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QA REPORT

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Innovative Multidisciplinary Curriculum in Artificial Implants for Bio-Engineering BSc/MSc Degrees

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Results of curriculum evaluation

In accordance with the current requirements, a curriculum for the preparation of masters was developed (http://bmi.vntu.edu.ua/bioart/program/Plan_2019_mag_ukr.pdf) and adapted to the requirements of the educational process (http://bmi.vntu.edu/ua/students/163_mag_2020_d.pdf). The project team has developed and successfully tested 4 compulsory academic disciplines for students of Master's graduate: Hardware and software and medical engineering support of bioengineering and medical devices and systems; Modern information technologies in science and education; Processing of biomedical images and reconstruction of objects; Regenerative biomedical technologies and 3D printing of implants. In addition, in order to deepen the acquired skills, develop competencies, and assimilate programmatic learning outcomes, the training curriculum provides for the study of 4 selective disciplines (total volume - 23 ECTS credits), the list of which is determined annually in accordance with the proposals of employers, students and the capabilities of VNTU.

On December 15, 2020, a new educational program "Intelligent artificial implants and medical devices in bioengineering" of the second (master's) level of training (study period - 1 year and 4 months) in specialty 163 - Biomedical engineering, which was developed and put into implementation, successfully was accredited (https://vntu.edu.ua/uploads/2021/visn/1.pdf) and received a certificate from the National Agency for Quality Assurance in Higher Education (Ukraine) (https://vntu.edu.ua/uploads/2021/1/163.pdf).

Within the framework of the project for the preparation of bachelors, 8 disciplines of the training curriculum for the educational program "Biomedical Engineering" of the specialty 163 - Biomedical Engineering (training period - 3 years 10 months) were adapted: Biochemistry, Biomedical mechanics, Biophysics, Digital circuit engineering, Higher mathematics, Mathematic modeling in biomedical science, Measuring information converters and sensors for medical and engineering systems, Nanotechnologies in biomedical science. Accreditation of the educational program "Biomedical Engineering" in the specialty 163 - Biomedical Engineering is scheduled for March 2022.

The teaching materials of the developed disciplines are presented in the electronic system of support of the educational process of VNTU JetIq (https://jetiq.vntu.edu.ua). Practical and laboratory work in these disciplines is carried out using equipment purchased with funds from the BIOART project (http://bmi.vntu.edu.ua/bioart/doc/foto.pdf).

In general book of the BIOART project, the staff of VNTU, in collaboration with colleagues from other educational institutions, published 3 sections intended for the respective disciplines of student education. Published 1 study guide by a team of authors VNTU "Intelligent technologies of computer planning and modeling in medical diagnostics, treatment and rehabilitation, study guide // edited by S.V. Pavlov, O. G. Avrunin, O. V. Hrushko - Zhytomyr: PE "Euro-Volyn", 2021. - 202 p. "

Thus, two new educational programs for the preparation of bachelors and masters have been developed and provided with educational and methodological materials and personnel and have been successfully introduced and accredited.

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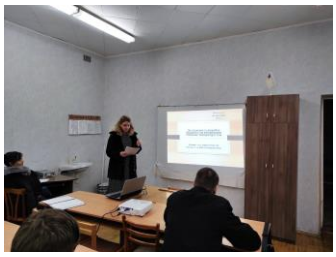
Evaluation of pilot teaching results. Number of students participating in pilot teaching

During the pilot teachining on the new curriculum, students showed interest in the study of disciplines. Senior year internships were carried out in medical organizations. Based on the results of the first year of study, curricula were adjusted taking into account the analysis of the results, a survey of students and employers, and advanced training of teachers.

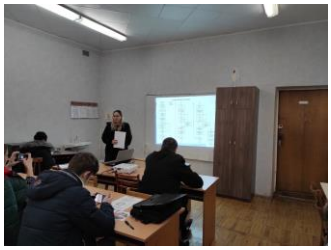
Number of students enrolled during the 2019-2020 and 2020-2021 academic year

Specialty/ program	*Academic year*	*Number of BSc students*		*Number of MSc students*		*Total Number of students, BSc/MSc*
		Full time	*Part time*	*Full time*	*Part time*	
163 - Biomedical Engineering / «Biomedical Engineering», «Intelligent artificial implants and medical devices in bioengineering»	2019-2020	34	23	10	25	57/35
	2020-2021	38	28	3	-	66 /3

In December 2020, VNTU held the defense of master's qualification works in the specialty 163 - Biomedical Engineering, educational program - Intelligent artificial implants and medical devices in bioengineering (http://bmi.vntu.edu.ua/bioart_events_detailph&=en). The defended master's theses were devoted to various aspects of bioengineering and medicine, including using information technology.











Student evaluation survey templates

Indicative Questions to determine the level of awareness about the project among students and teachers VNTU.

1. Do you know about the ERASMUS+ program?
(Yes/no)
2. Do you know about the project BioArt ?
(Yes/no)
3. Evaluate is the necessity of the educational process modernization.
(1 - not interested, 2 - partially interested, 3 - interesting, 4 - well interested, 5 - very interested)
4. What do you think about the participation of your University in international projects along with the leading European universities?
(1 – Positive,2 – Indifferent, 3 – Negative)
5. What do you think, will the acquisition of practical skills in Artificial Implants increase your professional competence?
(Yes/no)
6. How do you consider, whether the use of a new laboratories will increase your interest in Artificial Implants?
(1 – Positive,2 – Indifferent, 3 – Negative)
7. Are you interested to get more information about the purpose, objectives and the scope of the BioArt project?
(Yes/no)
8. Do you think that the teaching of special subjects is performed at a satisfactory level?
(1 – Positive,2 – Indifferent, 3 – Negative)
9. Do you think that the content of special disciplines is at a satisfactory level?
(1 – Positive,2 – Indifferent, 3 – Negative)
10. Do you think that the equipment in laboratories and computer classrooms is at a sufficient level to achieve the goals of the research?
(Yes/no)
11. Do you think new approaches, such as blended learning and distance learning, can improve the quality of learning?
(1 – Positive,2 – Indifferent, 3 – Negative)
12. What do you think should be done to improve the quality of teaching and learning special disciplines?

Survey results: students are well aware of the Erazmus + program (2020 - 96%, 2021 - 100%), note the high interest of students in the subjects studied and the involvement of new laboratories in the educational process (2020 - 84%, 2021 - 96%) , students appreciate the participation of VNTU in international projects (100%), students believe that the acquired skills will increase their professional competence (2020 - 96%, 2021 - 100%). 23% of students believe that the content of academic disciplines needs to be updated to improve their qualifications. Students' suggestions for improving the educational process: more practical training in equipped laboratories; more demonstration tasks from teachers; more interactive activities.

Tentative questions about academic disciplines among VNTU students.

1. What is the one primary reason why you chose to take this course? (Please tick accordingly)
(1 - The course is required for my degree, 2 - The course is optional / an elective, 3 - The course is compulsory, 4 - The course aligns well with my interests, 5 - The course fits my schedule)
2. I consistently prepared for class
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)

3. I attend class regularly
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
4. I have put a great deal of effort into advancing my learning in this course
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
5. In this course, I have been challenged to learn more than I expected
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
6. I was well-prepared for class/discussion rounds
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
7. The course was well organized
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
8. The course followed the syllabus well
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
9. The workload for this course was appropriate
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
10. Exams and assignments were reflective of course content
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
11. The text and assigned readings were valuable
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
12. Graded assignments were useful
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
13. The grading practices were clearly defined
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
14. This course gave me confidence to do more advanced work in the subject
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
15. Student learning was fairly assessed (e.g., through exams, projects, and other graded work)
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
16. I believe that what I am being asked to learn in this course is important
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
17. The instructional materials (books, readings, handouts, study guides, lab manuals, multimedia software) increased my knowledge and skills in the subject matter
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
18. The lectures and assignments complemented each other
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
19. The course was organised in a manner that helped me understand
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
20. Assignments helped me understand the course material
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
21. The instructor used class time effectively
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
22. The instructor presented course material in a clear manner that facilitated understanding
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
23. The instructor was available to students
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
24. The instructor provided helpful feedback
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
25. This course enhanced my knowledge of bioengineering
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
26. This course helped me develop intellectual skills (e.g., critical or creative thinking, quantitative reasoning, problem solving, etc.).

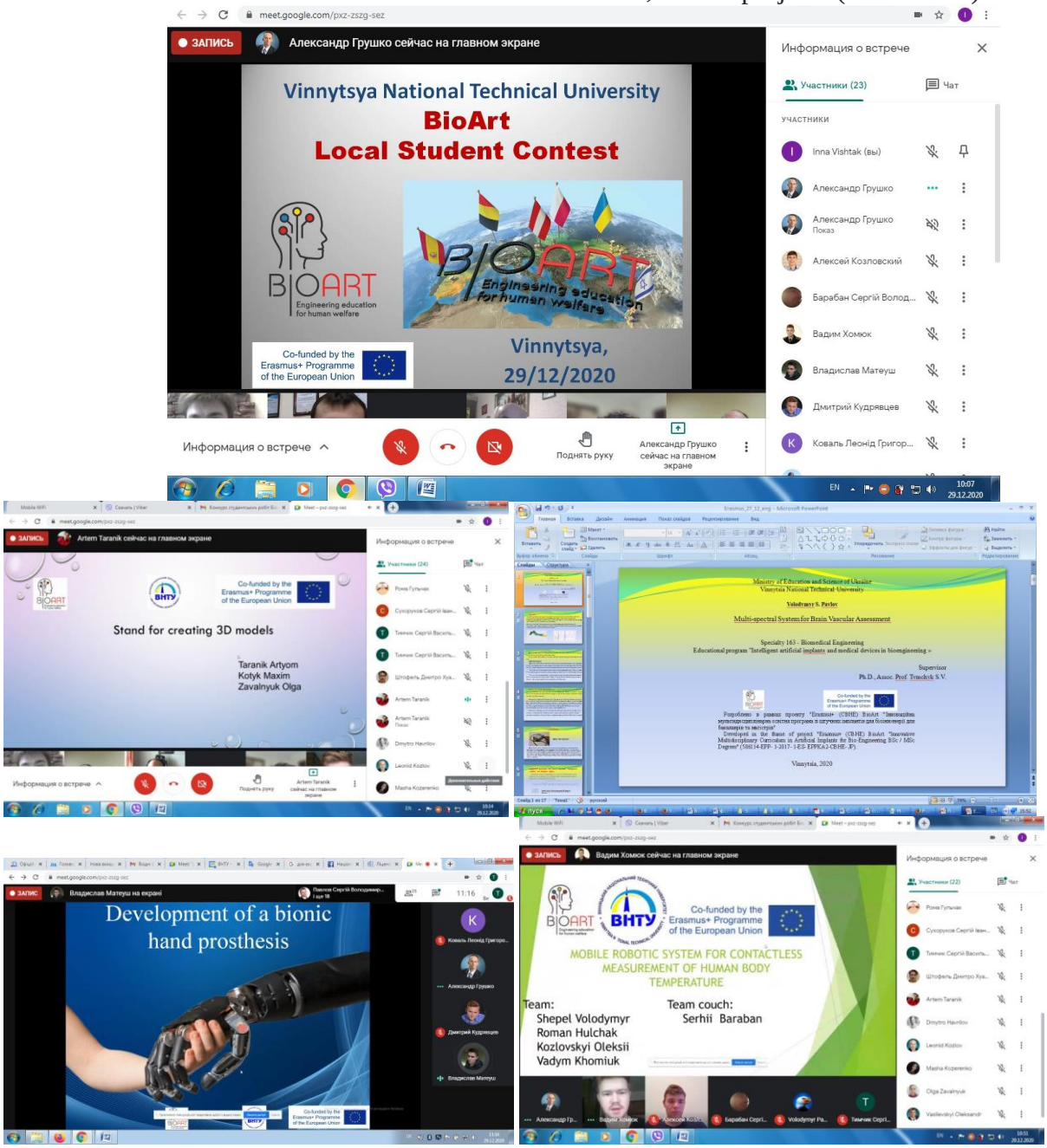
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
27. The instructor stimulated my interest in the subject matter
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
28. I would recommend this course to others
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
29. I would recommend this instructor to others
(1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree, 5 - strongly disagree)
30. Do you have any specific recommendations for improving this course?
31. What changes might improve your learning?
Question 30-31 is a free choice question to answer.

Survey results: Students express interest in the subjects studied (100% in 2020 and 2021), in 2020 100% of students are satisfied with their studies and in 2021 - about 85% (the main reason is the use of distance learning, which is associated with measures to combat Covid -19). Students believe that courses of acquired skills will increase their professional competence: 50% (in 2020), 70% (in 2021), 10% believe that the content of academic disciplines needs to be updated to improve the quality of education.

Student's suggestions for improving the courses: more practical and laboratory classes in equipped laboratories, attracting representatives of enterprises to general studies with students.

National student contest results

In 2020, VNTU hosted contest for the best student scientific work on interdisciplinary topics of the Erasmus + BioArt project. Topics of the work concerned the solution of problems in the biomedical sphere both in the field of information support and in the direction of developments in the use of modern electronic means. In the final round of the contest, 6 team projects (11 students) were presented.



On December 29, 2020, VNTU completed the competition of student works within the framework of the European Union Erasmus + program "Innovative multidisciplinary training program on artificial implants for BSc / MSc degrees in bioengineering" (BioArt). The final of the competition was held online. The total number of students participating in student contest is 27 people. (http://bmi.vntu.edu.ua/bioart_events_detail.php?id=21&lang=en). All participants of the contest presented the development of applied problems in the field of bioengineering within the framework of

the Bioart project. During the competition, students had the opportunity to demonstrate and improve their skills in modern solutions in the field of bioengineering. All participants of the Teams were awarded certificates of participation in the competition.

The winners are Serhii Pavlov, Vladyslav Mateush and Artem Taranik took part in the international student contest.