STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus universiteto

NANOTECHNOLOGIJOS IR MEDŽIAGOTYRA PROGRAMOS (612F10003) VERTINIMO IŠVADOS

EVALUATION REPORT OF *NANOTECHNOLOGIES AND MATERIAL SCIENCE* (612F10003) STUDY PROGRAMME

at Vilnius University

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Išvados parengtos anglų kalba
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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	***Nanotechnologijos ir medžiagotyra***
Valstybinis kodas	612F10003
Studijų sritis	Fiziniai mokslai
Studijų kryptis	Chemija
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	pirmoji
Studijų forma (trukmė metais)	Nuolatinė (4)
Studijų programos apimtis kreditais	240
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Chemijos bakalauras
Studijų programos įregistravimo data	2011-06-22, ISAK NR. 1-01-84

INFORMATION ON ASSESSED STUDY PROGRAMME

Name of the study programme	***Nanotechnologies and Material Science***
State code	612F10003
Study area	Physical Sciences
Study field	Chemistry
Kind of the study programme	University studies
Level of studies	First
Study mode (length in years)	Full-time (4)
Scope of the study programme in credits	240
Degree and (or) professional qualifications awarded	Bachelor of Chemistry
Date of registration of the study programme	Order No. ISAK 1-01-84 of 22 June, 2011

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I. INTRODUCTION

Vilnius University comprises 14 academic subdivisions (faculties and institutes), 5 research institutes, some other subdivisions. It has about 16000 first cycle, 4000 second cycle and 800 third cycle students, and employs 220 professors, 500 associated professors, 700 lecturers, 500 scientific fellows. The faculties are led by the Faculty Council and the Administration. Each faculty delivers studies and conducts research in a specific area of science. More detail information about University subdivisions can be found in: www.vu.lt/en/about-us/structure/departments.

The Faculty of Chemistry consists of five departments including Department of Analytical and Environmental Chemistry; Department of Inorganic Chemistry; Department of Physical Chemistry; Department of Organic Chemistry; and the Department of Polymer Chemistry. Each department has its own area of scientific research. The pedagogical work of the teaching staff is connected with the area of their scientific research. For example, the subjects that are related to organic chemistry are delivered by the teaching staff from the Department of Organic Chemistry and so on. Subjects from other study areas are taught by the teaching staff from the appropriate faculty.

The Bachelor degree study programme of Nanotechnologies and Materials Science at Vilnius University was evaluated by an external team consisting of:

- Prof. Ana M. Pelacho (team leader), Horticulture, Botany and Landscaping Department, University of Lleida, Spain;
- Prof. Christoph Griesbeck, Department of Biotechnology, MCI, Innsbruck, Austria;
- Prof. Arthur J. Ragauskas, School of Chemistry and Biochemistry, Institute of Paper Science and Technology at Georgia Institute of Technology, Atlanta, Georgia, USA;
- Karolis Stanius (student representative);
- Dr. Sarunas Zigmantas (local representative), Thermo Fisher Scientific, Vilnius, Lithuania.

The Self Evaluation Report (SER) was made available to the site evaluation team and the members examined the report individually, preparing preliminary reports and indicating points of interest and/or discussion points. The site visit for the evaluation process was conducted on 2013-05-08 by the reviewing team. Hereby interviews with the university administration, department heads, teaching staff, students, and social partners were held. After the visit, on 2013-05-09, the expert group held a meeting, discussed the contents of the evaluation report and agreed upon the numerical evaluation of every section of the evaluation.

II. PROGRAMME ANALYSIS

1. Programme aims and learning outcomes

The aims and learning outcomes of the Study Programme at Vilnius University are well defined, clear and integrated into an undergraduate study programme named “Nanotechnologies and Materials Science”. As summarized in the department’s self-evaluation report, the programme aims are:

- To acquire theoretical knowledge of explaining and predicting properties of materials on the basis of the principles of thermodynamics, kinetics, and quantum chemistry.

- To obtain practical skills to perform standard laboratory procedures, synthesize and analyze classical and nanostructured chemical substances, to work with standard chemical equipment and apply instrumental methods.
- To critically evaluate chemical information, data, solve quantitative and qualitative problems of familiar and unfamiliar nature, analyze novel problems and plan their solution strategies.
- To acquire skills to communicate in writing and orally in Lithuanian and English, to work autonomously and in a team, organize and plan their time, study and continuously develop their professionalism and general literacy.

These aims and the quantifiable learning outcomes are presented on the web at www.vu.lt/kviecia/ & www.vu.lt/en/studies/degree-students/degree-programmes https://klevas.vu.lt/pls/klevas/public_ni$www_progr_app.show. The learning outcomes of the study programme are certainly well within the general expectations of leading national and international requirements for undergraduate student education. However, the self-evaluation report failed to link the 'learning outcomes of the studies' (see Table 2 of the self-evaluation report) with specific courses in the study programme. The description of each programme course needs to answer the question what learning outcomes in Table 2 of the report are specifically addressed by each course.

The experts' group recommends that the Vilnius university academic team involved in this programme be more actively engaged and responsible for writing the self-evaluation report. The report needs to re-examine and describe what courses will lead to specific learning outcomes in Table 2 and provide a detailed description as to how this will be accomplished and determined.

In a broad content, the expert group supports the need of this study programme in the national, regional and international labor markets but the review process highlighted several needs and concerns. As will be discussed in greater detail later in the report, the name of the study programme "Nanotechnologies and Material Science" does not fully matches with the proposed study curriculum. The programme is lacking sufficient subjects in material science, main focus is directed towards basic chemistry and nanotechnology related disciplines. Furthermore, although the report addresses the issue of career opportunities for the future graduating studies, it became clear in the site interviews with social partners that there was no specific involvement from future employers in developing these learning outcomes and integration into labor opportunities. This situation must be rectified.

2. Curriculum design

The study programme provides very good coverage in fundamental chemistry and to a lesser extent mathematics and physics. Furthermore, in the latter years of the study programme the students are educated in several important and leading issues in nanosciences and technology. Based on the data provide to the expert's group the study programme meets the legal requirements as summarized in the evaluation Table 1 below.

Table 1: Comparison of Legal and Study programme "Nanotechnologies and Material Science" Accomplishments

Requirement	**In study programme**
Extent of the first cycle study programme	240 credits

210-240 credits.	
Courses in the field of study must comprise at least 165 credits.	170 credits
General university education courses must make up at least 15 credits.	30 credits.
Practice workload not less than 15 credits.	15 credits
Workload of the Graduation paper not less than 12 credits.	15 credits
The number of courses studied per semester must not exceed 7.	4-5 courses per semester.

The overall study programme is complimentary in learning courses especially in chemistry, mathematics, physics and nanotechnology with an overall logical progression of courses and little repetitive or overlapping learning experiences. But a key concern for experts' group is that the balance in material science is not apparent and does not address the aim and name of the study programme. In addition, the students would benefit from a series of technical presentations on the basics of nanotechnology, why this field is different from over fields of material science and how the educational experience in chemistry, physics and mathematics will facilitate a deeper understanding of nanoscience and technology. The impact of these learning modules would be most important and beneficial to the participating students if included in semester I.

Although the detailed learning outcomes in Table 2 should be readily accomplished by the proposed curriculum it must be again mentioned that it has a heavy emphasis in the natural sciences, appropriate in nanoscience/technology and insufficient in material science. The experts' group needs to stress again the need for more details in the report in linking learning outcomes to specific courses and their appropriate education accomplishments. Indeed, these two sections were not fully integrated in the report and the site visit also reflected insufficient team participation in the overall self-evaluation report.

The faculty should be complimented for integrating a strong laboratory experience into this study programme and bringing new/updated laboratory infrastructure into the learning experience. The practical training is leveraged with practical training in the 7^{th} semester. Table 5 of the self-evaluation report highlights (i.e., possible of 47 sites) where this practical training can be achieved. It would be beneficial for this assessment if a discussion could be included as to how some of these potential work experiences are integrated into the overall objectives of this programme. For example, several social partners mentioned the need to have students well equipped in operating and analyzing data from several analytical instruments. The SER would benefit if faculty described how this challenge is going to be addressed. For example, specific research topics/projects could be presented to illustrate the learning process and potential benefit for the students.

In light of these considerations, the experts' group believes that:

- That the name Nanotechnology and Material Science is not fully captured in the current study programme. Certainly, graduates from this programme will exhibit a strong

combination of skills in chemistry and nanotechnology, but the material science component is not developed in current academic curriculum.

- The programme needs to develop a faculty assessment of high priority infrastructure resources needed for the continued success of this programme.
- There is a need early in the programme for a series of lectures on nanotechnology/science to the 1st year students that highlights the forefront of this discipline. These lectures would demonstrate how the study programme is aligned with the nanotechnology science and its applications in everyday life, show the importance of the given courses and motivate students in their future studies.
- The students involved in this programme expressed a concern for the level of professional attention/resources directed to this programme in comparison to other programmes in the Faculty of Chemistry.
    - A specific issue highlighted by several students is the need for additional academic support in introductory Physics course;
    - The students also expressed a strong desire to broaden the nature of the electives they are required to take such that it could include courses from business and management, English language and other related topics.

3. Staff

As succinctly summarized in the self-evaluation report the participating Faculty of Chemistry currently employs 52 university teachers: 22 professors, 20 associated professors, 10 lecturers. Technical staff (12 persons) is responsible for the operation of educational laboratories. The average practical work experience of the teachers participating in delivery of this study programme is approximately 20 years, the pedagogical experience averages 18 years. The majority of the faculty members are involved in the research activities that are related to the study programme. The average age of the teachers involved in the Programme is approximately 50 years. This level of experience is a strength of this study programme but it also brings into question the long term stability of the programme as when this faculty team retires in may challenge the integrated teaching experience of future faculty. Certainly, the study programme needs to examine a viable progress plan with a special emphasis on training junior faculty.

The current Vilnius University human capital resources are a key asset of this programme. The reported teaching loads, tutorials and laboratory work are guided by associated professors or lecturers in which the University has a general requirement that no less than half of the academic staff teaching in the study field must be scientific researchers. In the analyzed study programme all the academic staff involved holds a science degree. University teachers are delivering lectures in the field that is connected with their scientific interests. The self-evaluation report and the site visit strengthened the impression that most of the staff members have contacts with foreign counterparts although this evaluation would benefit from a more detailed description of these interactions and how they are being leverage in this study programme. Overall, the report and discussion with participating faculty acknowledge the need for research publications, especially in international journals. Nonetheless, there seemed to be a tension between heavy teaching loads and time for research. Although this is a common concern in many higher education systems, innovative solutions should be examined, such as increasing undergraduate participation in research; leveraging international organizations for short sabbatical visits and greater social partner interactions focused about state-of-the research opportunities.

An examination of the teaching staff CV's indicates a strong research interest/alignment in several aspects of the study programme. The self-evaluation report is lacking in a detailed description of faculty professional development programme needs, management procedures used to identify teaching needs and subsequent action items. The academic staff from other faculties of Vilnius University also takes part in teaching the students in this programme such as

mathematics and the social science courses the students are required to take. Lectures are delivered by professors or associated professors of relevant fields in chemistry and nanotechnology and to a lesser degree in material science. Tutorials and laboratory work are guided by associated professors or lecturers. Lectures are delivered for big student groups (approximately 100 students from various study programmes). Tutorials are organized for groups of 20-25 students. For the laboratory work students are divided into subgroups of 10-12 students. One academic staff member is responsible for guiding one subgroup. During the laboratory visits, the teaching staff appeared to be well engaged with the students and exhibited a true passion for the teaching mission. However, the teachers indicated the need for additional support staff and chemical supplies in the teaching laboratories. Overall, the science and applied aspects of chemistry/nanotechnology are well integrated into this study programme both from the formal class room learning experience and laboratory studies, to-date. As discussed early there are a few concerns (1) the need to provide supplementary learning experiences in physics for incoming students; (2) a student desire to receive an overview series of lecture on nanotechnology early in their academic career; (3) the ability to broaden their selection of liberal art courses the students are required to take, such as English or Business Management.

From the site visit and the written report it is apparent that the faculty and staff have a strong commitment to academic excellence. Entrance into this study programme appears to be rigorous and the undergraduate programme challenges to the students and all faculty should be congratulated on this issue. Nonetheless, the student perception is that they are not supported to the same level as other programme which is of great concern to the experts committee. Other programme issues that were highlighted during the site visit included:

- Student participation in evaluations of teaching staff, accomplished over the web, is poor and clearly is failing. New methodologies for student evaluation of faculty teaching effectiveness need to be developed and clearly the students need to be educated of their responsibilities and feel that their input is valuable to the future improvement of this program.
- The teaching faculty involved in this programme need to become more involved in the overall self-evaluation report and in the development of the programme. The upcoming student practice is described in general terms and greater details about this aspect need to be provided. The students and experts' group would benefit if a few detailed examples of student practice programmes were developed in the self-evaluation report. This aspect of the programme would clearly benefit if Vilnius University developed an academic coordinator position to help manage this issue.

4. Facilities and learning resources

A strength of this programme is the physical science teaching laboratories, updates in infrastructure and supporting information systems. The site visit by the expert's group of the teaching laboratories was one of the highlights of this programme review. It vividly demonstrated a strong integration of advanced laboratory equipment into the teaching laboratories and it was apparent from the laboratory tours that chemistry students were engaged in their studies, received technical guidance and had resources to accomplish their goals. The documented current international reference textbooks and reference material is good but should be enhanced in the future. The computational facilities and wireless capabilities of Vilnius University are strong and it appears that students and faculty have good access to electronic journals. Given the current and future size of the programme, the laboratories and teaching halls are appropriate for the educational mission in their size and quality. As mentioned earlier, the laboratory research equipment and professional students/staff associated with this programme is

a strength of this programme. Nonetheless, faculty members and staff highlighted the need for additional resources in laboratory studies (i.e., chemical reagents and laboratory personnel) and formal classroom teaching (i.e., software and teaching textbooks) to improve the overall quality of the educational experience.

Students of this study programme have the opportunity to receive training on advanced analytical equipment and should be well trained in their appropriate field of study when graduating. In general, the evaluation report addresses the upcoming student practice opportunities. The faculty presented a reasonable pathway for the students' future practical training. The programme would benefit if more of this information was provided to the students about the practice over the web in greater detail..

5. Study process and student assessment

Vilnius University and especially the Faculty of Chemistry appear to have a strong and successful programme to recruit qualified and strong students into this study programme. The admission policies are well developed and described in the self-evaluation report and associate internet sites. As described earlier, the experts' group takes issue with the name of this programme and the proposed learning outcomes. This is of concern to the experts' group as the incoming students could be left with the impression that they will receive a balanced education in the nanosciences and material sciences and this is not the case.

Although the study programme and students are early in their development it is clear to the experts' group that they will receive a strong laboratory education in chemistry and nanoscience/technology. This is a major strength of this programme.

Many students involved in this study programme expressed an interest in international exchange programmes, but it was of concern to the experts' group that their knowledge of this opportunity, in general, was very diffuse and indirect. The students should also be encouraged to join international associations in their perspective fields which are often free for students and helps broaden their contacts and future career development. Although the students are early in the study programme, the report should highlight how the participating faculty is preparing students for exchange programmes (i.e., material provided, professional development, initial international contacts, etc.) and a visionary section that highlights where students may go, length of exchange visits, objectives and anticipated outcomes.

As mentioned in the other sections, the development of an Academic Consular for this study programme could readily address this issue. In addition, the administration should explore opportunities to partner incoming students with graduating students so they could learn from each other experiences, especially as it applies to international exchange, professional development and career development.

The quality of lectures and courses can be assessed by several means, e.g. by organized evaluation processes. Actions should be taken in order to increase the number of students involved in evaluations. Voluntary participation in online evaluation processes is obviously not enough in order to gain significant results. Moreover, processes for the direct communication of students and responsible study programme managers could be helpful. A review of the testing material and discussions with faculty, students and staff clearly indicates that the study programme is academic challenging and rigorous with the clear objective of graduating students well skilled and trained in their respective field of study.

There is a strong need for a dedicated academic coordinator for students in this programme, to guide professional development, outreach to industry, exchange programmes like ERASMUS, and tailoring the latter end of their academic programme.

6. Programme management

Based on the site visit and supporting documentation there is a clear management chain for this study programme. The teaching responsibilities are well defined and expectations for excellence were frequently described by senior administrators and faculty. The testing material provided to the experts' group reflected an in-depth effort to assess the students' academic capabilities.

Nonetheless, students need greater input into their learning experiences since clearly all interested parties are ultimately interested in developing the highest caliber graduating student. For example, the opportunity to critique teaching outcomes over the web by students is not succeeding and a student-faculty committee needs to be developed to find new approaches that will truly reflect all students' thoughts on their learning experiences for all courses. Only once this information is collected and analyzed can the programme actively improve the learning experience.

During the expert committee student interviews, the students expressed their impression that their study programme possibly does not earn the same attention as other study programmes in terms as resources and appreciation. Although this might be a quite subjective opinion, this aspect should be followed up.

The study programme appears to have a very interested set of potential social partners from industry and government. The experts' group was impressed by the number and positions of participating social partners for practical studies as summarized below:

Table 2. List of possible institutions for practical placement

No	Name of the institution
1	The Institute of Agriculture
2	The Institute of Applied Research
3	The Institute of Biochemistry
4	The Institute of Biotechnology
5	The Institute of Chemistry of the Centre for Physical Sciences and Technologies (SSRI)
6	The Institute of Physics of the Centre for Physical Sciences and Technologies (SSRI)
7	The Lithuanian Energy Institute
8	The Lithuanian Institute of Horticulture
9	The National Food and Veterinary Risk Assessment Institute
10	The Semiconductor Physics Institute of the Centre for Physical Sciences and Technologies (SSRI)
11	The Institute of Oncology
12	"Thermo Fisher Scientific" Vilnius branch (former UAB "Fermentas")
13	The Centre for Innovative Medicine (SSRI)
14	National Public Health Surveillance Laboratory (NPHSL)

15	The Lithuanian Customs Laboratory
16	The State Plant Service under the Ministry of Agriculture
17	VĮ „Visagino energija“
18	UAB „Vilniaus energija“
19	UAB „Lesta“
20	UAB “Intersurgical”
21	UAB “Neo Group”
22	UAB “Vita Baltic International”
23	UAB “Tikslioji sintezė”
24	UAB “Audėjas”
25	UAB “Valentis”
26	UAB „Labtarna“
27	UAB „Areta“
28	UAB “Kurana”
29	UAB „Chromtech“
30	UAB „Gerva“
31	UAB “Grota”
32	AB “Klaipėdos vanduo”
33	UAB „Vandens tyrimai“
34	UAB “Vilniaus vandenys”
35	UAB “Nepriklausoma tyrimų laboratorija”
36	AB “Actas”
37	AB “Amilina”
38	AB-F “Šilutės Rambynas”
39	AB “Gubernija” (brewery)
40	UAB „Vilniaus alus“ (brewery)
41	UAB „Švyturys-Utenos alus“ (brewery)
42	AB „Vilniaus degtinė“
43	AB „Anykščių vynas”
44	UAB „Coca-Cola“ HBC Lietuva
45	AB „Šilutės Rambynas“
46	UAB „Marijampolės pieno fabrikas“
47	AB „Pieno žvaigždės“

This indicates a great interest of many different companies and institutions in the university and its programmes. However, when it came to discussions about the programme’s content and aims, knowledge about the concerning programme was very scarce or lacking. This appeared to be indicative for a limited participation of social partners in this study programme. Clearly, for the success of this programme this must be changed and several industry leaders volunteered during the site visit should participate in a future advisory panel.

III. RECOMMENDATIONS

1. The programme name “Nanotechnology and Material Science” is not fully captured in the current study programme. Certainly, graduates from this study programme will exhibit a strong combination of skills in chemistry and nanotechnology, but the material science component is not developed in current academic curriculum. The committee recommends that this issue be addressed by either adjusting the programme curriculum or changing the programme name so that it more appropriately reflects the goals and structure of the programme.

2. The management of this study programme needs to develop a critical, faculty led assessment of high priority resources needed for the continued success of this programme and then begin to provide the support needed for this to be accomplished.
3. There is a need for a survey series of lectures on nanotechnology/science to the 1st year students that highlights the forefront of this discipline and highlights how their study programme is tailored to the students such that they will be able participate in this field. The experts' group recommends that this been accomplished in the 1st or 2nd semester of the study programme.
4. The students involved in this study programme expressed a concern for the level of professional attention/resources directed to this programme in comparison to other study programmes in the Faculty of Chemistry. This issue must be addressed.
5. A specific issue highlighted by several students is the need for additional academic support in introductory Physics course. The students also expressed a strong desire to broaden the nature of the electives they are required to take such that it could include courses from business and management, English language and other related topics.
6. There is a strong need for a dedicated academic coordinator for students in this study programme, to guide professional development, outreach to industry, exchange programmes like ERASMUS, and tailoring the latter end of their academic programme.
7. Students' participation in evaluations of teaching staff, accomplished over the web, is poor and clearly failing. New methodologies for student evaluation of faculty teaching effectiveness need to be developed and clearly the students need to be educated of their responsibilities and feel that their input is valuable to the future improvement of this study programme.
8. The teaching staff involved in this programme need to become more involved in the written portion of the self-evaluation report and in the development of the programme. Overall, the success of this programme and the participating staff must become more integrated.
9. Additional human resources and supplies should be provided in the teaching laboratories, along with additional access to formal teaching textbooks and software.
10. Development of an advisory panel, formed from the social partners that is chartered to help improve this programme and its relevance to the students and Lithuanian industry and national needs.

IV. SUMMARY

The study programme titled “Nanotechnologies and Materials Science” (NMS) was started May, 2011 at Vilnius University is managed by the Faculty of Chemistry which consists of the Department of Analytical and Environmental Chemistry; Department of Inorganic Chemistry; Department of Physical Chemistry; Department of Organic Chemistry and the Department of Polymer Chemistry. The School of Chemistry has had a long and productive history in teaching and research that is recognized both nationally and internationally. Currently, the faculty offer study programmes in Biochemistry, Chemistry, Nanotechnologies and Materials Science and Nonmaterial’s Chemistry. The faculty stress academic excellence both at the undergraduate and graduate level, this study programme benefits from this history and the excellent research infrastructure available for the students.

The overall aims of NMS programme are clearly specified with well defined measureable learning outcomes. However, the name of the study programme is not fully compatible with the content of proposed study programme. What was also not apparent to the experts’ group was how the individual courses of the programme would address the particular learning outcomes. Specifically, how the courses involved in this study programme do address the learning outcomes of the studies highlighted in Table 2 of the VU self-evaluation report. The participating teachers of NMS programme need to provide a road map as to how each course addresses the proposed learning outcomes.

The course curriculum is very strong in chemistry and nanosciences but the curriculum is deficit in material science. The experts’ group recommends that either the curriculum design is modified to address this issue or change the name of the programme so as to better reflect its current learning outcomes.

The legal requirements concerning staff are fulfilled with regard to the number of teachers and their general qualifications. The NMS teachers are involved in various forms of international cooperation as several participate in joint international projects, research work activities, teaching and/or research inter-university exchange. Overall, there is a good acknowledgement by the faculty for the need to publish and most of the teachers have shown good publication records. Although it is still too early in the programme, the teaching staff of this study programme should strongly engage the NMS students in research and fully capture modern concepts of undergraduate research.

The teaching and research facilities for the students are exemplary and supported by internet and wireless capabilities. Nonetheless, the students and teaching staff have stressed the need for additional learning infrastructure including for example, international textbooks, software, additional support staff and chemical reagents for the laboratories. Certainly, a need of assessment by the faculty, staff and students should be undertaken and this document and should be presented to the administration which would be chartered to address critical issues. In addition, the students in the NMS programme voiced a concern that their programme was not receiving sufficient strategic support in comparison to other study programmes on going in the Faculty of Chemistry and this must be addressed.

The VU library facilities are sufficient and as is the case with most modern universities, there is good access to electronic journals and databases. A strength of this study programme is the excellent laboratory facilities and research infrastructure. Clearly, the research needs of undergraduate students seem to be well integrated with advanced research laboratories and it was apparent that the students will be well trained in the operation of modern equipment employed in the broad fields of chemistry, nanosciences and nanotechnology.

The programme benefits from Vilnius University’s excellent academic reputation among Lithuanian high-school graduates and a high calibre of student is attracted to this programme.

This is leveraged with a series of out-reach efforts which appear to be operating well. Although the overall effectiveness of this study programme cannot be accomplished since the first class is only in the second year, it seems to be on a productive pathway. It need to be acknowledged that this study programme attracts students more interested in technology applications, especially in nanosciences/engineering and the programme should provide the students in the first year an overview set of lectures that illustrate the exciting developments in nanosciences and how their course curriculum will allow them to be part of this future. Likewise, there is a need to provide additional academic support for structural deficiencies of the incoming students (i.e., refresher course in basic physics) and provide a broader breath of courses electives (i.e., Business, English, etc.). The students' work load seems challenging but acceptable and student learning assessments are preformed sufficiently well. The students in this programme appear to have little information on international exchange programmes, such as ERASMUS, and the career benefits that these activities could entail. Likewise, few students appeared to be networked into international scientific undergraduate organizations. There is a very strong need to develop the position of an academic coordinator that would be chartered to help students develop their study programme according to their career ambitions, introduce the students to future employee's, develop career building capabilities (i.e., interview skills, CV, etc.), prepare for the ERASMUS programme, champion social student/faculty activities of the NMS programme and help future students to become quickly integrated into the NMS programme.

The procedures for internal quality assurance are currently defined by conventional student evaluation parameters and senior faculty evaluations of teaching methodology. Certainly, during the site visit all Faculty of Chemistry teachers stressed an emphasis on academic excellence. But the low student participation in teaching evaluations indicates a lack of student feedback into teaching effectiveness. Likewise, the social partners were unaware of the NMS curriculum and did not appear to have an active role in the study programme. This situation must be changed and an advisory panel needs to be developed.

The social partners supporting this study programme and supposedly potential employers of graduating students appear to have little or no information of the study programme curriculum. There is a strong need to develop great engagement with the social partners. Indeed, during the site visit by the external committee several representatives of the social partners indicated a strong willingness to participate in an advisory panel to the future benefit of the programme. This clearly must be done as quickly as possible.

V. GENERAL ASSESSMENT

The study programme *Nanotechnologies and material science* (state code – 612F10003) at Vilnius University is given **positive** evaluation.

Study programme assessment in points by fields of assessment.

No.	Evaluation Area	Evaluation Area in Points*
1.	Programme aims and learning outcomes	2
2.	Curriculum design	3
3.	Staff	3
4.	Material resources	4
5.	Study process and assessment (student admission, study process student support, achievement assessment)	2
6.	Programme management (programme administration, internal quality assurance)	3
	Total:	**17**

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;

2 (satisfactory) - meets the established minimum requirements, needs improvement;

3 (good) - the field develops systematically, has distinctive features;

4 (very good) - the field is exceptionally good.

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Grupės nariai:
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IV. APIBENDRINAMASIS ĮVERTINIMAS

Vilniaus universiteto studijų programa *Nanotechnologijos ir medžiagotyra* (valstybinis kodas – 612F10003) vertinama teigiamai.

Eil. Nr.	Vertinimo sritis	Srities įvertinimas, balais*
1.	Programos tikslai ir numatomi studijų rezultatai	2
2.	Programos sandara	3
3.	Personalas	3
4.	Materialieji ištekliai	4
5.	Studijų eiga ir jos vertinimas	2
6.	Programos vadyba	3
	Iš viso:	**17**

* 1 - Nepatenkinamai (yra esminių trūkumų, kuriuos būtina pašalinti)

2 - Patenkinamai (tenkina minimalius reikalavimus, reikia tobulinti)

3 - Gerai (sistemiškai plėtojama sritis, turi savitų bruožų)

4 - Labai gerai (sritis yra išskirtinė)

IV. SANTRAUKA

Nanotechnologijų ir medžiagotyros studijų (NMS) programa Vilniaus universitete buvo įkurta 2011 m. gegužės mėn. Studijų programą administruoja Chemijos fakultetas, kuriame yra šios katedros: Analizės ir aplinkos chemijos katedra, Neorganinės chemijos katedra, Fizikinės chemijos katedra, Organinės chemijos ir Polimerų chemijos katedros. Šalies ir tarptautiniu lygiu pripažįstama chemijos mokyklos mokymo ir mokslinių tyrimų istorija buvo ilga ir produktyvi. Šiuo metu fakultetas siūlo Biochemijos, Chemijos, Nanotechnologijų ir medžiagotyros ir Nemedžiagų chemijos studijų programas. Fakultetas pabrėžia akademinį studentų ir absolventų pranašumą, istorija šiai studijų programai teikia privalumų, o studentai gali naudotis puikia mokslinių tyrimų infrastruktūra.

Bendrieji NMS programos tikslai yra aiškiai apibrėžti nurodant išmatuojamus studijų rezultatus. Tačiau studijų programos pavadinimas ne visiškai atitinka siūlomos studijų programos turinį. Ekspertų grupei taip pat buvo neaišku, kokią įtaką atskiri programos studijuojami dalykai turi konkretiems studijų rezultatams. Būtent, kokią įtaką į šią studijų programą įtraukti studijų dalykai turi VU pateiktos savianalizės suvestinės 2 lentelėje įvardytiems studijų rezultatams. NMS programoje dėstantys dėstytojai turėtų pateikti išsamų planą, kaip kiekvienas studijuojamas dalykas dera su numatomais studijų rezultatais.

Chemijos ir nanomokslų studijų turinys yra labai stiprus, tačiau medžiagotyrai studijų programoje skiriama nepakankamai dėmesio. Šiai problemai spręsti ekspertų grupė rekomenduoja pakeisti studijų turinį arba pakeisti studijų programos pavadinimą, kad jis geriau atspindėtų dabartinius jos studijų rezultatus.

Studijų kokybės vertinimo centras

Dėstytojų skaičiaus ir jų bendrosios kvalifikacijos atitinka teisės aktų reikalavimus. NMS dėstytojai dalyvauja įvairiose tarptautinio bendradarbiavimo formose, o keli dalyvauja bendruose tarptautiniuose projektuose, mokslinių tyrimų veikloje, mokymo ir (arba) mokslinių tyrimų tarpuniversitetiniuose mainuose. Apskritai, fakultetas geranoriškai traktuoja poreikį skelbti publikacijas ir dauguma dėstytojų yra išleidę nemažai publikacijų. Nors šioje programoje dar kol kas anksti, bet šios studijų programos dėstytai turėtų stipriai įtraukti NMS studentus į mokslinių tyrimų veiklą ir susieti studentų tyrimus su moderniomis koncepcijomis.

Studentų mokymo ir mokslinių tyrimų patalpos yra pavyzdinės, jose įrengtos interneto ir belaidžio ryšio paslaugos. Nepaisant to, studentai ir dėstantis personalas pabrėžė, jog yra poreikis gauti papildomą mokymosi infrastruktūrą, pavyzdžiui, tarptautinius vadovėlius, programinę įrangą, papildomą pagalbinį personalą ir cheminių reagentų laboratorijoms. Žinoma, fakultetas, personalas ir studentai turi įvertinti šį dokumentą ir jį pristatyti administracijai, kuri privalės imtis veiksmų šiems svarbiems klausimams spręsti. Be to, NMS programos studentai išreiškė susirūpinimą, kad, palyginus su kitomis Chemijos fakulteto siūlomomis studijų programomis, jų programa negauna pakankamai strateginės paramos ir šį klausimą reikia spręsti.

VU bibliotekos ištekliai yra pakankami ir kaip ir daugumoje modernių universitetų, prie jų galima lengvai prieiti naudojantis elektroniniais žurnalais ir duomenų bazėmis. Šios studijų programos privalumas yra puikios laboratorijų patalpos ir mokslinių tyrimų infrastruktūra. Aišku, kad studentų mokslinių tyrimų poreikiai yra susiję su pažangiomis mokslinių tyrimų laboratorijomis ir buvo akivaizdu, kad studentai bus gerai išmokyti naudotis plačiose chemijos, nanomokslų ir nanotechnologijų srityse naudojama modernia įranga.

Programai naudinga, kad Vilniaus universitetas turi puikią akademinę reputaciją tarp Lietuvos aukštųjų mokyklų absolventų ir ši programa domina aukšto lygio studentus. Tai lemia įvairios pastangos, kurios, akivaizdu, veikia puikiai. Nors bendrai šios studijų programos efektyvumas negali būti pasiektas, kadangi pirmoji paskaita skaitoma tik antraisiais metais, pastebima, kad programa artėja prie savo našumo aukštumų. Reikia pripažinti, kad ši studijų programa pritraukia studentus, kurie yra labiau suinteresuoti technologijų taikymu, ypač nanomokslų / inžinerijos srityse, o programos metu, pirmaisiais studijų metais, studentams reiktų teikti paskaitų apžvalgą apie įdomią nanomokslų plėtrą ir informuoti, kaip jų studijų dalyko turinys leis jiems ateityje dalyvauti šioje plėtroje. Taip pat reiktų teikti papildomą akademinę pagalbą tuo atveju, jei trūktų stojančiųjų (t.y. atnaujinti pagrindinės fizikos studijas) ir suteikti galimybę rinktis platesnį pasirenkamųjų studijų dalykų spektrą (t.y. verslo, anglų kalbos ir kt.). Studentams tenkantis krūvis atrodo nemažas, tačiau priimtinas, o studentų mokymosi vertinimas atliekamas pakankamai gerai. Šią studijų programą studijuojantys asmenys atrodo turi mažai informacijos apie tarptautines mainų programas, tokias, kaip ERASMUS ir apie karjeros privalumus, kuriuos gali teikti šios programos. Taip pat nedaug studentų yra įtraukti į tarptautines mokslines studentų organizacijas. Kyla didelis poreikis įsteigti akademinio koordinatoriaus pareigas, kuris privalėtų padėti studentams plėsti savo studijų programą pagal jų karjeros ambicijas, supažindintų studentus su būsimais darbdaviais, vystytų karjeros plėtros galimybes (t.y. pokalbių įgūdžius, CV ir kt.), rengtų ERASMUS programai, remtų NMS programos socialinę studentų / fakulteto veiklą ir padėtų būsimiems studentams greitai integruotis į NMS programą.

Vidinės kokybės užtikrinimo procedūros šiuo metu apibūdinamos įprastais studentų vertinimo parametrais ir fakulteto vyresniųjų mokymo metodikos vertinimais. Žinoma, susitikimo metu visi Chemijos fakulteto dėstytojai pabrėžė akademinio pranašumo svarbą. Tačiau mažas mokymo vertinimuose dalyvaujančių studentų skaičius rodo, kad trūksta studentų atsiliepimų apie mokymo efektyvumą. Panašiai ir socialiniai partneriai nebuvo supažindinti su NMS studijų turiniu ir panašu, kad studijų programoje jiems nėra skirtas aktyvus vaidmuo. Šią situaciją reikia keisti ir suburti konsultacinę grupę.

Šią studijų programą remiantys socialiniai partneriai ir, kaip manoma, potencialūs absolventų darbdaviai nedaug žino arba išvis nežino apie studijų programos turinį. Kyla didelis poreikis į šį

procesą įtraukti socialinius partnerius. Susitikimo metu su vertinimo grupe keli socialinių partnerių atstovai pareiškė didelį norą dalyvauti konsultacinės grupės sudėtyje, kad programa ateityje būtų tobulinama. Šį klausimą, be abejo, reikia išspręsti kuo greičiau.

III. REKOMENDACIJOS

11. Programos pavadinimas „Nanotechnologijos ir medžiagotyra“ nėra visiškai įtrauktas į dabartinę studijų programą. Žinoma, šios studijų programos absolventai demonstruos gerus chemijos ir nanotechnologijų įgūdžius, tačiau medžiagotyra dabartiniame akademiniame studijų turinyje nėra visiškai išplėtota. Ekspertų grupė rekomenduoja spręsti šį klausimą koreguojant programos studijų turinį arba pakeičiant programos pavadinimą į tokį, kuris labiau atspindėtų programos tikslus ir struktūrą.
12. Šios studijų programos vadovybei reikia sukurti kritinį, fakulteto inicijuotą itin prioritetinių išteklių, kurių reikia norint, kad ši programa būtų nuolat sėkminga, vertinimą, o tada pradėti teikti pagalbą šiam tikslui įgyvendinti.
13. Nanotechnologijų / mokslo paskaitų metu pirmo kurso studentams reikia organizuoti tyrimų seriją, kurių metu būtų apibrėžiama pagrindinė šios disciplinos esmė ir apibūdinama, kaip yra sudaryta jų studijų programa, kad studentai šiame procese galėtų dalyvauti patys. Ekspertų grupė rekomenduoja šį tikslą įgyvendinti studijų programos pirmo arba antro semestro metu.
14. Šioje studijų programoje besimokantys studentai išreiškė susirūpinimą dėl šiai programai skiriamo profesionalaus dėmesio / išteklių palyginus su kitomis Chemijos fakulteto studijų programomis. Reikia spręsti šią problemą.
15. Keli studentai pažymėjo, jog reikia papildomos akademinės pagalbos pradinio fizikos kurso metu. Studentai taip pat pareiškė didelį pageidavimą išplėsti pasirenkamųjų dalykų pobūdį, kuriuos jiems privaloma pasirinkti, kad tai galėtų būti verslo ir vadybos dalykai, anglų kalba ir kiti susiję studijų dalykai.
16. Šiai studijų programai reikalingas paskirtasis studentų akademinis koordinatorius, kuris vadovautų profesinei plėtrai, ryšiams su pramone, mainų programoms, tokioms kaip ERASMUS, ir pritaikytų akademinę programą jai pabaigus.
17. Studentų dalyvavimas internetu vertinant dėstantį personalą yra menkas ir akivaizdžiai nėra tinkamai vykdomas. Reikia sukurti naujas metodikas, kaip studentai galėtų vertinti fakulteto dėstytojų efektyvumą, o studentus aiškiai reikia mokyti vykdyti įsipareigojimus ir įtikinti, kad jų indėlis bus reikšmingas gerinant studijų programą ateityje.
18. Šioje programoje dėstantis personalas turėtų aktyviau dalyvauti rašant savianalizės suvestinę ir plėtojant programą. Apskritai, dėstytojai šioje programoje turėtų būti labiau įtraukti siekiant programos sėkmės.
19. Mokymo laboratorijoms reikia skirti papildomų žmogiškųjų išteklių, kartu teikiant papildomą prieigą prie formalių mokymo vadovėlių ir programinės įrangos.
20. Reikia suburti konsultacinę grupę, kurioje dalyvautų socialiniai partneriai, siekiantys pagerinti šią programą ir padaryti ją labiau tinkamą studentams, Lietuvos pramonei ir nacionaliniams poreikiams.

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