AKKORK

Agency for Quality Assurance in Higher Education and Career Development

Approved

Chairman of the Advisory Council

_____ V.D. Shadrikov

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REPORT
on the Results of External Assessment of the Programme "Programming and Information Technology" Saint Petersburg State University (SPBU)

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SUMMARY OF THE PROGRAMME

The programme "Programming and Information Technology" is implemented as part of 02.03.02 "Fundamental Computer Science and Information Technology" at Saint Petersburg State University and leads to Bachelor's degree. The programme is managed by Sergei Pogozhev, PhD in Physics and Mathematics, Associate Professor, Department of Computer Technology and Systems.

AKKORK experts visited the university within the external programme assessment procedure from the 5th to the 7th of March, 2018.

Strong points of the programme under analysis

1. High quality of training, proven by the fact that graduates in the programme are much sought-after in the labor market, positive feedback from employers, and the results of direct assessment of competencies.
2. There is a clear programme development strategy that includes efficient methods of involving various parties concerned like teachers, students, and employers in programme management.
3. The learning process is well-balanced in terms of various forms of learning sessions. The development of e-learning at the higher education establishment enables new educational techniques and individual learning paths. The curriculum includes classes in English, which helps develop important communication skills.
4. The educational process is provided by teaching and academic staff who have passed rigorous competitive selection and whose qualification enables them to use approved educational technologies and methods in implementing the learning process. The internal teaching staff monitoring system helps maintain and constantly improve the qualifications of teaching staff and ensure their participation in research activities.
5. The programme has all the necessary teaching and learning, material, technical, financial, and information resources.
6. SPBU is a research hub of global importance. A large number of research work and high publication activity prove that SPBU is highly competitive in scientific research. Both teachers and students participate in various research activities on a large scale.

Weak points of the programme under analysis

1. 19% of graduates are dissatisfied with the learning outcomes. The key causes of dissatisfaction are as follows:
    - The name of the programme is not fully representative of its content. Even though the programme is titled "Programing and Information Technology," it is largely represented by fundamental mathematical disciplines. This makes students feel like they study not in the same programme as they applied for.

- Poor balance between fundamental and practical subjects. Some graduates believe the programme to offer too few practical IT subjects to form practical competencies that are sought-after in the labor market, which makes it necessary for graduates to acquire the competencies on their own to find good employment.

2. The programme includes no subjects aimed at developing professional competencies that are associated with entrepreneurship and skills in small and large-scale business.

3. Low teaching staff loyalty: less than 50% of the teaching staff reported to be fully or partly satisfied with the personnel policy and motivation system.

4. A student survey showed students' opinion to have a very limited influence on the programme's content as well as the organization and management of the learning process.

Key expert recommendations on the programme

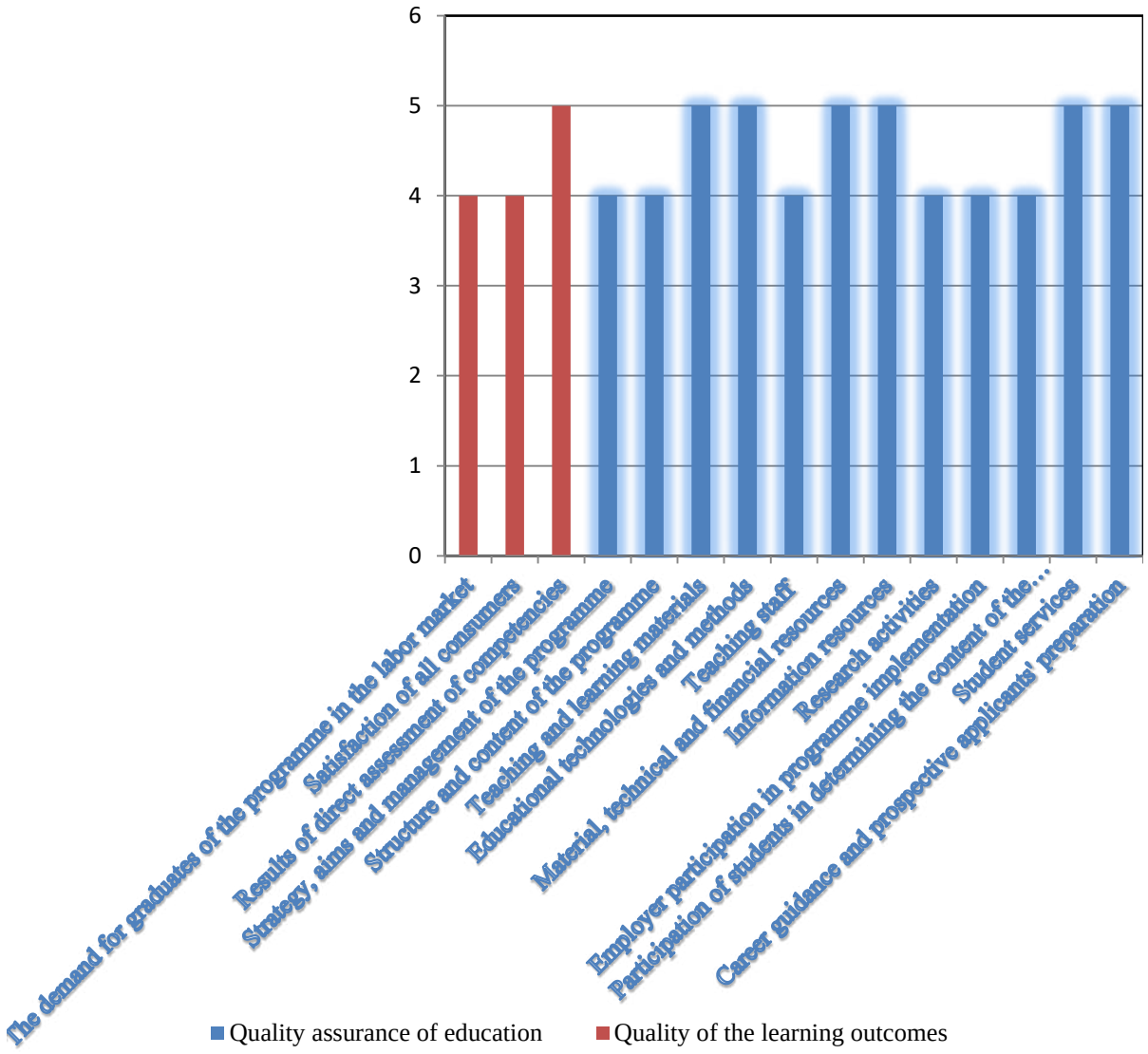
1. Make sure that the name of the programme is representative of its content. There are several ways of ensuring it:
   - Renaming the programme so that the title is more representative of the content, e.g. "Applied Mathematics and Information Technology" or "Applied Mathematics and Programming" and by including additional programming-related subjects to develop certain professional competencies (e.g. "Mobile Application Development").
   - Improving the balance between fundamental and practical subjects by increasing the share of practice-oriented subjects in the programme. It is critical that the quality of fundamental training should remain traditionally high.
2. With due regard to particular features of digital economy and IT industry, the competency-oriented graduate model should include new professional competencies that are related to copyright protection, entrepreneurship and skills in small and large-scale business. Corresponding subjects should be introduced.
3. Low satisfaction of teaching staff with the personnel policy and motivation system indicates that it has to be modified. A public discussion of documents regulating the personnel policy and teaching staff motivation system is advisable.
4. In order to enhance students' role in programme management, the results of student surveys should be monitored at the end of each study period. The survey results and measures taken in respect of each problem should be reported.

Assessment profile of the learning outcomes and quality assurance of education

No.	Critetion	Assessment
I	*Quality of the learning outcomes*	

	1.	The demand for graduates of the programme in the labor market	*4*
	2.	Satisfaction of all consumers	*4*
	3.	Results of direct assessment of competencies	*5*
II	*Quality assurance of education:*		
	1.	Strategy, aims and management of the programme	*4*
	2.	Structure and content of the programme	*4*
	3.	Teaching and learning materials	*5*
	4.	Educational technologies and methods	*5*
	5.	Teaching staff	*4*
	6.	Material, technical and financial resources	*5*
	7.	Information resources	*5*
	8.	Research activities	*4*
	9.	Employer participation in programme implementation	*4*
	10.	Participation of students in determining the content of the programme	*4*
	11.	Student services	*5*
	12.	Career guidance and prospective applicants' preparation	*5*

Assessment profile of the learning outcomes and quality assurance of education



QUALITY OF THE LEARNING OUTCOMES

1. Demand for the graduates of the programme on the federal and regional labor market

Criterion assessment: good

Analysis of the role and place of the programme

Graduates of the programme are much sought-after within the region as well as beyond it. The high demand is due to the booming industry (information technology), which ensures favorable conditions in the labor market, in particular for young professionals.

The labor market clealry lacks IT experts and information system analysts. A survey by HeadHunter (http://hh.ru) and the SuperJob HR agency (http://www.superjob.ru) estimated the demand for graduates in this field in Saint Petersburg as high. HeadHunter Northwest Survey Agency analyzed the Saint Petersburg labor market in the second quarter of 2017 (https://spb.hh.ru/article/20819). The professional area "Information Technology, Internet and Telecommunication" ranked 2nd by the number of jobs it offered (17% of the market's total) and had "*increased the share by 2% over a year due to increased automation and intense advancement of technology*". CVs posted on employment websites of "Information Technology, Internet and Telecommunication" made as few as 6% of the total (as of the 2nd quarter of 2017) with an HHI (CVs per job) of 2.8, which suggests a staff shortage.

According to Headhunter (http://hh.ru), a total of 17,371 jobs were found on 05.02.2018 as "Jobs in Technology, Internet and Telecommunication in Saint Petersburg", of which

1. 328 were titled Database Administrator,
2. 561 were titled Analyst,
3. 3,216 were in programming and development,
4. 572 were in testing,
5. and 743 were in project management.

SuperJob (http://superjob.ru) reported the following search results as of 05.02.2018:

6. 877 jobs found as "Programmer jobs in Saint Petersburg" and
7. 1,027 jobs found as "Jobs in IT, Internet, Communication and Telecommunication.

Intense competition in IT education in northwestern and central Russia causes the quality of such services to improve. Accordingly, the programme is highly popular with applicants with a minimum total UNE score in 3 tests for a budgetary place at 256 in 2015 and 2016 and 265 in 2017.

Analysis of information indicators submitted by the higher education institution (conclusions)

Monitoring graduate employment and demand is the responsibility of the SPBU Graduate Office. The Office's key fields of activity are the following:

1. working with SPBU graduates and interacting with the SPBU graduate community;
2. developing work, business, and other contacts among SPBU graduates (within the SPBU graduate community);
3. encouraging graduates to cooperate with SPBU for education, science, culture, social and other projects.

In order to collect employment data, the University carried out a survey among 2015 to 2017 graduates. A total of 26 people filled out the questionnaires. 25 of them reported being employed in the field of study, which is 96%. 61% of the graduates were generally satisfied with their career development.

21 out of 50 (42%) 2016 graduates are currently in SPBU Master's programmes (9 in the same field of study).

16 out of 44 (36%) 2017 graduates are currently in SPBU Master's programmes (8 in the same field of study).

Employers (Epam Systems LLC, Reksoft LLC, and Capital Programme LLC) have provided three positive graduate reviews. No complaints about graduates have been received.

Based on the results of self-evaluation carried out by the educational institution, the data are presented on graduates placement. The data was confirmed during the examination of the relevant documents.

An analysis of the information indicators as reported by the higher education establishments showed that graduates (and even current students) are highly sought-after in the labor market. This is due to the high capacity and rapid growth of the IT market as well as the high quality of the training offered by SPBU.

Yet, the data of student and graduate employment, the average graduate's salary on graduation and later on, and graduates' ability to keep their jobs according to their qualifications as well as their career advancement is scarce. An analysis of the indicators will ensure a more objective estimate of the demand for graduates in the labor market than individual employer's feedback.

2. Satisfaction of consumers with the learning outcomes

Criterion assessment: good

The three employers' reviews (from (Epam Systems LLC, Reksoft LLC, and Capital Programme LLC) indicate high employer satisfaction with the content of the programme as well as graduates' competencies. The fact that the programme is largely appreciated by employers was confirmed in an employer attitude that took place during the visit. The following persons were interviewed.

No.	Full name	Company	Position
1	Vasilii Pashkevich	Capital Programme LLC www.pcapital.ru	Director General
2	Vladimir Shvarts	EPAM Systems LLC www.epam.com	Director, Algorithm Development Department

The employers finds the quality of graduates' basic training in Mathematics and related disciplines to be high.

The results of a programme graduate questionnaire survey provided by the higher education institution show graduates to be generally satisfied with the learning outcomes with 19% of graduates reporting dissatisfaction:

1. 8% were completely satisfied;
2. 73% were generally satisfied;
3. 19% were rather dissatisfied.

The data was confirmed in a graduate interview that took place during the site-visit. Four 2016–2017 graduates of the programme were interviewed:

No.	Full name	Graduation year	Note
1	Denis Pryazhennikov	2017	Master's Programme, OKTET Labs LLC, Programme
2	Lyudmila Aleksandrovskaya	2016	Master's programme, SPBU Resource Center
3	Lyudmila Avdyushkina	2016	Master's programme
4	Aleksandr \Golokoz	2016	Master's programme, Software Developer, V Kontakte LLC

The key causes of dissatisfaction are as follows:

1. The name of the programme is not fully representative of its content. Even though the programme is titled "Programing and Information Technology," it is largely represented by fundamental mathematical disciplines. This makes students feel like they study not in the same programme as they applied for.
2. Poor balance between fundamental and practical subjects. Some graduates believe the programme to offer too few practical IT subjects to form practical competencies that are sought-after in the labor market, which makes it necessary for graduates to acquire the competencies on their own to find good employment. The competencies include skills of developing applications in modern programming environments (in particular mobile applications, web applications, etc.)

The experts believe the above reasons for dissatisfaction to be well-argued. The following measures are recommended to eliminate them:

1. Make sure that the name of the programme is representative of its content. This can be done by renaming the programme so that the title is more representative of the content, e.g. "Applied Mathematics and Information Technology" or "Applied Mathematics and Programming" and
2. Improving the balance between fundamental and practical subjects by increasing the share of practice-oriented subjects in the programme. It is critical that the quality of fundamental training should remain traditionally high.

3. Direct assessment of competencies by an expert
Criterion assessment: excellent

During the site-visit, a direct assessment of the competencies of graduate students was conducted. 8 4th year students took part in the direct evaluation, which is 19.5% of the graduate course.

In the process of direct assessment, test and exam materials developed by the educational institutions were applied as far as the experts considered these materials as valid.

To analyze the formation of competencies, the experts selected the following:

Assessment of competencies characterizing the individual's personal qualities as an integral part of their professional competence:

- OKB-7 Able to understand the nature and meaning of information in the development of society, ready to use basic methods, techniques, and means of retrieving, storing, and processing information, work with a computer as a means of information management, in particular in global computer networks, and meet basic information safety requirements, including official secrets protection
- OKB-8 Prepared to use laws and regulations in their activities and act in a civil society

Assessment of competencies aimed at the development, maintenance and improvement of communications:

- OKB-1 Able to produce oral and written speech in Russian in a well-argued, logically correct, and meaningful manner; can use public speaking, discussing, and polemic skills
- OKB-2 Prepared to interact with colleagues for team work, capable of analyzing experience, adapting to various situations and demonstrating creativity, initiative, and perseverance in attaining professional goals
- Assessment of professional competencies ("competence core"), including the competencies reflecting the need (requirements) of

the regional and/or federal labor market, depending on the main consumers of the graduates of the programme:

- PK-1 should be capable of using in professional activities contemporary programming and database languages, system engineering methodologies, design automation systems, electronic libraries and collections, network technology, program library and packages, and contermporary professional standards in information technology;
- PK-2 should be able to professionally solve problems in industry and technology using state-of-the-art science and technology, in particular to develop algorithmic and software solutions in system and application programming; to develop mathematical, information, and simulation models related to the research subject; creating global network information resources, learning contents, and application databases; developing tests and system testing facilities/products for compliance with standards and terms of reference, and to develop ergonomic human-machine interfaces;
- PK-3 should be able to develop and implement life cycle processes of information systems, software, and information technology system services as well as methods and techniques of assessing and analyzing the performance of information technology tools and systems; able to develop compliant design and software documentation;
- PK-8 should be able to professionally use basic mathematical knowledge and information technology and apply them in an efficient manner to solve scientific and technical as well as practical problems in developing and using information technology;
- PK-9 should be able to implement in practice modern methodology of life cycle and quality management for information systems, software, and information technology services;
- PK-10 should be able to judge on the meaning and consequences of their professional activities with due regard to social, professional, and ethical attitudes.

In performing the direct assessment of competencies procedure, the experts used the following test and exam materials:

1. Key Concepts in Modeling Theory. Modern Methods of Computer Modeling: Component Approach and Object-Oriented Technology.
2. Computer and Simulation Modeling of Information Objects and Processes in MATLAB-Simulink.
3. Modern DBMS Architecture. Transactions. Query Optimization and Execution.
4. Relational Model. SQL. Database Design.

5. Basic Ideas of Modern Multiprocessing Systems (Parallel and Distributed Systems). Programming Language and Technology for the Systems (Basic Concepts).
6. Data Structures: Arrays, List, Trees, and Hashing Methods.
7. Standard Sorting and Search Algorithms.
8. Algorithms: Greedy Algorithms, Dynamic Programming. The Branch-and-Bound Method.
9. Standard Efficiency Classes of Algorithms.
10. Grid Technology: Introduction. Resource, Data, and Information Management in Grid.
11. Setting Clustering Problems. Examples of Clustering Problems. Clustering Algorithms.
12. Setting Classification Problems. Compare and Contrast Clustering vs. Classification Problems. Classification Methods.
13. Support Vector Machine (SVM).
14. The Regulatory Framework of IT Startup.
15. The Regulatory Framework of Intellectual Property Protection in IT.

The direct assessment of competencies showed the quality of student training to be very high. Students demonstrated deep knowledge in fundamental disciplines such as Mathematics, Basic Theory of Programming, etc. The level of occupational practical competencies was somewhat lower but still high. None of the students participating in the assessment showed a low level of competency development. Most respondents (65% to 90%) completed at least 80% of the assignments.

However, questions related to the legal framework of IT business and copyright protection in IT appeared difficult to 100% of respondents. The experts believes the issues to be highly important in today's information society and deserve to be studied in greater detail within the programme.

Level / Percentage of students	Sufficient level (students coped with 80 % of the proposed tasks)	Acceptable level (percentage of tasks solved: 50 to 79 % of the tasks were completed)	Low level (percentage of tasks solved: less than or equal to 49 %)
Results of direct assessment of competencies characterizing the individual's personal qualities as an integral part of their professional competence			
70%	+		
30%		+	
The results of direct assessment of competencies aimed at the development, maintenance and improvement of communications			
90%	+		
10%		+	
The results of direct assessment of professional competencies ("competence core"),			

including the competencies reflecting the need (requirements) of the regional and/or federal labor market, depending on the main consumers of the graduates of the programme			
65%	+		
35%		+	

When conducting the quality assessment of education, the experts analyzed 5 graduate qualification works, which amounted to 11% of the graduate works of the previous year in this field. The expert concluded that the analyzed graduate qualification works generally complied with all the requirements stated below:

GRADUATE QUALIFICATION WORKS

No.	Objects of assessment	Expert commentaries
1.	Topics of graduate qualification works correspond to the field of study and current level of scientific and/or technological development in the programme field.	100% compliant
2.	The tasks and contents of graduate qualification works are aimed at demonstrating competency formation in the graduate.	100% compliant
3.	The degree to which data collected or received during the predegree practice and the implementation of course projects was incorporated in the independent research part of the graduate qualification works.	100% compliant
4.	Graduate thesis topics are defined by the needs of manufacturers as well as the experimental purposes of teachers of the educational institution.	100% compliant
5.	The findings of graduate qualification works can be applied in industry.	60% compliant
6.	The degree to which research findings of the chair, faculty and outside research and production and/or research organizations was incorporated in the independent research part of the graduate qualification works.	80% compliant

Conclusions and recommendations of experts

Conclusions

The quality of the learning outcomes was generally high. Criteria were assessed as follows:

- the demand for graduates of the programme in the labor market: good;

- satisfaction of all consumers: good;
- direct assessment results: excellent.

Strong points of the programme:

- high quality of training, proven by employers' feedback and the results of direct assessment of competencies;
- high demand for graduates of the programme in the labor market;
- high employer satisfaction with learning outcomes.

Disadvantages:

- No/inefficient monitoring of student and graduate employment indicators: the average graduate's salary on graduation and later on, and graduates' ability to keep their jobs according to their qualifications as well as their career advancement.
- 19% of graduates were rather dissatisfied with the learning outcomes.
- The name of the programme is not fully representative of its content. Even though the programme is titled "Programing and Information Technology," it is largely represented by fundamental mathematical disciplines. This makes students feel like they study not in the same programme as they applied for.
- Poor balance between fundamental and practical subjects. Some graduates believe the programme to offer too few practical IT subjects to form practical competencies that are sought-after in the labor market, which makes it necessary for graduates to acquire the competencies on their own to find good employment.
- Lack of balance between the role of employers in the determination of graduate qualification work subjects as well as their presentation and their contribution to the project. Employers play the key role in determining graduate qualification work subjects and make the majority of the board to which the works are presented. However, their role in the completion of the assignment is mostly limited. The academic staff who directly supervise the project thus have a very limited influence on the assessment. This brings about client-contractor relations between the University and the employer and does not favor cooperation and mutual understanding between the academic community and businesses on a daily basis.

Recommendations

1. Enhance monitoring of graduate and student employment through questionnaires. An analysis of the indicators will ensure a more objective estimate of the demand for graduates in the labor market than individual employer's feedback.
2. Make sure that the name of the programme is representative of its content. There are two ways of ensuring it:
    a. renaming the programme so that the title is more representative of the content, e.g. "Applied Mathematics and Information Technology" or "Applied Mathematics and Programming" and

b. by including additional programming-related subjects to develop certain professional competencies.

3. Improving the balance between fundamental and practical subjects by increasing the share of practice-oriented subjects in the programme. It is critical that the quality of fundamental training should remain traditionally high.
4. Introduce measures to ensure deeper involvement of employers in the preparation of graduate projects as well as full-fledged regular consulting between employers, students, and teachers. Increase the number of representatives of academic staff in graduate qualification work boards. All parties to managing graduate projects should play equal roles in assessing them.

QUALITY ASSURANCE OF EDUCATION

1. Strategy, aims and management of the programme

Criterion assessment: good

Strong points of the programme

- A clear programme development strategy is present. The strategy is aligned with the University's general development strategy with due regard to the prospective development of the national and global labor markets as well as industry-specific trends in the respective field of study as identified through analysis and prognosis of the demand of the labor market for experts in this area.
- The programme management system is highly efficient and helps involve various parties concerned in its development and modernization.
- Internal quality monitoring is formalized and ensured by an independent unit. The results of the monitoring are reported to all parties concerned and taken into account in updating the programme.

Recommendations

- In order to improve the efficiency of programme management annual monitoring of programme development strategy implementation is advisable, which should include explicit reporting of programme implementation progress over the previous year.
- To ensure timely adjustment to any changes in the rapidly developing IT industry, more employer questionnaire surveys should be carried out to obtain unbiased feedback on whether the current programme goals meet the demands of the labor market.

Additional material

Employers were interviewed during the visit. The interview showed high satisfaction of employers with the goals and content of the programme as well as its implementation quality.

In the process of self-evaluation of the educational institution, data on teachers' satisfaction with the personnel policy and applicable motivation system was presented.

Less than 50% of the teaching staff reported to be fully or partly satisfied with the personnel policy for the programme. The low satisfaction of teaching staff with the personnel policy indicates that it has to be modified. For example, the procedure of calculating teaching staff workload should be changed to include individual work with students as workload.

Only 50% of the teaching staff reported to be fully or partly satisfied with the motivation system of the educational institution. The low satisfaction of teaching staff with the motivation system indicates that it has to be modified and developed, in particular by changing the teaching staff performance assessment criteria with due regard to teachers' opinion.

The experts believe that no all activities of the teaching staff are adequately represented in workload estimates. The recommendation is to cooperate with teaching staff to develop a fairer and more encouraging workload system to include teaching, the preparation and development of new teaching methods and courses, research work, publications, reports, the development of new learning materials, supervision of projects and graduation works, etc. All professional activities of teaching staff should be adequately represented as workload, and increased workload should be associated with financial incentives.

2. Structure and content of the programme

Criterion assessment: good

Strong points of the programme

- An all-round competency-oriented graduate model is used, which contains diverse competencies, in particular those aimed at developing professional knowledge and skills, personal qualities, and communication skills.
- All study programmes are subject to inspection by the Teaching Committee, which consists exclusively of employers. Graduate qualification work subjects must be agreed with employers.
- The programme has state accrediation and complies with all mandatory regulatory requirements.

Recommendations

- 19% of graduates were rather dissatisfied with the learning outcomes. The expert's conclusions and recommendations are detailed in Section I-2 of this Report.

- The programme includes no subjects aimed at developing professional competencies that are associated with entrepreneurship and skills in small and large-scale business. With due regard to particular features of digital economy and IT industry, the competency-oriented graduate model should include such professional competencies. Corresponding subjects should be introduced within the programme.
- In order to enhance the development of professional competencies, employers should have greater influence of programme content, for instance, by increasing the percentage of academic disciplines (courses) to be developed in cooperation with employers.
- The traditional performance control methods (examinations and pass/fail examinations) in the form of an interview sometimes fail to ensure efficient assessment of professional competencies. It is advisable to extend the use of modern knowledge assessment techniques, including case studies, for more accurate assessment of the above competencies.

Additional material

In the course of the site-visit, the experts met with students of the assessed programme. One of the issues discussed is the relevance of the structure and content of the programme to the expectations of direct consumers of programmes, i.e. students. The meetings confirmed low student satisfaction with learning outcomes as specified in the self-evaluation report.

The opinion was expressed during the interview with students and graduates that students could not influence the content of the programme. For instance, students believed the results of regular questionnaire surveys to have no effect on programme content. Besides, it was impossible to find out how students' feedback was incorporated in the assessment of teaching staff performance and programme content.

The experts recommends increasing the information transparency of processes associated with processing and using students' feedback, for instance, by publishing reports on the feedback collected and measures taken based on it on the website.

3. Teaching and learning materials

Criterion assessment: good

Strong points of the programme

- The educational institution has formalized procedures for TLM development and updating by employers, students, and other stakeholders.
- The learning process involves high quality TLMs that support all required activities and competency assessment.

Recommendations

- In order to improve the balance between fundamental and practical subjects, the programme should contain a greater percentage of modern practice-oriented subjects and corresponding TLMSs aimed at developing practical competencies that are highly values in the labor market.

Additional material

In the course of the visit, the expert analyzed the test and exam materials that the educational institution uses for formative performance assessment. The expert found the evaluation tools to fit the content of the programme.

Under the questionnaire survey presented by the educational institution and the results of which were confirmed in the course of visit, the majority of students reckon that their opinion is not taken into account in TLM development and updating. The expert thus recommends the educational institution increasing the information transparency of processes associated with processing and using students' feedback, for instance, by publishing reports on the feedback collected and measures taken based on it on the website.

4. Educational technologies and methods

Criterion assessment: satisfactory

Strong points of the programme

- The learning process is well-balanced in terms of various forms of learning sessions, including interactive ones. Modern educational technology, in particular e-learning, is used on a large scale.
- The implementation of e-learning on programme level is part of the university's strategy for improving education quality and availability. The development of e-learning at the higher education establishment enables new educational techniques and individual learning paths.
- The curriculum of the Bachelor's programme includes classes (in the 8th term) in English, which helps develop competencies that involve communication skills and the ability to participate in discussions, in particular in English, and present research findings.

Recommendations

- It is advisable to increase the share of modern interactive forms of learning sessions such as training sessions and workshops, in particular involving employers. It would improve the balance between fundamental and practical knowledge and skills that the programme develops.

Additional material

During the site-visit, the experts attended a class, the analysis of which is presented below.

Teacher's full name: Professor Yevgenii Veremei
Group/specialization: 3rd year
1. Subject/module: Information Process Modeling
2. Learning session type
■ lecture
□ seminar
□ laboratory work
□ practical classes
□ complex class
□ other
3. Subject of the learning session: Introduction to the Theory of Mathematical Modeling of Dynamic Objects
4. Goal of the learning session: To study the basic principles of using key concepts of functional analysis to model information management processes and systems
5. Objectives of the learning session: Studying elements of the theory of metric and normalized spaces and their applications in modeling problems. Studying specific issues of using operators and functionals in metric spaces to model dynamic processes and objects in information systems
6. Material and technical support of the learning session: not required

7. Specify:

Item No.	Knowledge and skills planned to be developed at the lesson as well as the competencies affected by knowledge and skills (д.б. are announced by the lesson teacher)	Forms, means, methods and techniques that are planned to be used during the learning session for the formation of competence
1.	knowledge of the theoretical principles of using key concepts of functional analysis for mathematical and computer modeling of information systems	Form: lecture Method: reporting presentation with problem elements.
2.	the ability to formulate meaningful and formalized problems on building mathematical and computer models	Form: lecture Method: theoretical problem-based presentations.
3.	skills of ensuring practical implementability of methods of solving formalized problems	Form: lecture Method: research method.

ASSESSMENT OF THE TEACHER

No.	**Analysis criteria**	**Indicators**	**Rating (0, 1, 2)**
1.	Compliance with the training schedule	Timely start and end of class, time-balanced sections.	2

2.	Organizing time	Greeting. Topic, goal messaging (connection of the goal with the competences formed).	2
3.	Motivation of listeners for upcoming activities	Indication of relevance, the formed professional and / or social and personal competencies.	2
4.	Psychological climate in the audience	The presence of positive emotional interaction between the professor and students; mutual benevolence and audience involvement.	2
5.	Quality of presentation	Structured material; the clarity of the definition of current tasks; systematic and accessible presentation; adaptability of presentation to the peculiarities of the audience; availability of examples, relevant facts.	2
6.	Conformity of the content to the course programme	Compare with working curriculum of the discipline (teaching and learning materials).	2
7.	Use of visual materials	A textbook, a workshop, handouts, tables, drawings, etc.	0
8.	Oratory	Audibility, intelligibility, euphony, literacy, speech tempo; facial expression, gestures, pantomime; emotional saturation of the performance.	2
9.	Feeling the audience	The ability to respond in time to changes in perceptions of the students.	2
10.	Civility in relation to students		2
11.	Methods of organizing attention and regulating students' behavior	Increase of interest among listeners (original examples, humor, rhetorical techniques, etc.); involving listeners in a dialog, into the process of performing tasks, etc. But not: open call for attention of listeners; demonstration of disapproval; psychological pressure, blackmail.	2
12.	Maintaining "feedback" with the audience during the class	Learning control	2
13.	Summarizing the learning session *(reflection*	The organization of reflection, during which students actively discuss the outcomes	0

	organization)		
14.	Image	Compliance with corporate style, presentability, charisma	2
15.	Final grade		2
16.	Notes and suggestions of the expert The teacher was using traditional visualization means such as chalk and a blackboard even though multimedia equipment was present in the room. It is advisable to review the lecture courses to identify optimum visualization forms and opportunities of enhancing modern IT support of the educational process.		

While performing a desktop analysis of the self-evaluation report as well as an analysis of the curriculum and the schedule of classes, the experts determined that interactive classes accounted for 40% to 60%. The teaching and learning materials of five subjects were studied in the course of the visit. The data on interactive classes within the TLMs studies are largely the same as specified in the self-evaluation report. The experts thus found the percentage of interactive learning sessions in the programme to be sufficient.

5. Teaching staff
Criterion assessment: good

Strong points of the programme

- The educational process is provided by teaching and academic staff who have passed rigorous competitive selection and whose qualification enables them to use approved educational technologies and methods in implementing the learning process.
- The internal teaching staff monitoring system helps maintain and constantly improve the qualifications of teaching staff and ensure their participation in research activities, in particular publishing articles in journals indexed by the WoS and Scopus international scientometric systems.
- High percentage (73%) of academic degree holders among the programme's teaching staff.

Recommendations

- Less than 50% of the teaching staff reported to be fully or partly satisfied with the personnel policy for the programme.
  The low satisfaction of teaching staff with the personnel policy indicates that it has to be modified. For example, the procedure of calculating teaching staff workload should be changed to include individual work with students as workload.

- Only 50% of the teaching staff reported to be fully or partly satisfied with the motivation system of the educational institution. Extremely low satisfaction of teaching staff with the motivation system indicates that it has to be modified and developed, in particular by changing the teaching staff performance assessment criteria with due regard to teachers' opinion. The experts believe that no all activities of the teaching staff are adequately represented in workload estimates. The recommendation is to cooperate with teaching staff to develop a fairer and more encouraging workload system to include teaching, the preparation and development of new teaching methods and courses, research work, publications, reports, the development of new learning materials, supervision of projects and graduation works, etc. All professional activities of teaching staff should be adequately represented as workload, and increased workload should be associated with financial incentives.

6. Material, technical and financial resources of the programme

Criterion assessment: good

Strong points of the programme

- The programme has all the necessary material and technical as well as financial resources. The programme's financial resources enable the acquisition, maintenance, and operation of the material and technical resources and equipment required to implement the programme and supply the required teachers and employees with high qualifications and competence for the educational process.
- Teachers and students can use the computing resources of the SPBU Research Park for research work.
- Most teachers and students report to be satisfied with the quality of material and technical support of the learning process.

Recommendations

- Teaching staff complained during the interview carried out in the framework of the visit that the educational institution did not plan the upgrading of its laboratory equipment, which caused difficulties in scheduling software and educational course updating. It is advisable to prepare such plans for 1 year and 5 years and report them to employees.
- Teaching staff and students complained during the interview carried out in the framework of the visit that the procedure of allocating computing resources of the Research Park was too bureaucratic. It is advisable to simplify the procedure in order to improve research efficiency.

7. Information resources of the programme

Criterion assessment: excellent

Strong points of the programme

- The programme has all the necessary types of information resources: automatic information management, accounting, and documentation systems, electronic learning resources in Blackboard, personal accounts, an ELS, etc.
- An open WiFi network in all buildings of the educational institution ensures free and quick access to any necessary information for students as well as teachers.
- The information openness of the educational institution is ensured through publishing of information on the educational institution's official Internet website and communities on social media.

Recommendations

- It is advisable to maintain the high level of information support and develop automatic information systems and resources to meet modern challenges.

8. Research activities

Criterion assessment: satisfactory

Strong points of the programme

- SPBU is a research hub of global importance operating dozens of scientific centers and laboratories as well as the Science Park, which is fitted with innovative equipment and technology. A large number of research work and high publication activity prove that SPBU is highly competitive in scientific research.
- Teachers and students actively participate in research work, which ensures the development of essential professional competencies and the use of research findings in the learning process.

Recommendations

- The institution has no patents and certificates to confirm that its research findings meet Russian and/or international quality standards. The percentage of patents and certificates to confirm that research findings meet Russian (GOST) and/or international (ISO) quality standards within the general research scope should be increased.
- No information is available on any student science clubs offered by the educational institution. Further effort should be taken to establish and manage science clubs at the systemic level to ensure more efficient students research work.
- Further measures should be taken to involve students in Russian and international competitions for academic grants, which would encourage students to set and achieve ambitious research goals.

9. Employer participation in programme implementation
Criterion assessment: satisfactory

Strong points of the programme

- SPBU tightly cooperates with employers at every stage of programme implementation from planning and development to State Final Examination and graduate employment. The curricula of the programme as well as the competencies to be developed (including the competency matrix) are subject to review and discussion by Teaching Committees, which include employer representatives.
- Employers are involved in identifying assignments for and reviewing graduate qualification works as well as in assessing graduate qualification works as members of the State Examination Board.
- Employers facilitate employment for graduates of the programme. Students can visit the annual IT Trade Fair. Employers offer internship opportunities. Employers also select graduates based on their graduate qualification work presentations and invite them for interviews.

Recommendations

- The role of employers in the context of graduate qualification works is limited to agreeing the subject, reviewing the work, and participating in the presentation as members of the State Examination Board. It is advisable to involve employer representatives in graduate qualification work supervision on a larger scale.
- Employers make the majority of State Examination Boards. The poor balance between representatives of the academic and employer communities in State Examination Boards increases the risk of biased assessment of graduate qualification work, which was confirmed in the course of the student interview that took place during the visit. In order to minimize the risks, it is advisable to ensure that the academic and employer communities have equal representation in State Examination Boards for Bachelors' works.
- Employers who participate in programme implementation do not contribute to its resource support. It is advised to address the issue of attracting resources from employers engaged in programme implementation, for instance, to equip specialized laboratories etc.

Additional material

The self-evaluation report of the educational institution provides no information on the results of the questionnaire survey of employers regarding their satisfaction with the quality of graduate training. Instead, it contains three positive feedbacks from employers that indicate high quality of graduate training and the programme in general. The expert found this set to be non-representative. In order

to ensure unbiased feedback, it is advisable to develop a questionnaire form and involve more employers in surveys.

The employers' positive opinion of graduates and the programme in general were confirmed during the employer interview that took place in the course of the visit. The employers found it noteworthy that graduates generally have good fundamental mathematical knowledge as the universal basis for practical skills in IT. However, they reported a need for additional workplace training for graduates to adjust their professional competencies to corporate needs.

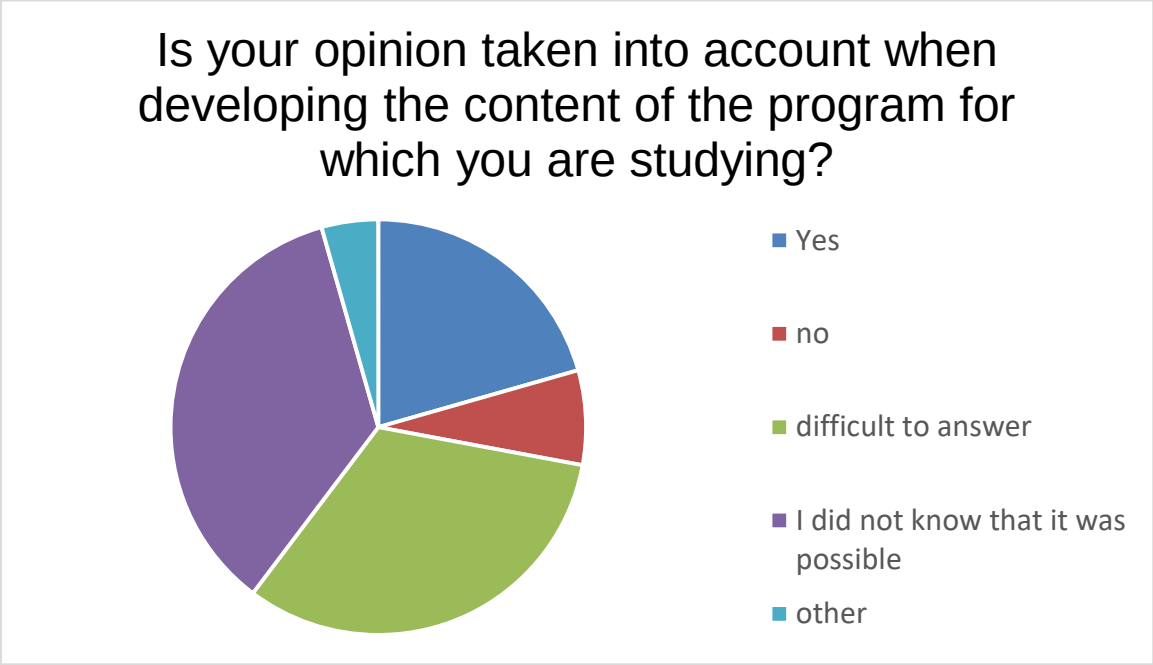
10. Participation of students in determining the content of the programme
Criterion assessment: good

Strong points of the programme

- Students can participate in programme management under formalized documented procedures through the Student Council, whose representatives are members of Academic Councils of various levels as well as Teaching Councils for programmes.
- Students are involved in teaching quality monitoring on a biannual basis, in which they fill out the questionnaires at the end of each study period (term) using their personal accounts.

Recommendations

- The experts carried out a desktop analysis of the self-evaluation report to study the results of a student survey on students' influence on programme management. The survey showed students' opinion to have a very limited influence on the programme's content as well as the organization and management of the learning process.



The data of the questionnaire survey was confirmed during the student interview that took place in the course of the visit. In order to enhance students' role in programme management, the results of student surveys should be monitored at the end of each study period. The survey results and measures taken in respect of each problem should be reported.

- No special measures are provided for to encourage the participation of students in determining the content of the programme and the organization of the educational process. In order to enhance student involvement in programme management, it is advisable to develop special moral and/or financial incentives encourage student participation, such as establishing a special scholarship for such students. The experts believe that non-financial motivation should include not just receiving feedback on certain subjects and the programme in general but actually taking into account students' suggestions. The interaction in which the suggestions are taken into account and directly implemented in the educational process, would not just make students feel like part of the decision-making process but become a non-financial incentive.

11. Student services at the programme level
Criterion assessment: good

Strong points of the programme

- The SPBU has numerous student councils of various scales that have broad powers and aim in particular at developing personal and social competencies in students as well as offering recreation opportunities that fit students' individual qualities and needs.
- SPBU students are entitled to various forms of financial support.
- All buildings of the University offer WiFi connection with free access to the Internet for students.
- The SPBU Psychological Aid Service was established in 2012 to provide help and support to students and employees faced with various psychological problems and difficult situations. The chief purpose of the Service is to provide physchological aid to students and employees on a free of charge basis (http://www.psy.spbu.ru/department/psychcentre/sluzhba).

Recommendations

- In order to facilitate students' adaptation to the labor market, career guidance should be enhanced for senior students. This should include business training on how to find employment, act in interviews, establish start-ups and other forms of small businesses. The measures are necessary since the programme contains no subjects that would form the corresponding competencies and due to intense competition for high-paying jobs in the IT labor market.

12. Career guidance. Assessment of the training quality of prospective students (for the Bachelor's Programme)
Criterion assessment: excellent

Strong points of the programme

- SPBU organizes various events to identify and attract highly motivated and talented students, including open days (at least 4 times a year), programme poster presentations on SPBU Applicant Days (at least 2 times a year), and meetings of SPBU representatives with graduates and parents, which are hosted by Saint Petersburg schools (at least 5 events a year). Competitions among schoolchildren in subjects included in entrance examinations enable the most gifted applicants to obtain advantages for admission.
- SPBU implements the School to University continuous education system at the premises of the SPBU D. Faddeev Academic Gymnasium and as part of pre-university courses and guest lectures on Science Days (at least 10 lectures a year).
- Students in supplementary programmes are provided with all the necessary teaching aid developed by SPBU teachers.

Recommendations

- The set of career guidance measures taken by SPBU as well as SPBU's reputation ensure traditionally outstanding background in applicants. To prove it, numerous applicants compete for each budgetary place with a high average UNE score. It is advisable to maintain high efficiency of career guidance events.

CV OF THE EXPERT *(EXPERTS)*

Full name of an expert: Sergei Sosenushkin

Company and position	Associate Professor, Department of Information System, Federal State Budget Higher Education Establishment "STANKIN Moscow State Technical University"; Deputy Head of the Office for the Development of New Information Technology
Academic degree and academic title	PhD in Engineering
Education	Higher
Professional achievements	Governmental Award of the Russian Federation in Education, twice winner of the competition for RF Presidential Grants for young scientists, author of over 30 academic and teaching works
Research interests	Information telecommunication systems and technology
Practical experience in the field of the programme subject to assessment	PhD thesis titled "System Analysis, Information Management and Processing (Technical Systems)"; Experience of heading an IT unit of a higher education establishment (7 years); Head of Sub-Committee 5 "Functional Safety of ICT in Education", Technical Committee 461 "Information and Communication Technology in Education", co-author of over 10 draft RF national standard on the use of ICT in education

Full name of an expert: Eduard Petlenkov

Company and position	Tallinn University Of Technology (TUT) Associate Professor, Department of Computer Systems; Head of the Centre for Intelligent Systems
Academic degree and academic title	PhD
Education	Higher
Professional achievements	Member of the Qualification Assessment Council in Information Technology and Telecommunication (established by the Estonian government) Member of the Council of the TUT Computer System Department Member of the Management Committee for Project COST CA15225 "Fraction Order Systems: Analysis, Synthesis, and Their Importance for Further Programming".

	Member of the International Committee for Artificial Intelligence, Control Technical Committee Member of the Estonian Association of System Engineers
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Full name of an expert: Vitalii Shaposhnikov

Company and position	Member of the Information Security Committee of the Council for Professional Qualifications in IT
Academic degree and academic title	PhD in Physics and Mathematics, Associate Professor
Education	Higher
Professional achievements	Expert of the Education Committee, Data Protection Association. Many years' experience of cooperation with educational institutions at: IT Security Research Center as Director of the Department for Educational Projects, then NPP "Spetsialnie vychislitelnye kompleksy" LLC.

Full name of an expert: Andrei Ikarov

Company and position	Student, BMSTU
Academic degree and academic title	
Education	
Professional achievements	