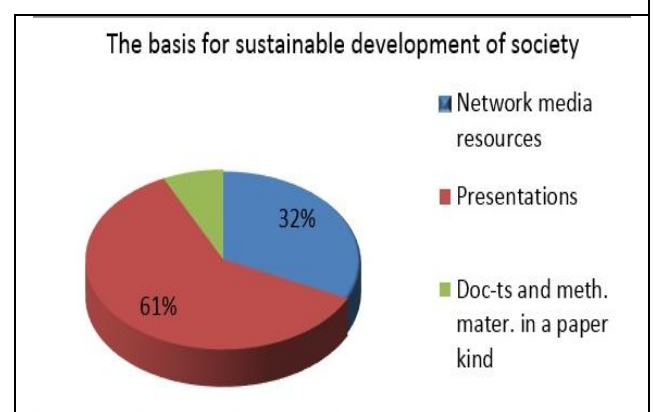
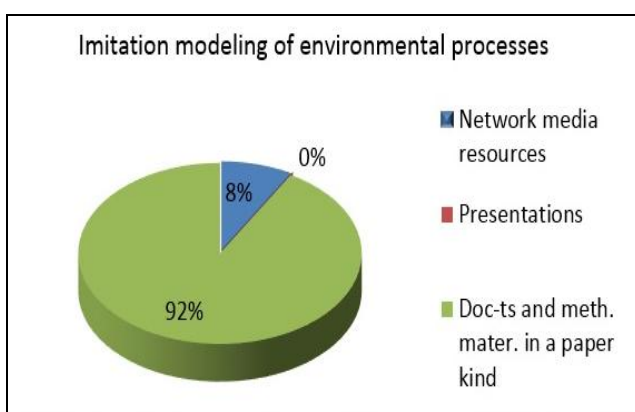
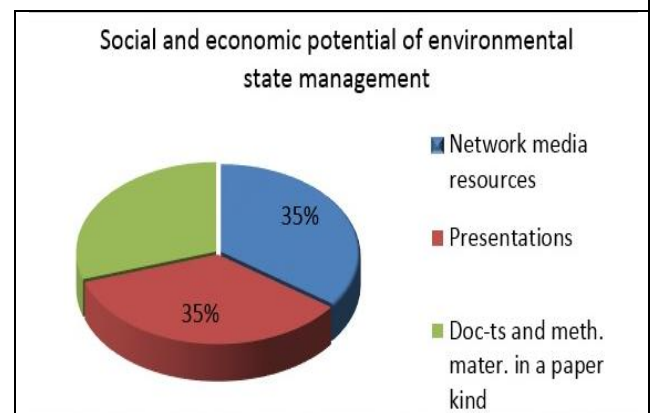
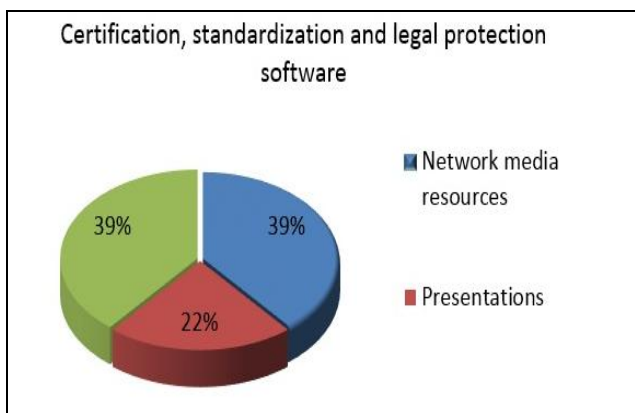
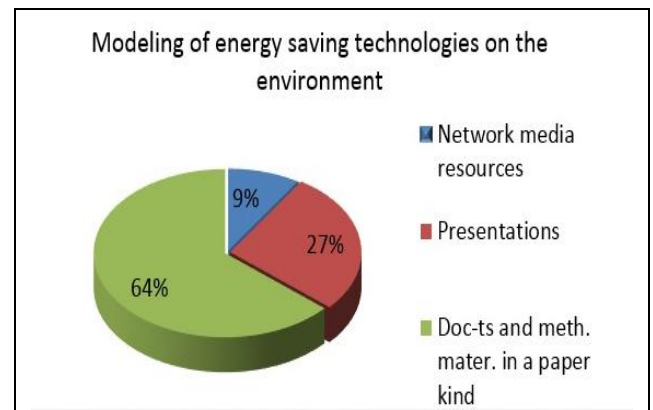
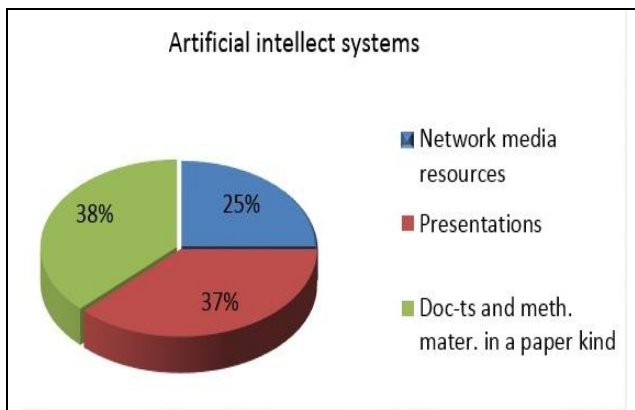
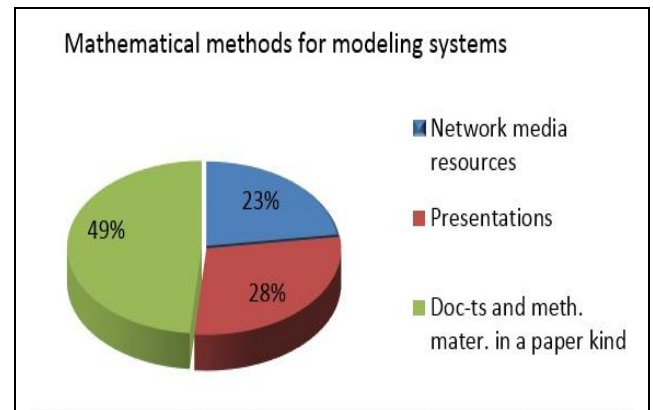
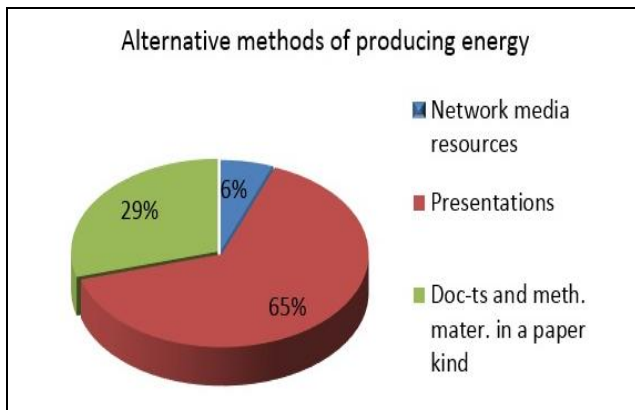
APENDIX II

(Results for social poll of students about the quality of teaching of each modified disciplines)

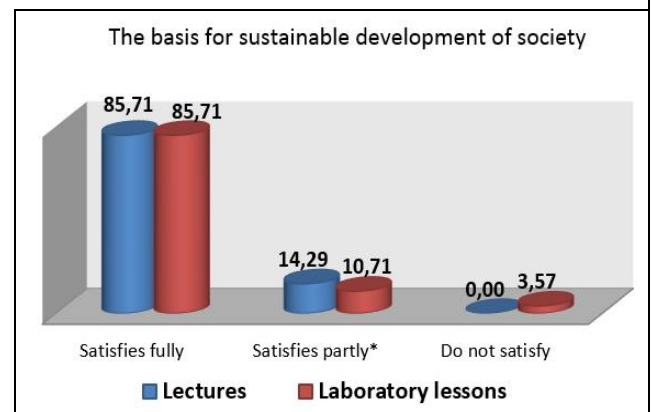
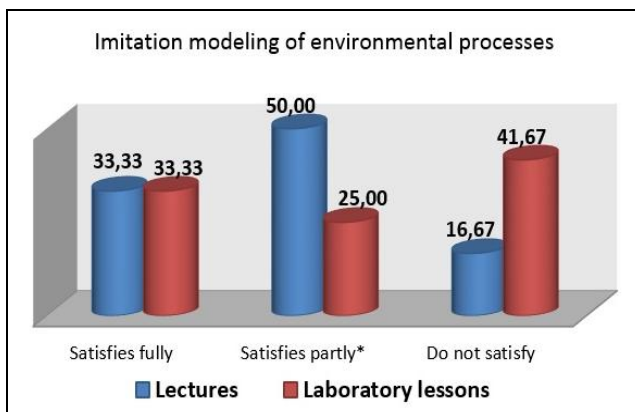
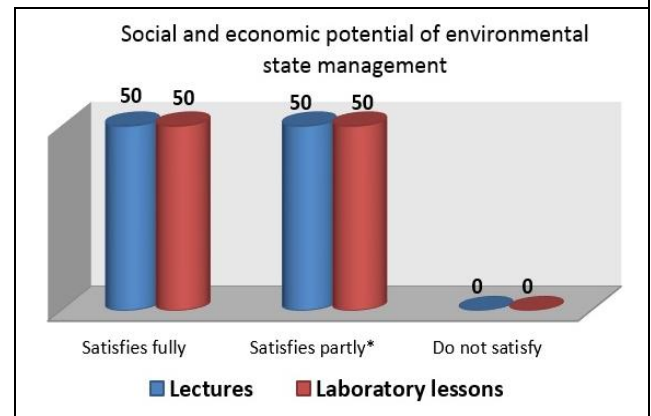
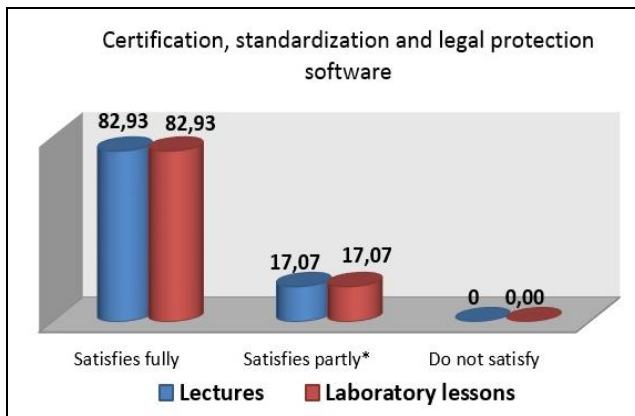
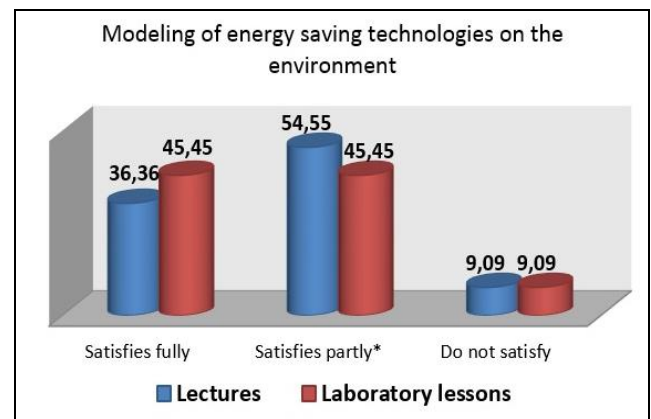
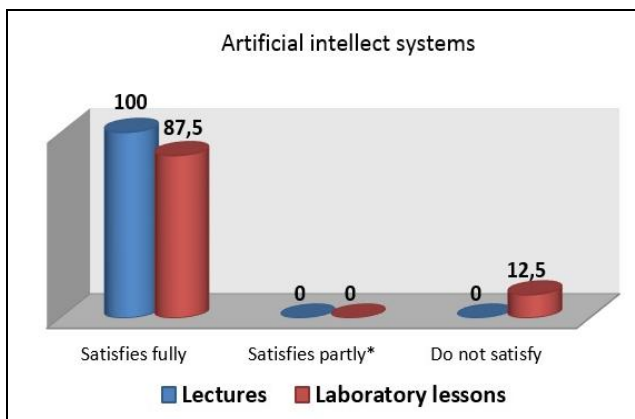
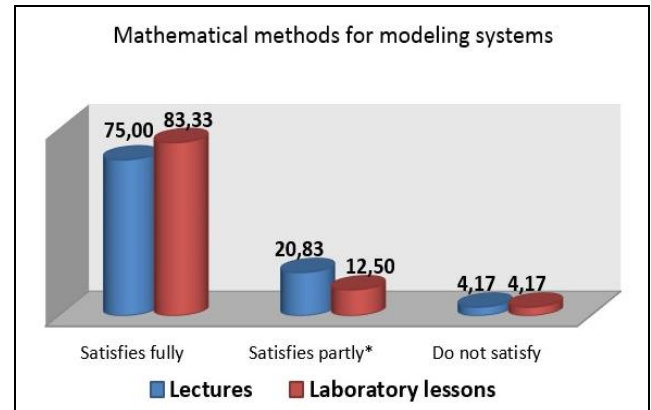
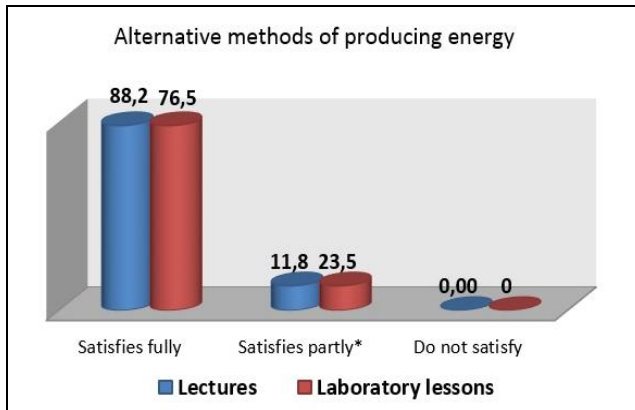
How do you estimate the professional level of teacher preparation of the course?



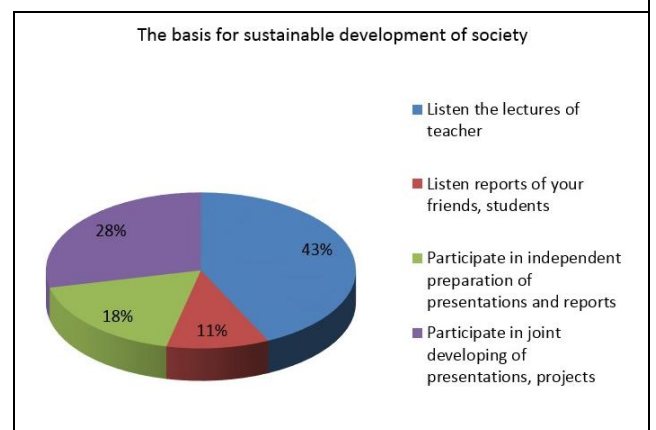
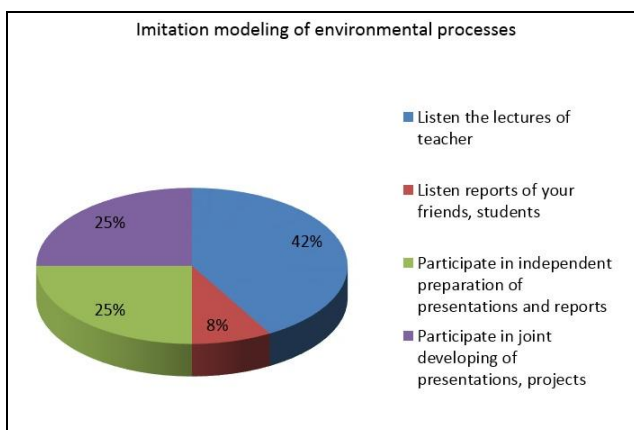
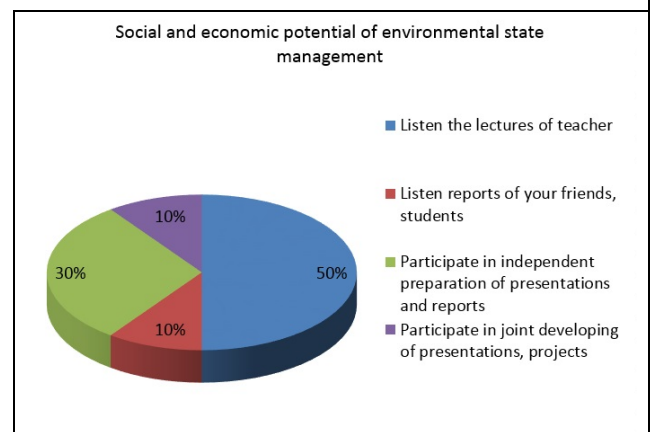
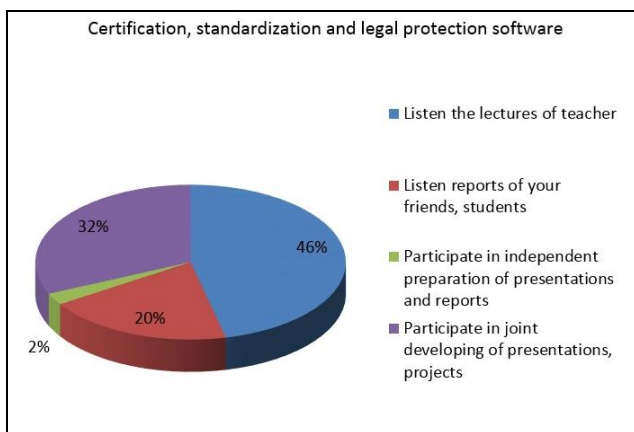
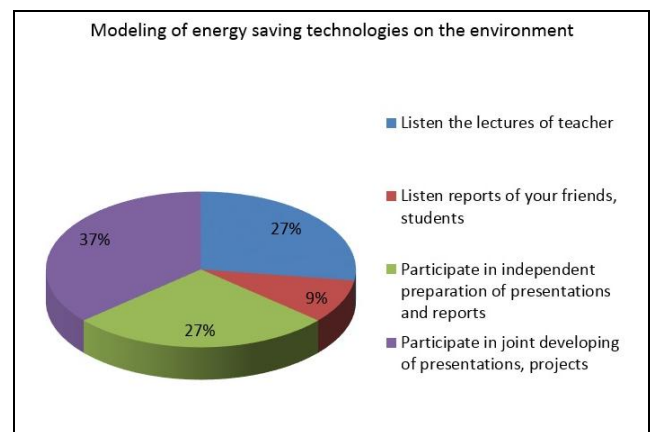
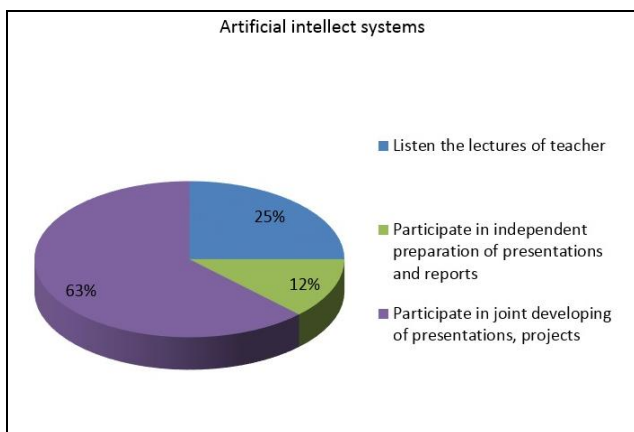
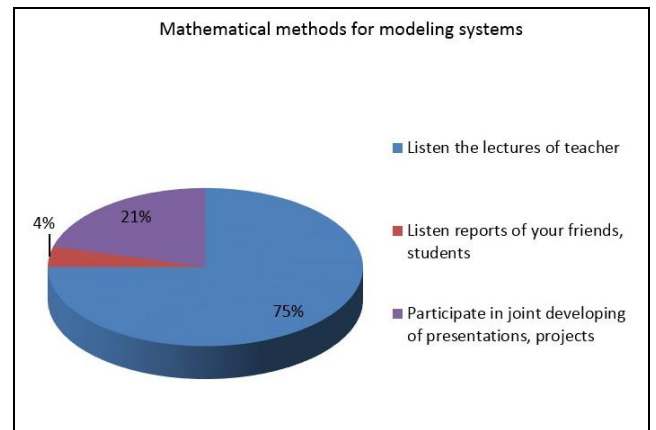
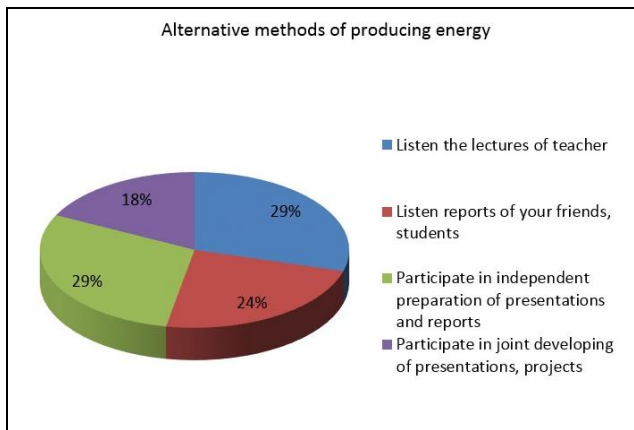
What informatively-technological facilities are used in an educational process?



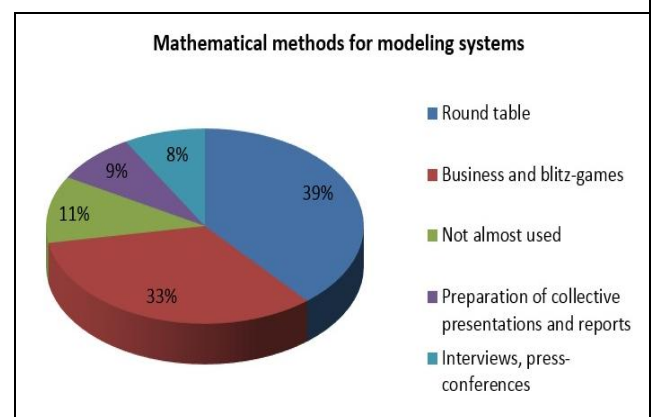
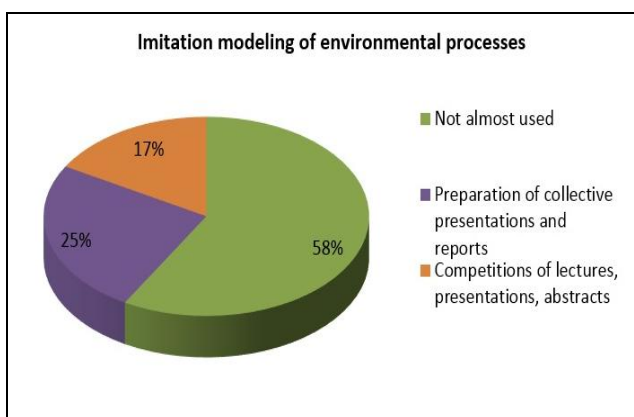
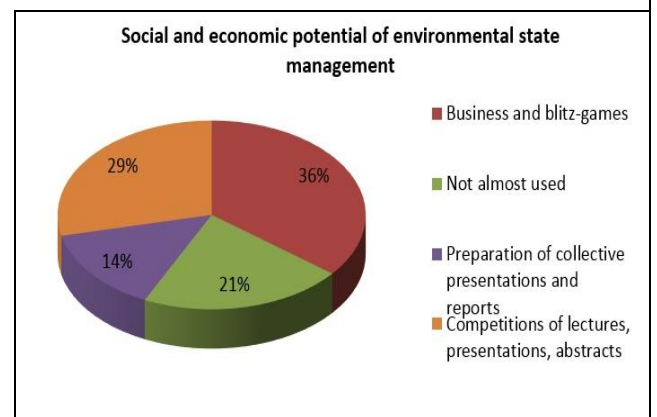
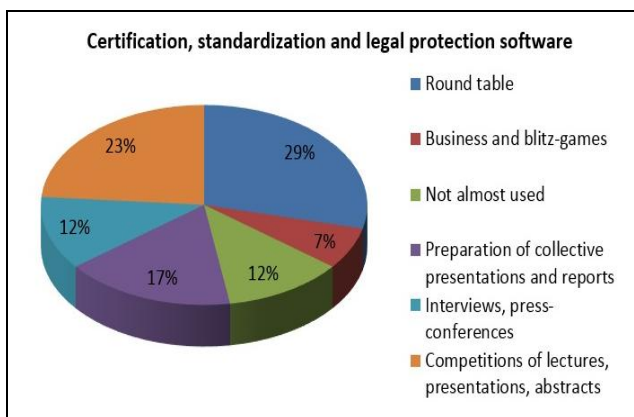
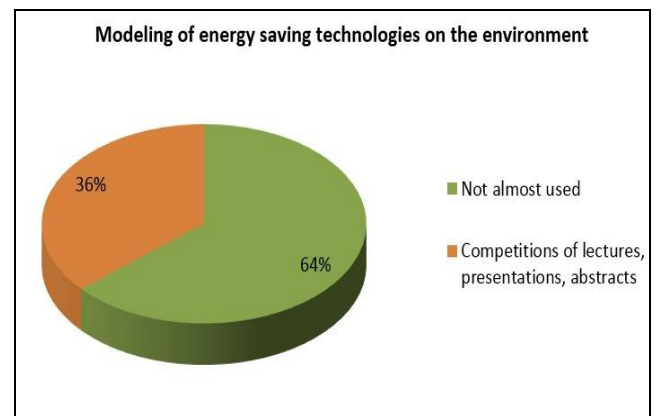
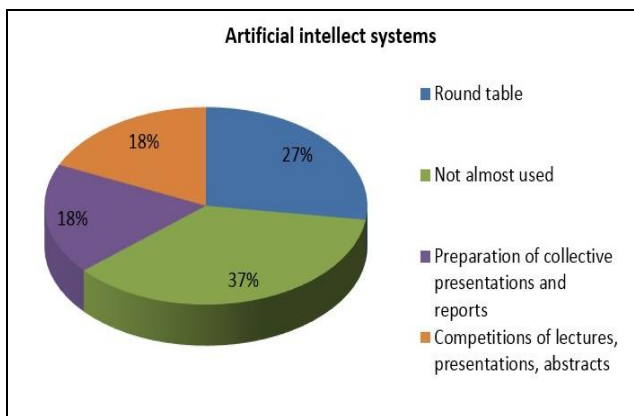
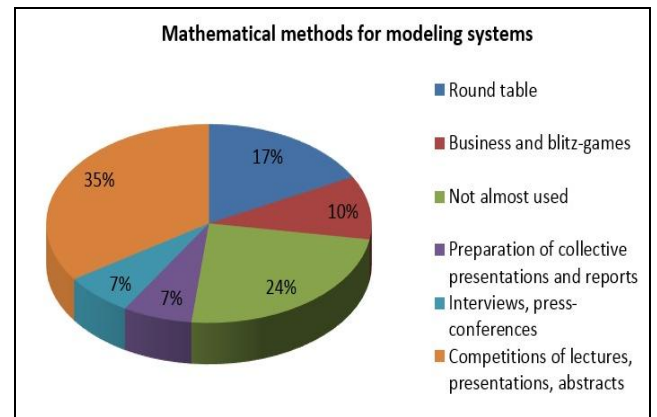
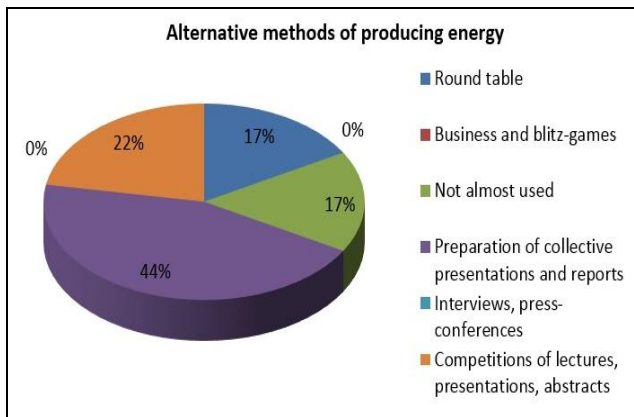
Make attempt to define the deep and modern level of professional information at lectures and laboratory (practical) lessons you get.



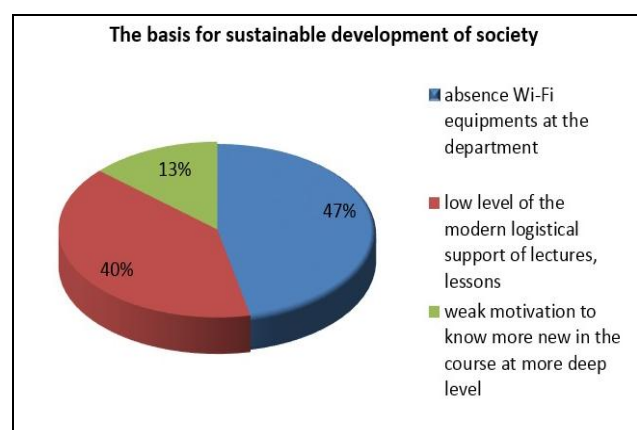
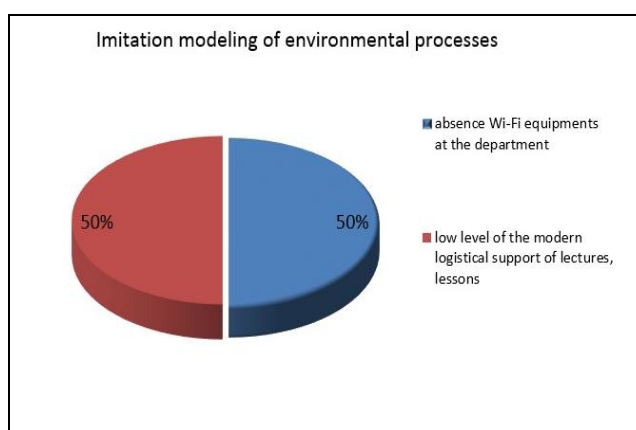
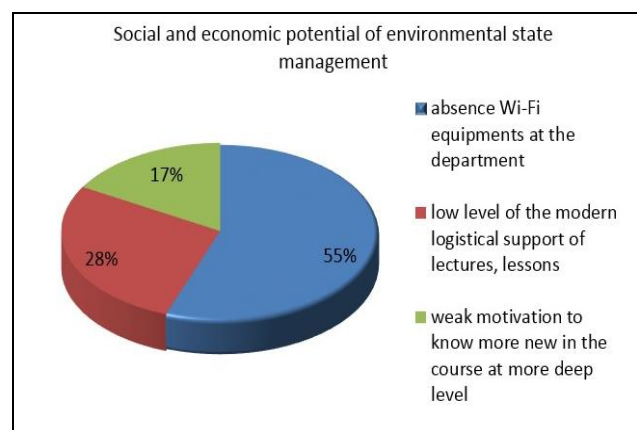
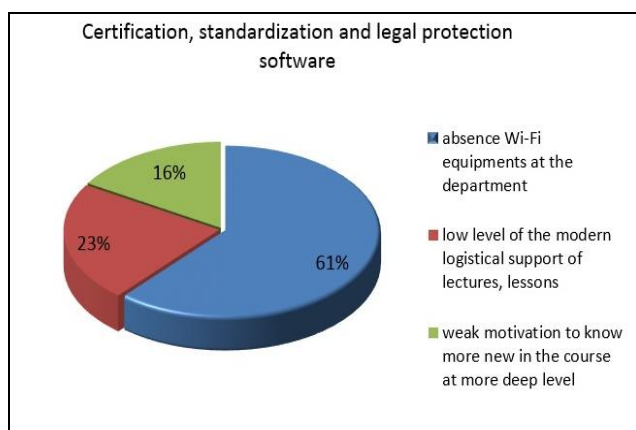
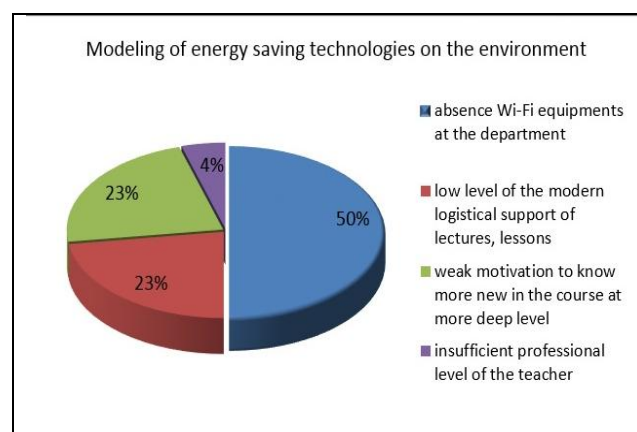
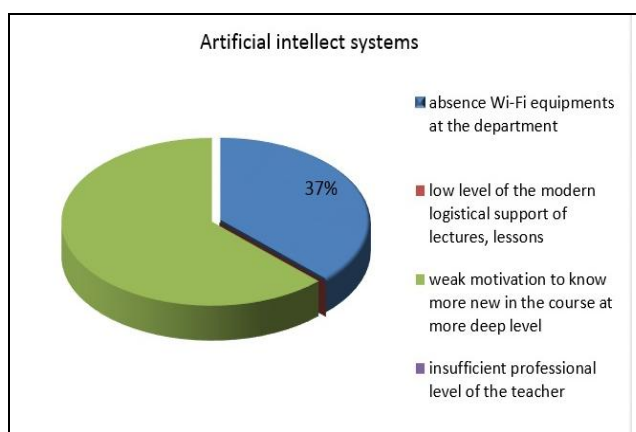
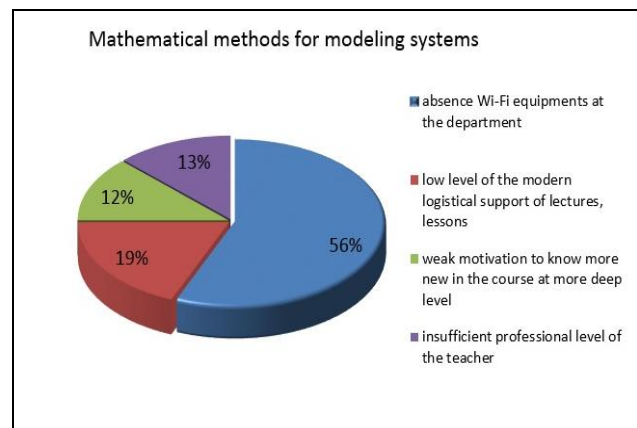
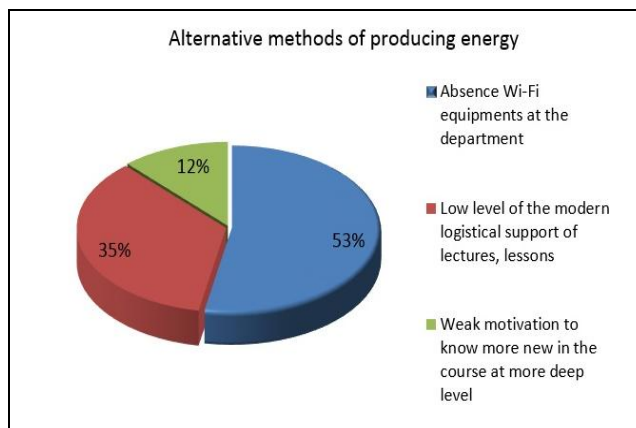
What kind of the work at lessons seems for you most attractive?



What methods of collective work are used during the study of the course?



What factors has most negatively influence on quality of studying the course?



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