ErgoDesign

Improving digital skills for Ergonomics and Bioengineering Innovations for inclusive Health Care

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PR2: Delphi method

REPORT

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1 Methodology

1.1 Procedure

In our project ErgoDesign we applied the Delphi method to carry out survey which aimed at easing the exchange of views on the data collected in PR2/A1: State-of-the-art and definition of first principles. It was designed by PUT with the support of Valuedo. Each participant was asked to give estimates and assumptions to the Delphi facilitator (PUT), who collected the information via Google form and prepared a first summary report. Helped by the facilitator, the invited respondents reviewed the summary report, giving updated information to the facilitator, who reviewed the material and issue a second report. This process continued until all participants reached a consensus. In our study we assumed that the consensus is achieved when 60% or more statements were assessed as "agree" or "strongly agree" in all stages. The Delphi study was conducted in two levels:

- national level
- international level

by the 5 partner countries by the Universities with at least 10 participants each and then in an international Delphi study, led by PUT, with at least 8 participants.

The participants were selected on the basis of their educational background, experience and employment. They were representatives of three groups: academia, practice and students. We reached them sending the link to the questionnaire via emails. Our intention was to invite more than required amount of respondents each time, at least 11-12 people to reach finally the assumed indicators. It would be good if at least one of them was from each group. Summarizing, the required characteristics of the potential respondents were the following:

- Educational background (university degree)
- Period practice – at least 1 year of using qualifications
- Field of expertise related to the project – engineering, ergonomics, medicine, physiotherapy, software engineering, IT, education, psychology, technical device operation, health care, rehabilitation, dentist
- English language

In a case of students, they were supposed to be on Master level in the field of study related to the project, the same as academicians and practitioners.

We also assumed that we will invite people who have experience in working with people with special needs (individuals who require assistance for disabilities that may be medical, mental,

or psychological).

All the respondents were anonymous and the list of the respondents was only known to the project partners.

1.1.1 The first national round of Delphi method

The questionnaire was distributed via google form: (Figure 1).

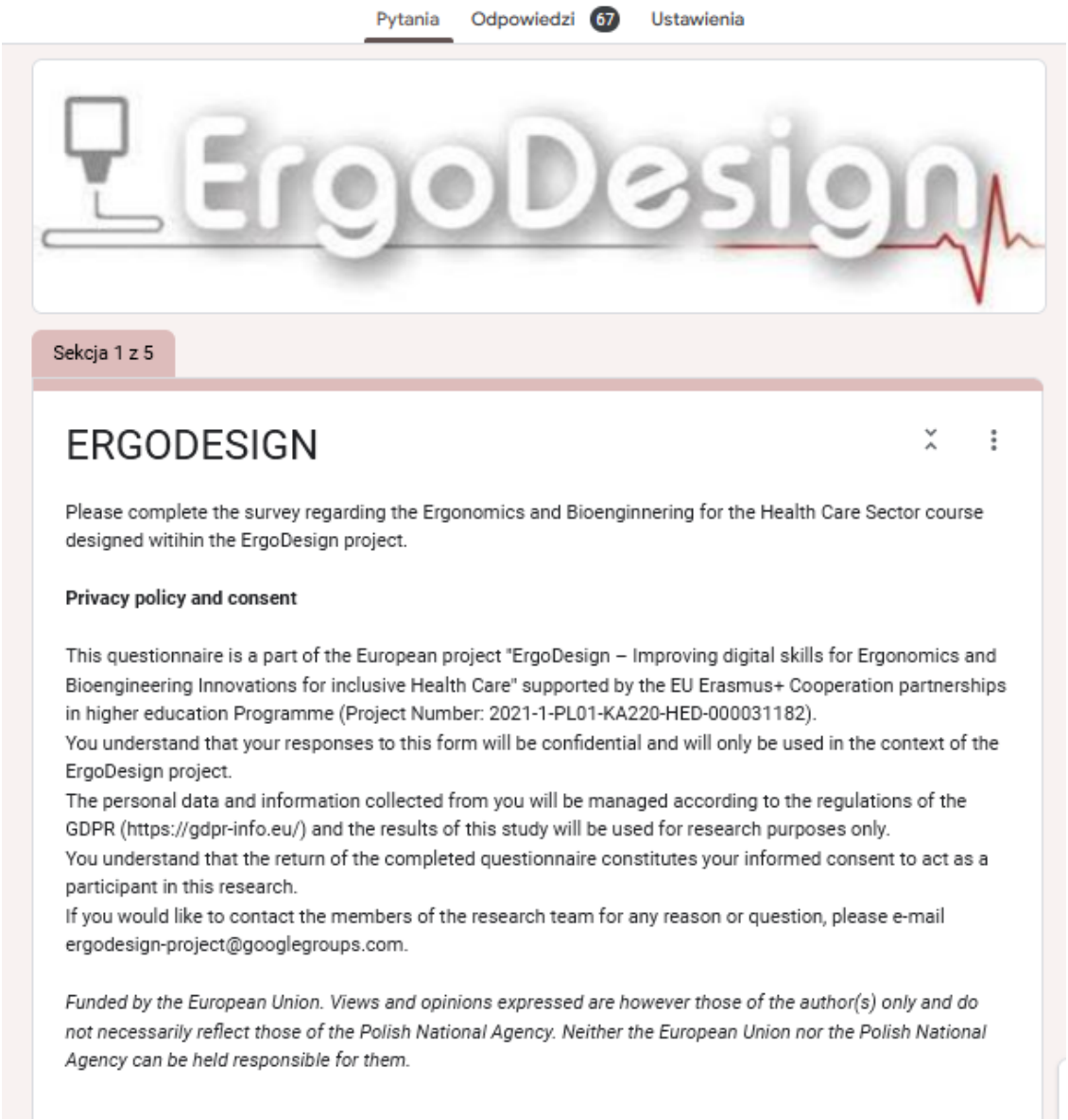

Figure 1. ErgoDesign google form in 1st round of Delphi method

The Google form was available for almost five weeks from 25th November 2022 till 1th January 2023. We closed it when we collected at least 8 questionnaires from each sector representative on the national level from each partner.

1.1.2 The second international round of Delphi method

The questionnaire was prepared on the basis of information which we collected in the first round. We provided here questions from the first round only if we did not achieve consensus. Additionally, to the questions we were showing the charts presenting the results from the previous data. Our international respondents, having this knowledge, could provide us their assessment (Figure 3).

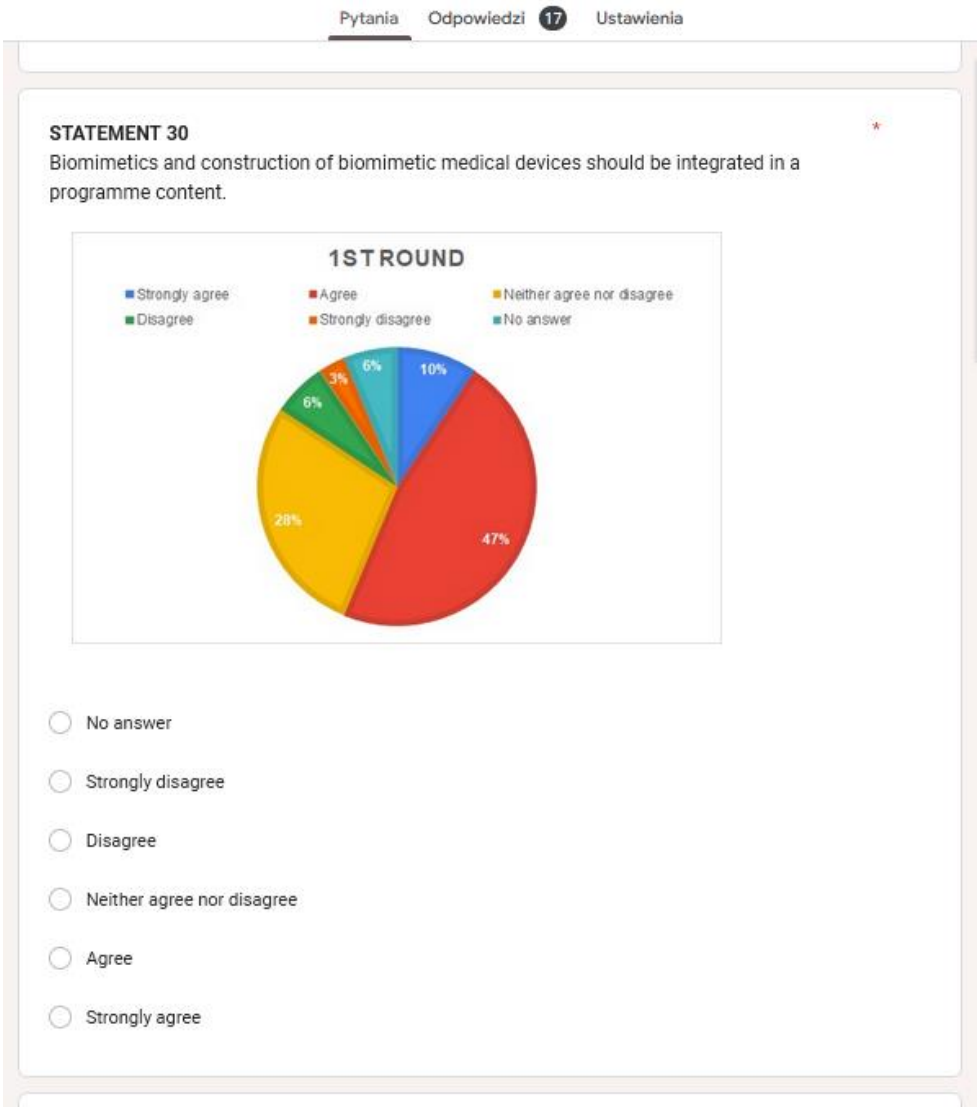

Figure 3. Example statement from the 2nd round of Delphi method

The questionnaire was distributed via google form: https://forms.gle/WxcbY63P6Bg5DXkN9 (Figure 4).

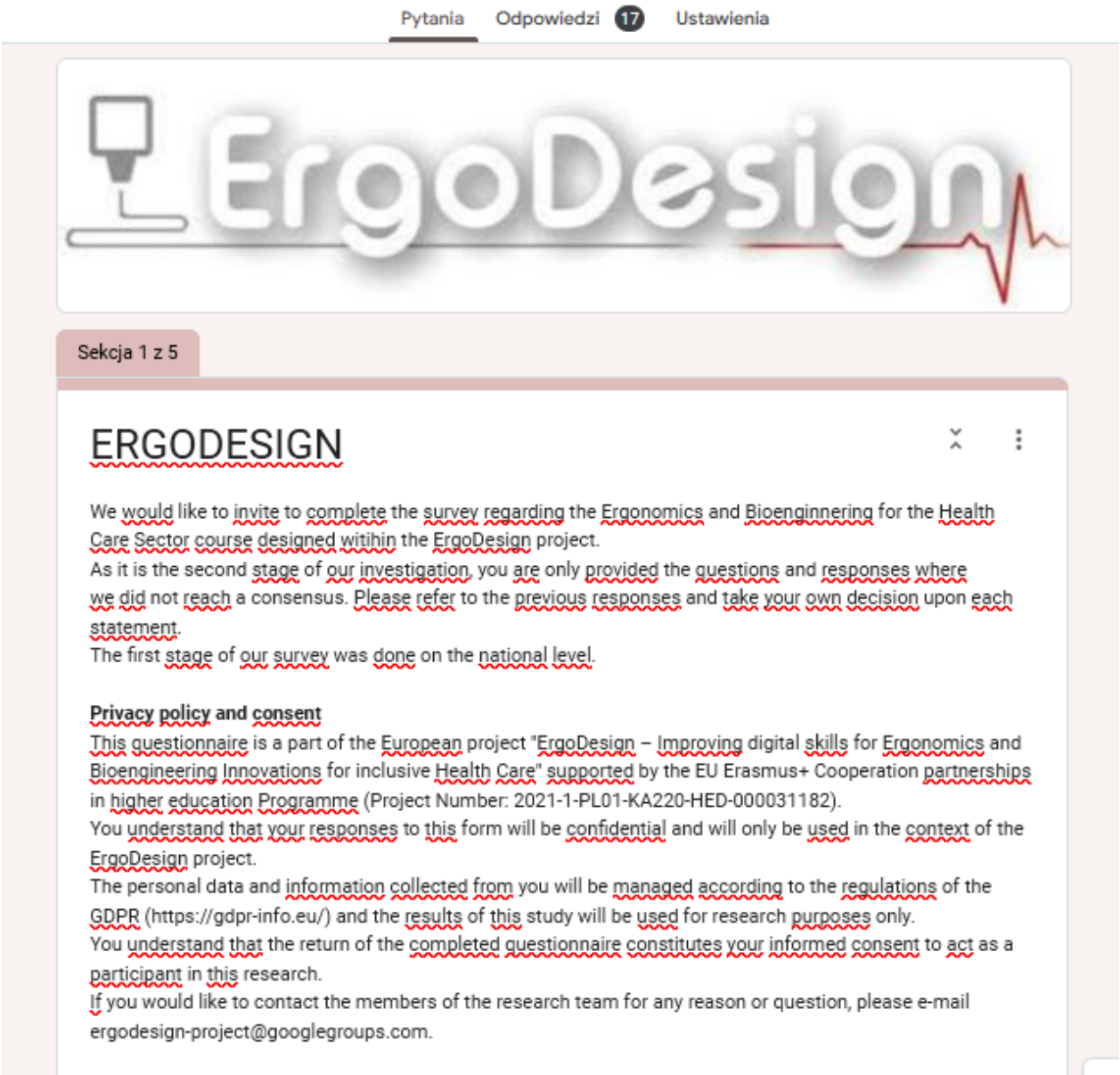

Figure 2. ErgoDesign google form in 2nd round of Delphi method

The Google form was available for 7 days from 6th January 2023.

1.2 Participants

1.2.1 The first national round of Delphi method

Table 1. List of experts in the first round of Delphi method

No	Country	University partner	Expertise sector	Expertise in working with people with special needs
1	Bulgaria	TUV	academia	Yes
2	Bulgaria		practitioner (medicine)	Yes
3	Bulgaria		academia (health care)	Yes
4	Bulgaria		academia	No
5	Bulgaria		practitioner (engineering)	No
6	Bulgaria		education	No
7	Bulgaria		practitioner (dental, education, health care)	No
8	Bulgaria		practitioner (engineering)	No
9	Bulgaria		practitioner (software engineering, technical device operation)	Yes
10	Bulgaria		student	No
11	Bulgaria		student	Yes
12	Bulgaria		student	No
13	Bulgaria		student	No
14	Bulgaria		student	No
15	Bulgaria		student (engineering, IT, software engineering)	No
16	Bulgaria		practitioner (IT)	No
17	Bulgaria		student	No
18	Bulgaria		student (IT)	No
19	Bulgaria		practitioner (engineering)	No
20	Bulgaria		student	No
21	Bulgaria		practitioner (engineering)	No
22	Bulgaria		practitioner (engineering)	No
23	Greece	NTUA	practitioner (health care)	Yes
24	Greece		practitioner (engineering)	No
25	Greece		practitioner (engineering)	No

26	Greece		practitioner (engineering)	No
27	Greece		academia (engineering)	No
28	Greece		practitioner (engineering)	No
29	Greece		academia	Yes
30	Greece		academia	Yes
31	Greece		other	No
32	Greece		practitioner (engineering)	Yes
33	Greece		practitioner (health care)	No
34	Hungary	OU	academia	No
35	Hungary		academia	No
36	Hungary		academia (education, engineering)	No
37	Hungary		practitioner (software engineering)	No
38	Hungary		practitioner (dental)	Yes
39	Hungary		academia	Yes
40	Hungary		academia (education, engineering, IT)	Yes
41	Hungary		academia (education)	No
42	Hungary		academia, practitioner (education, rehabilitation)	Yes
43	Hungary		engineering, student	Yes
44	Hungary		student	Yes
45	Hungary		practitioner (psychology)	Yes
46	Hungary		student (education, engineering, ergonomics, technical device operation)	Yes
47	Poland	PUT	practitioner (engineering)	Yes
48	Poland		practitioner (engineering, IT, software engineering)	Yes
49	Poland		practitioner (engineering, IT, software engineering)	No
50	Poland		academia (education, engineering, ergonomics)	Yes
51	Poland		academia (education, engineering)	Yes
52	Poland		academia	Yes
53	Poland		student (education, engineering)	Yes
54	Poland		practitioner (engineering, ergonomics, medicine)	Yes
55	Poland		academia (engineering)	No

56	Poland		academia (education, engineering, ergonomics)	No
57	Slovakia	TUKE	education	No
58	Slovakia		practitioner (engineering)	No
59	Slovakia		practitioner (IT)	Yes
60	Slovakia		practitioner (engineering)	No
61	Slovakia		practitioner (engineering)	No
62	Slovakia		education	Yes
63	Slovakia		practitioner (engineering)	No
64	Slovakia		practitioner (engineering)	Yes
65	Slovakia		other	Yes
66	Slovakia		academia (education)	No
67	Slovakia		academia, student	No

In the first round 67 participants (22 – TUV, 11 – NTUA, 13 – OB, 10 - PUT and 11 - TUKA) answered the questionnaire from 5 partner universities. They represented three sectors: academia, practice and student. When we analyzed the affiliation of our respondents it appeared that three of them (numbers: 1, 3 and 33) are our team members (TUV and OB) what was a misunderstanding and we had to delete these results from our further analysis. However, it did not influence the indicators as finally we accepted 64 respondents - 20 respondents invited by TUV team and 12 respondents invited by OB team.

1.2.1 The second national round of Delphi method

Table 2. List of experts in the second round of Delphi method

No	Country	Expertise sector	Expertise in working with people with special needs	Contact
1	Estonia	academia (engineering, ergonomics)	Yes	PUT
2	Malaysia	academia	No	PUT
3	Türkiye	academia (education, IT, software engineering)	Yes	TUV
4	Latvia	academia (ergonomics)	Yes	PUT
5	Turkey	academia	Yes	NTUA
6	Romania	academia	No	TUV

7	Turkey	academia	Yes	NTUA
8	England	academia (education, engineering, ergonomics, health care, IT, technical device operation)	Yes	TUKE
9	Greece	academia (education, engineering)	No	TUKE
10	Greece	academia (education, engineering)	No	TUKE
11	Tunisia	practitioner (engineering, medicine)	No	TUKE
12	Croatia	academia	No	TUKE
13	Greece	academia (education, engineering, ergonomics)	No	TUKE
14	Romania	academia	Yes	TUKE
15	Italy	academia (engineering, ergonomics)	No	TUKE
16	Croatia	academia	Yes	OU
17	Croatia	academia (education, IT, software engineering)	No	TUKE

In the second round of Delphi study 17 participants answered the questionnaire. In details, 13 academics and 4 practitioners. However, when we analyzed the affiliation of our respondents it appeared that three of them (numbers: 9, 10 and 13) come from the countries of one of the project partners. Due to this fact we decided not to take their responses in the further analysis as this stage was assumed to be conducted on the international level (countries except 5 partner universities). We accepted the results from the respondent from Italy as the partner ValueDo is not university partner.

1.3 Analysis methodology

1.3.1 The first national round of Delphi method

The opinions were collected from a group of experts that were not physically assembled, through a questionnaire on google form. The questionnaire consisted of three parts:

- **Part A: Ergonomics and Bioengineering**
- **Part B: Software and digital tools**
- **Part C: Teaching and training methodology**

The first part included 60 statements, the second one contained 39 statements whereas in the last part there were 6 statements. Each of these statements was assessed separately using a scale:

- no answer
- strongly disagree
- disagree
- neither agree nor disagree
- agree
- strongly agree.

We assumed that the consensus was achieved when 60% or more answers where “agree” or “strongly agree” for a statement. If the decision of our respondents was lower than 60% the international experts were invited for the second round.

1.3.2 The second international round of Delphi method

In the second round the international experts responded to a questionnaire on google forms. However, this time not only statements were assessed but also the responses were aggregated and shared with them after the first round. Again we assumed that the consensus was achieved when 60% or more answers where “agree” or “strongly agree” for a statement. In a case that the decision of our respondents was lower than 60% the statement was rejected and did not included as an idea for a topic of the course.

1.3.3 Statistical analysis

For the further analysis of all accepted statements were investigated with the use of statistics. We calculated mean and standard deviation (SD) to identify which and how much the topics in the statements were vital in teaching in our ErgoDesign course. It results from the fact that a standard deviation is a measure of how dispersed the data is in relation to the mean. Low standard deviation means data are clustered around the mean, and high standard deviation indicates data are more spread out.

2 Analysis of the results of the first national round of Delphi method

The results of the first national round of Delphi are presented in Table 3. According to our assumptions, the statements which achieved 60% or more than 60% positive responses - "agree" or "strongly agree" (green) were taken as the potential topics for our ErgoDesign course and further analyzed using statistics. The statements, which were assessed below 60% (red), were investigated again in the second round.

Table 3. Results of Delphi method – first round

Statement	Number of positive responses		SUM	Positive responses %
	Agree	Strongly agree		
PART A Ergonomics and Bioengineering				
STATEMENT 1 Ergonomics as a scientific and practical field: efficiency-safety-convenience in transforming, developing different environments, especially work environment adjusted to work with people with special needs should be integrated in a programme content.	38	14	52	0.81
STATEMENT 2 Fundamental topics of muscle anatomy, physiology and treatment, and muscle modeling should be integrated in a programme content.	35	12	47	0.73
STATEMENT 3 Anthropometry: human body data in ergonomic assessments and developments should be integrated in a programme content.	31	15	46	0.72
STATEMENT 4 Contactless measurement techniques for anthropometric data gathering (such as 3D scanning, photogrammetry etc.) should be integrated in a programme content.	30	20	50	0.78

STATEMENT 5 Mechanical behavior of biological tissues and systems should be integrated in a programme content.	37	8	45	0.7
STATEMENT 6 Force systems, resultant, equalities, equilibrium, planar force systems, internal forces and moments, internal force diagrams and problems including friction should be integrated in a programme content.	27	11	38	0.59
STATEMENT 7 Kinematics and kinetics of movement and muscle force system in a programme content.	36	11	47	0.73
STATEMENT 8 Knowledge engineering and expert systems should be integrated in a programme content.	28	18	46	0.72
STATEMENT 9 Fundamental mathematical models in medical simulations should be integrated in a programme content.	31	13	44	0.69
STATEMENT 10 Bioinformatics principles should be integrated in a programme content.	32	12	44	0.69
STATEMENT 11 Computational methods in biomedical technology using finite elements should be integrated in a programme content.	31	14	45	0.7
STATEMENT 12 Kinematics, dynamics and energetic aspects of human movement using biomechanical models should be integrated in a programme content.	39	11	50	0.78
STATEMENT 13 Biomechanical models of the musculoskeletal system based on the anthropometry of the human body and the mechanical laws of	32	12	44	0.69

movement should be integrated in a programme content.				
STATEMENT 14 Biomechanical applications in human movement should be integrated in a programme content.	33	16	49	0.77
STATEMENT 15 Basic concepts on solids mechanics should be integrated in a programme content.	34	11	45	0.7
STATEMENT 16 Interaction of biomaterials with biological tissues and biological fluids should be integrated in a programme content.	29	12	41	0.64
STATEMENT 17 Biomaterials in biomedical applications should be integrated in a programme content.	31	13	44	0.69
STATEMENT 18 Interaction of biomaterials with the human body, inflammation, trauma, infections, physiology, biomechanics, bioelectric phenomena, tissue engineering, cardiovascular models should be integrated in a programme content.	31	12	43	0.67
STATEMENT 19 Mechanical properties of materials should be integrated in a programme content.	32	12	44	0.69
STATEMENT 20 Physical, chemical and mechanical aspects of bulk and surface properties of metallic, polymer and ceramic biomaterials should be integrated in a programme content.	28	11	39	0.61
STATEMENT 21 Selection of biomaterials based on function, biological environments, toxicity and economic aspects should be integrated in a programme content.	33	12	45	0.7

STATEMENT 22 Basic function and performance of passive and active implant materials should be integrated in a programme content.	36	12	48	0.75
STATEMENT 23 Corrosion and degradation mechanisms of biomaterials in different applications should be integrated in a programme content.	32	9	41	0.64
STATEMENT 24 Ergonomics of workstation design including the principles of work with screen monitors should be integrated in a programme content.	28	15	43	0.67
STATEMENT 25 Principles of design and operation of medical equipment should be integrated in a programme content.	35	12	47	0.73
STATEMENT 26 Principles of design and operation of sensors should be integrated in a programme content.	31	13	44	0.69
STATEMENT 27 Ergonomic design of medical devices and tools should be integrated in a programme content.	26	14	40	0.63
STATEMENT 28 Basic principles of biomedicine, electronics and measurements with emphasis on operational characteristics and the selection of the inverters, instruments and systems for the collection and processing of biomedical data should be integrated in a programme content.	28	14	42	0.66
STATEMENT 29 Devices recording biosignal of (pressure, flow, bioelectric dynamics, temperature), and amplifiers should be integrated in a programme content.	34	9	43	0.67
STATEMENT 30 Biomimetics and construction of biomimetic	30	6	36	0.56

medical devices should be integrated in a programme content.				
STATEMENT 31 Medical device regulations should be integrated in a programme content.	30	11	41	0.64
STATEMENT 32 Technologies for measuring myoelectric activity: signal generation; electrodes; biological and environmental noise; amplifiers; sources of signal distortion should be integrated in a programme content.	30	11	41	0.64
STATEMENT 33 Technologies for measuring forces exchanged between the subject and the environment: sensors and signal conditioning units; amplifiers; pressure maps; sources of signal distortions should be integrated in a programme content.	31	10	41	0.64
STATEMENT 34 Technologies for measurement of motion kinematics: interfacing features; sensors; information recognition and extraction; signal processors; noise identification and suppression; off-line and real time tracking; calibration and 3D reconstruction should be integrated in a programme content.	36	13	49	0.77
STATEMENT 35 Human motor behaviour simulation and virtualization; human body modelling; application of captured human motion data to virtual models and scene to simulate interaction should be integrated in a programme content.	31	14	45	0.7
STATEMENT 36 Technologies of additive (layered) manufacturing of organic shapes (also known	26	19	45	0.7

as 3D printing) should be integrated in a programme content.				
STATEMENT 37 Technologies of 3D bioprinting of organic tissues and hydrogels should be integrated in a programme content.	29	17	46	0.72
STATEMENT 38 Technologies of rapid manufacturing and rapid prototyping of personalized medical devices (including, but not limited to 3D printing processes) should be integrated in a programme content.	29	19	48	0.75
STATEMENT 39 Medical imaging technologies (such as computed tomography, magnetic resonance imaging and ultrasound examination) should be integrated in a programme content.	27	19	46	0.72
STATEMENT 40 Principles of design, material selection and production of personalized implants and endoprostheses should be integrated in a programme content.	34	15	49	0.77
STATEMENT 41 Principles of design, material selection, production and programming of personalized artificial organs (such as hearing implants or cardiac implants) should be integrated in a programme content.	33	12	45	0.7
STATEMENT 42 Methodologies of design and production of personalized implants and endoprostheses basing on medical imaging data and additive manufacturing technologies should be integrated in a programme content.	33	16	49	0.77
STATEMENT 43 Basic principles of operation of medical	29	10	39	0.61

(surgical) robots should be integrated in a programme content.				
STATEMENT 44 Basic principles of operation of industrial robots should be integrated in a programme content.	25	13	38	0.59
STATEMENT 45 Design solutions and principles of work of advanced bionic upper limb prosthetics should be integrated in a programme content.	28	9	37	0.58
STATEMENT 46 Knowledge about organ transplantation methods, techniques and restrictions should be integrated in a programme content.	24	8	32	0.5
STATEMENT 47 Basic principles of work of electronic implants should be integrated in a programme content.	35	7	42	0.66
STATEMENT 48 Basic principles of operation and applications of pharmaceutical (drug) implants should be integrated in a programme content.	26	4	30	0.47
STATEMENT 49 Surgical and general medical requirements and restrictions concerning personalized implants and endoprostheses should be integrated in a programme content.	34	6	40	0.63
STATEMENT 50 Future possibilities, development trends and potential, but not yet available solutions in personalized implants and artificial implants should be discussed with students and integrated in a programme content.	30	9	39	0.61
STATEMENT 51 Principles of conducting clinical studies of medical products should be integrated in a programme content.	32	11	43	0.67

STATEMENT 52 Medical standards and rules of certification of medical products should be integrated in a programme content.	32	19	51	0.8
STATEMENT 53 Patenting and intellectual property protection in context of innovative medical devices should be integrated in a programme content.	31	11	42	0.66
STATEMENT 54 Physiological person-environment fit: evolutionary and medical aspects should be integrated in a programme content.	26	9	35	0.55
STATEMENT 55 Holistic psychology and wellness of people with special needs should be integrated in a programme content.	25	12	37	0.58
STATEMENT 56 Soft skills for contact with people with special needs should be integrated in a programme content.	24	15	39	0.61
STATEMENT 57 Accessibility for people with special needs should be integrated in a programme content.	33	13	46	0.72
STATEMENT 58 Building for equality: disability and the built environment, legal requirement of architecture of buildings for people with special needs should be integrated in a programme content.	26	12	38	0.59
STATEMENT 59 Management skills and other soft skills should be practiced and integrated in a programme content.	28	12	40	0.63
STATEMENT 60 Quality management tools and systems in biomedical engineering should be integrated in a programme content.	30	8	38	0.59
				PART B

				Software and digital tools
STATEMENT 1 Both knowledge of software and hardware should be integrated in practical activities.	30	26	56	0.88
STATEMENT 2 Software for medical devices, which will be integrated in a programme content, should be in the native language.	25	15	40	0.63
STATEMENT 3 Orthosis/prosthesis modeling software should be integrated in practical activities.	34	15	49	0.77
STATEMENT 4 Software to analyze the scan of a healthy arm / leg of a patient with an arm / leg after injury should be integrated in practical activities.	38	12	50	0.78
STATEMENT 26 Software to analyze the mechanics of movement from real measurements in a biomechanical laboratory should be integrated in a programme content.	33	17	50	0.78
STATEMENT 6 Operation, inspection and maintainance of diagnostic and therapeutic equipment and software within the healthcare facility, including assistance to physicians during the examination of patients should be integrated in in practical activities.	34	11	45	0.7
STATEMENT 7 Registration and operation of medical equipment, to evaluate cases of failure and to create concepts of preventative measures against these failures should be integrated in practical activities.	36	7	43	0.67
STATEMENT 8 Intelligent (automated) computer aided design models in medicine should be integrated in practical activities.	34	14	48	0.75

STATEMENT 9 Basic types of 3D modelling (wireframe, solid, surface, mesh) should be integrated in practical activities.	26	20	46	0.72
STATEMENT 10 Both freeware and commercial software for medical imaging and digital mesh processing should be considered for use during the classes.	28	17	45	0.7
STATEMENT 11 Both freeware and commercial CAD software should be considered for use during the classes.	26	16	42	0.66
STATEMENT 12 Algorithms of automation of processing of medical data should be integrated in practical activities.	24	18	42	0.66
STATEMENT 13 Information and communication technologies applications for innovative solutions in dentistry should be integrated in practical activities.	32	10	42	0.66
STATEMENT 14 Technologies for affordable and high-speed connectivity for patient data exchange should be integrated in practical activities.	31	10	41	0.64
STATEMENT 15 Human-centered design, offering holistic methodologies for defining, solving problems and innovating in oral healthcare should be integrated in practical activities.	32	10	42	0.66
STATEMENT 16 Basic principles of programming of medical robots should be integrated in practical activities.	30	11	41	0.64
STATEMENT 17 General robot programming course (online	23	12	35	0.55

and offline programming) should be integrated in in practical activities.				
STATEMENT 18 Advanced 3D parametric surface modelling over reverse-engineered 3D data (of medical imaging or 3D scanning) should be integrated in practical activities.	24	15	39	0.61
STATEMENT 19 Telemedicine, telediagnostics and telesurgery software should be included in practical activities.	28	11	39	0.61
STATEMENT 20 CAM software for planning of various manufacturing processes should be integrated in practical activities.	20	11	31	0.48
STATEMENT 21 Basic principles of Computer Aided Engineering (CAE) applications for medical devices, including Finite Element Analysis, should be integrated in practical activities.	26	13	39	0.61
STATEMENT 22 Programming of augmented and mixed reality applications used in medicine should be integrated in practical activities.	30	9	39	0.61
STATEMENT 23 Programming of augmented and mixed reality applications used in medicine should be integrated in practical activities.	27	10	37	0.58
STATEMENT 24 Principles of design of medical architecture (e.g. hospital rooms, care centers, surgery rooms etc.) along with dedicated software should be integrated in practical activities.	23	7	30	0.47
STATEMENT 25 Virtual reality applications aiding the design of medical architecture (e.g. VR hospital	25	9	34	0.53

configurator) should be integrated in practical activities.				
STATEMENT 26 Use of mesh processing software joined with haptic manipulators for design of personalized implants should be integrated in practical activities.	28	9	37	0.58
STATEMENT 27 CAx (CAD/CAM/CAE) software is very important part of bioengineering course and should not be limited to just the basics.	26	18	44	0.69
STATEMENT 28 Basic courses in popular programming languages (C#, Python, Java and others) should be integrated in practical activities.	28	15	43	0.67
STATEMENT 29 Students should learn creating and programming advanced databases in the medical and bioengineering context.	28	9	37	0.58
STATEMENT 30 Principles of building and programming interactive websites using PHP and other web technologies, in the medical context, should be integrated in practical activities.	25	8	33	0.52
STATEMENT 31 Advanced use of MS Excel, including macro programming in VBA language, in the medical and bioengineering context, should be integrated in practical activities.	25	11	36	0.56
STATEMENT 32 Hybrid 3D modelling techniques of anatomical shapes in advanced CAD systems should be integrated in practical activities.	30	11	41	0.64
STATEMENT 33 Applications of advanced dynamic simulation systems (e.g. fluid dynamics,	30	9	39	0.61

thermodynamics) in medical context should be integrated in practical activities.				
STATEMENT 34 Graphics design and UX design for medical software applications should be integrated in practical activities.	29	11	40	0.63
STATEMENT 35 Nature inspired artificial intelligence algorithms should be integrated in practical activities.	33	12	45	0.7
STATEMENT 36 Software tools for visualization of medical data should be integrated in practical activities.	33	16	49	0.77
STATEMENT 37 Project management strategies and advanced task management software tools should be integrated in practical activities.	26	6	32	0.5
STATEMENT 38 As an outcome of studies, graduates should have skills in programming allowing them to create their own software applications for medical use.	27	11	38	0.59
STATEMENT 39 As an outcome of studies, graduates should be able to utilize any source of medical 3D data to digitally design a personalized medical device (e.g. an implant or a prosthesis).	32	14	46	0.72
PART C Teaching and training methodology				
STATEMENT 1 It is important to familiarize the bioengineering students with as much various specialized software as possible, even at the cost of limited hours spent per one software package.	26	7	33	0.52

STATEMENT 2 In learning of 3D anatomical data processing and design of medical devices, project method and group work is more important than laboratory exercises.	26	4	30	0.47
STATEMENT 3 Complementary to face to face discussion in relevance to journal papers as a teaching method should be integrated in a programme content.	34	9	43	0.67
STATEMENT 4 Brainstorming and teamwork as teaching methods should be integrated in a programme content.	42	11	53	0.83
STATEMENT 5 Case studies, films and presentations as teaching methods should be integrated in a programme content.	40	12	52	0.81
STATEMENT 6 Interactive lectures and discussions as teaching methods should be integrated in a programme content.	40	17	57	0.89

Among 105 statements, which were assessed, the following number of statements was accepted after the first round of Delphi study:

- Part A: 50 statements,
- Part B: 11 statements.
- Part C: 4 statements.

It shows that the rest of statements had to be reconsidered in the second round also with the results from the first round, to let the international expert to make a decision.

3 Analysis of the results of the second international round of Delphi method

The results of the second international round of Delphi are presented in Table 4. According to our assumptions, the same as in the first round, the statements which achieved 60% or more than 60% positive responses - "agree" or "strongly agree" (green) were taken as the potential topics for our ErgoDesign course and further analyzed using statistics. The statements, which were assessed below 60% (red), were rejected.

Table 4. Results of Delphi method – second round

Statement	Number of positive responses		SUM	Positive responses %
	Agree	Strongly agree		
PART A Ergonomics and Bioengineering				
STATEMENT 6 Force systems, resultant, equalities, equilibrium, planar force systems, internal forces and moments, internal force diagrams and problems including friction should be integrated in a programme content.	8	4	12	0.86
STATEMENT 30 Biomimetics and construction of biomimetic medical devices should be integrated in a programme content.	7	2	9	0.64
STATEMENT 44 Basic principles of operation of industrial robots should be integrated in a programme content.	9	2	11	0.79
STATEMENT 45 Design solutions and principles of work of advanced bionic upper limb prosthetics should be integrated in a programme content.	10	2	12	0.86
STATEMENT 46 Knowledge about organ transplantation	7	0	7	0.5

methods, techniques and restrictions should be integrated in a programme content.				
STATEMENT 48 Basic principles of operation and applications of pharmaceutical (drug) implants should be integrated in a programme content.	7	0	7	0.5
STATEMENT 54 Physiological person-environment fit: evolutionary and medical aspects should be integrated in a programme content.	9	0	9	0.64
STATEMENT 55 Holistic psychology and wellness of people with special needs should be integrated in a programme content.	8	0	8	0.57
STATEMENT 58 Building for equality: disability and the built environment, legal requirement of architecture of buildings for people with special needs should be integrated in a programme content.	11	0	11	0.79
STATEMENT 60 Quality management tools and systems in biomedical engineering should be integrated in a programme content.	11	1	12	0.86
				PART B **Software and digital tools**
STATEMENT 17 General robot programming course (online and offline programming) should be integrated in in practical activities.	7	2	9	0.64
STATEMENT 20 CAM software for planning of various manufacturing processes should be integrated in practical activities.	9	3	12	0.86
STATEMENT 23 Programming of augmented and mixed reality	12	0	12	0.86

applications used in medicine should be integrated in practical activities.				
STATEMENT 24 Principles of design of medical architecture (e.g. hospital rooms, care centers, surgery rooms etc.) along with dedicated software should be integrated in practical activities.	9	1	10	0.71
STATEMENT 25 Virtual reality applications aiding the design of medical architecture (e.g. VR hospital configurator) should be integrated in practical activities.	10	1	11	0.79
STATEMENT 26 Use of mesh processing software joined with haptic manipulators for design of personalized implants should be integrated in practical activities.	8	3	11	0.79
STATEMENT 29 Students should learn creating and programming advanced databases in the medical and bioengineering context.	11	0	11	0.79
STATEMENT 30 Principles of building and programming interactive websites using PHP and other web technologies, in the medical context, should be integrated in practical activities.	6	1	7	0.5
STATEMENT 31 Advanced use of MS Excel, including macro programming in VBA language, in the medical and bioengineering context, should be integrated in practical activities.	8	0	8	0.57
STATEMENT 37 Project management strategies and advanced task management software tools should be integrated in practical activities.	9	1	10	0.71
STATEMENT 38 As an outcome of studies, graduates should	9	1	10	0.71

have skills in programming allowing them to create their own software applications for medical use.				
				PART C **Teaching and training methodology**
STATEMENT 1 It is important to familiarize the bioengineering students with as much various specialized software as possible, even at the cost of limited hours spent per one software package.	10	1	11	0.79
STATEMENT 2 In learning of 3D anatomical data processing and design of medical devices, project method and group work is more important than laboratory exercises.	6	3	9	0.64

On the basis of our research we achieved consensus for the following statements:

- Part A: 1-45, 47, 49-60 statements,
- Part B: 1-29, 32-39 statements,
- Part C: 6 statements (all accepted).

The information, which was presented in the statements which were not accepted (Part A: 46, 48 and 55; Part B: 30 and 31), will not be included in the design course.

4 Analysis and discussion of the results

In order to define the importance of the topics to be included in our course, we carried out the statistical analysis (Table 5 and Table 6).

Table 5. Analysis of the results from the first round of Delphi method

Statement	Mean	Standard deviation
		PART A Ergonomics and Bioengineering
STATEMENT 1 Ergonomics as a scientific and practical field: efficiency-safety-convenience in transforming, developing different environments, especially work environment adjusted to work with people with special needs should be integrated in a programme content.	4.1	0.64
STATEMENT 2 Fundamental topics of muscle anatomy, physiology and treatment, and muscle modeling should be integrated in a programme content.	3.93	0.78
STATEMENT 3 Anthropometry: human body data in ergonomic assessments and developments should be integrated in a programme content.	3.97	0.83
STATEMENT 4 Contactless measurement techniques for anthropometric data gathering (such as 3D scanning, photogrammetry etc.) should be integrated in a programme content.	4.11	0.75
STATEMENT 5 Mechanical behavior of biological tissues and systems should be integrated in a programme content.	3.82	0.74
STATEMENT 6 Force systems, resultant, equalities, equilibrium, planar force systems, internal forces and moments, internal force diagrams and problems including friction should be integrated in a programme content.	3.73	0.88
STATEMENT 7 Kinematics and kinetics of movement and muscle force system in a programme content.	3.93	0.68
STATEMENT 8 Knowledge engineering and expert systems should be integrated in a programme content.	4.07	0.73
STATEMENT 9 Fundamental mathematical models in medical simulations should be integrated in a programme content.	3.93	0.73

STATEMENT 10 Bioinformatics principles should be integrated in a programme content.	3.87	0.83
STATEMENT 11 Computational methods in biomedical technology using finite elements should be integrated in a programme content.	3.89	0.86
STATEMENT 12 Kinematics, dynamics and energetic aspects of human movement using biomechanical models should be integrated in a programme content.	3.94	0.72
STATEMENT 13 Biomechanical models of the musculoskeletal system based on the anthropometry of the human body and the mechanical laws of movement should be integrated in a programme content.	3.82	0.91
STATEMENT 14 Biomechanical applications in human movement should be integrated in a programme content.	3.97	0.85
STATEMENT 15 Basic concepts on solids mechanics should be integrated in a programme content.	3.85	0.82
STATEMENT 16 Interaction of biomaterials with biological tissues and biological fluids should be integrated in a programme content.	3.8	0.83
STATEMENT 17 Biomaterials in biomedical applications should be integrated in a programme content.	3.88	0.85
STATEMENT 18 Interaction of biomaterials with the human body, inflammation, trauma, infections, physiology, biomechanics, bioelectric phenomena, tissue engineering, cardiovascular models should be integrated in a programme content.	3.87	0.79
STATEMENT 19 Mechanical properties of materials should be integrated in a programme content.	3.88	0.83
STATEMENT 20 Physical, chemical and mechanical aspects of bulk and surface properties of metallic, polymer and ceramic biomaterials should be integrated in a programme content.	3.79	0.78
STATEMENT 21 Selection of biomaterials based on function, biological environments, toxicity and economic aspects should be integrated in a programme content.	3.9	0.77
STATEMENT 22 Basic function and performance of passive and active implant materials should be integrated in a programme content.	3.97	0.71

STATEMENT 23 Corrosion and degradation mechanisms of biomaterials in different applications should be integrated in a programme content.	3.77	0.79
STATEMENT 24 Ergonomics of workstation design including the principles of work with screen monitors should be integrated in a programme content.	3.84	0.95
STATEMENT 25 Principles of design and operation of medical equipment should be integrated in a programme content.	3.95	0.69
STATEMENT 26 Principles of design and operation of sensors should be integrated in a programme content.	3.89	0.8
STATEMENT 27 Ergonomic design of medical devices and tools should be integrated in a programme content.	3.85	0.84
STATEMENT 28 Basic principles of biomedicine, electronics and measurements with emphasis on operational characteristics and the selection of the inverters, instruments and systems for the collection and processing of biomedical data should be integrated in a programme content.	3.86	0.88
STATEMENT 29 Devices recording biosignal of (pressure, flow, bioelectric dynamics, temperature), and amplifiers should be integrated in a programme content.	3.79	0.77
STATEMENT 30 Biomimetics and construction of biomimetic medical devices should be integrated in a programme content.	3.57	0.89
STATEMENT 31 Medical device regulations should be integrated in a programme content.	3.83	0.79
STATEMENT 32 Technologies for measuring myoelectric activity: signal generation; electrodes; biological and environmental noise; amplifiers; sources of signal distortion should be integrated in a programme content.	3.78	0.87
STATEMENT 33 Technologies for measuring forces exchanged between the subject and the environment: sensors and signal conditioning units; amplifiers; pressure maps; sources of signal distortions should be integrated in a programme content.	3.8	0.75
STATEMENT 34 Technologies for measurement of motion kinematics: interfacing features; sensors; information recognition and extraction; signal processors; noise identification and suppression; off-line and real time tracking; calibration and 3D reconstruction should be integrated in a programme content.	3.97	0.75

STATEMENT 35 Human motor behaviour simulation and virtualization; human body modelling; application of captured human motion data to virtual models and scene to simulate interaction should be integrated in a programme content.	3.92	0.8
STATEMENT 36 Technologies of additive (layered) manufacturing of organic shapes (also known as 3D printing) should be integrated in a programme content.	3.92	1
STATEMENT 37 Technologies of 3D bioprinting of organic tissues and hydrogels should be integrated in a programme content.	3.9	0.97
STATEMENT 38 Technologies of rapid manufacturing and rapid prototyping of personalized medical devices (including, but not limited to 3D printing processes) should be integrated in a programme content.	4	0.91
STATEMENT 39 Medical imaging technologies (such as computed tomography, magnetic resonance imaging and ultrasound examination) should be integrated in a programme content.	3.97	0.9
STATEMENT 40 Principles of design, material selection and production of personalized implants and endoprostheses should be integrated in a programme content.	3.97	0.81
STATEMENT 41 Principles of design, material selection, production and programming of personalized artificial organs (such as hearing implants or cardiac implants) should be integrated in a programme content.	3.92	0.74
STATEMENT 42 Methodologies of design and production of personalized implants and endoprostheses basing on medical imaging data and additive manufacturing technologies should be integrated in a programme content.	4	0.81
STATEMENT 43 Basic principles of operation of medical (surgical) robots should be integrated in a programme content.	3.72	0.87
STATEMENT 44 Basic principles of operation of industrial robots should be integrated in a programme content.	3.69	0.99
STATEMENT 45 Design solutions and principles of work of advanced bionic upper limb prosthetics should be integrated in a programme content.	3.71	0.84
STATEMENT 46 Knowledge about organ transplantation methods, techniques and restrictions should be integrated in a programme content.	3.47	1

STATEMENT 47 Basic principles of work of electronic implants should be integrated in a programme content.	3.69	0.91
STATEMENT 48 Basic principles of operation and applications of pharmaceutical (drug) implants should be integrated in a programme content.	3.29	1.08
STATEMENT 49 Surgical and general medical requirements and restrictions concerning personalized implants and endoprostheses should be integrated in a programme content.	3.69	0.84
STATEMENT 50 Future possibilities, development trends and potential, but not yet available solutions in personalized implants and artificial implants should be discussed with students and integrated in a programme content.	3.65	0.95
STATEMENT 51 Principles of conducting clinical studies of medical products should be integrated in a programme content.	3.81	0.83
STATEMENT 52 Medical standards and rules of certification of medical products should be integrated in a programme content.	4.06	0.87
STATEMENT 53 Patenting and intellectual property protection in context of innovative medical devices should be integrated in a programme content.	3.8	0.81
STATEMENT 54 Physiological person-environment fit: evolutionary and medical aspects should be integrated in a programme content.	3.56	0.97
STATEMENT 55 Holistic psychology and wellness of people with special needs should be integrated in a programme content.	3.77	0.91
STATEMENT 56 Soft skills for contact with people with special needs should be integrated in a programme content.	3.8	0.93
STATEMENT 57 Accessibility for people with special needs should be integrated in a programme content.	3.92	0.83
STATEMENT 58 Building for equality: disability and the built environment, legal requirement of architecture of buildings for people with special needs should be integrated in a programme content.	3.73	0.92
STATEMENT 59 Management skills and other soft skills should be practiced and integrated in a programme content.	3.7	0.99

STATEMENT 60 Quality management tools and systems in biomedical engineering should be integrated in a programme content.	3.71	0.79
		PART B **Software and digital tools**
STATEMENT 1 Both knowledge of software and hardware should be integrated in practical activities.	4.22	0.89
STATEMENT 2 Software for medical devices, which will be integrated in a programme content, should be in the native language.	3.71	1.09
STATEMENT 3 Orthosis/prosthesis modeling software should be integrated in practical activities.	4.03	0.74
STATEMENT 4 Software to analyze the scan of a healthy arm / leg of a patient with an arm / leg after injury should be integrated in practical activities.	3.87	0.91
STATEMENT 26 Software to analyze the mechanics of movement from real measurements in a biomechanical laboratory should be integrated in a programme content.	3.97	0.9
STATEMENT 6 Operation, inspection and maintainance of diagnostic and therapeutic equipment and software within the healthcare facility, including assistance to physicians during the examination of patients should be integrated in in practical activities.	3.86	0.86
STATEMENT 7 Registration and operation of medical equipment, to evaluate cases of failure and to create concepts of preventative measures against these failures should be integrated in practical activities.	3.78	0.72
STATEMENT 8 Intelligent (automated) computer aided design models in medicine should be integrated in practical activities.	3.97	0.82
STATEMENT 9 Basic types of 3D modelling (wireframe, solid, surface, mesh) should be integrated in practical activities.	3.97	1
STATEMENT 10 Both freeware and commercial software for medical imaging and digital mesh processing should be considered for use during the classes.	3.97	0.86
STATEMENT 11 Both freeware and commercial CAD software should be considered for use during the classes.	3.91	0.9

STATEMENT 12 Algorithms of automation of processing of medical data should be integrated in practical activities.	3.97	0.89
STATEMENT 13 Information and communication technologies applications for innovative solutions in dentistry should be integrated in practical activities.	3.8	0.77
STATEMENT 14 Technologies for affordable and high-speed connectivity for patient data exchange should be integrated in practical activities.	3.72	0.93
STATEMENT 15 Human-centered design, offering holistic methodologies for defining, solving problems and innovating in oral healthcare should be integrated in practical activities.	3.77	0.89
STATEMENT 16 Basic principles of programming of medical robots should be integrated in practical activities.	3.7	0.95
STATEMENT 17 General robot programming course (online and offline programming) should be integrated in in practical activities.	3.72	0.91
STATEMENT 18 Advanced 3D parametric surface modelling over reverse-engineered 3D data (of medical imaging or 3D scanning) should be integrated in practical activities.	3.86	0.88
STATEMENT 19 Telemedicine, telediagnostics and telesurgery software should be included in practical activities.	3.75	0.93
STATEMENT 20 CAM software for planning of various manufacturing processes should be integrated in practical activities.	3.65	0.92
STATEMENT 21 Basic principles of Computer Aided Engineering (CAE) applications for medical devices, including Finite Element Analysis, should be integrated in practical activities.	3.84	0.83
STATEMENT 22 Programming of augmented and mixed reality applications used in medicine should be integrated in practical activities.	3.72	0.9
STATEMENT 23 Programming of augmented and mixed reality applications used in medicine should be integrated in practical activities.	3.66	0.98
STATEMENT 24 Principles of design of medical architecture (e.g. hospital rooms, care	3.44	1.04

centers, surgery rooms etc.) along with dedicated software should be integrated in practical activities.		
STATEMENT 25 Virtual reality applications aiding the design of medical architecture (e.g. VR hospital configurator) should be integrated in practical activities.	3.63	0.96
STATEMENT 26 Use of mesh processing software joined with haptic manipulators for design of personalized implants should be integrated in practical activities.	3.8	0.81
STATEMENT 27 CAx (CAD/CAM/CAE) software is very important part of bioengineering course and should not be limited to just the basics.	3.93	0.97
STATEMENT 28 Basic courses in popular programming languages (C#, Python, Java and others) should be integrated in practical activities.	3.82	0.95
STATEMENT 29 Students should learn creating and programming advanced databases in the medical and bioengineering context.	3.67	0.88
STATEMENT 30 Principles of building and programming interactive websites using PHP and other web technologies, in the medical context, should be integrated in practical activities.	3.5	1
STATEMENT 31 Advanced use of MS Excel, including macro programming in VBA language, in the medical and bioengineering context, should be integrated in practical activities.	3.6	0.98
STATEMENT 32 Hybrid 3D modelling techniques of anatomical shapes in advanced CAD systems should be integrated in practical activities.	3.78	0.91
STATEMENT 33 Applications of advanced dynamic simulation systems (e.g. fluid dynamics, thermodynamics) in medical context should be integrated in practical activities.	3.74	0.77
STATEMENT 34 Graphics design and UX design for medical software applications should be integrated in practical activities.	3.81	0.85
STATEMENT 35 Nature inspired artificial intelligence algorithms should be integrated in practical activities.	3.8	0.93
STATEMENT 36 Software tools for visualization of medical data should be integrated in practical activities.	4.02	0.81

STATEMENT 37 Project management strategies and advanced task management software tools should be integrated in practical activities.	3.5	0.89
STATEMENT 38 As an outcome of studies, graduates should have skills in programming allowing them to create their own software applications for medical use.	3.7	0.9
STATEMENT 39 As an outcome of studies, graduates should be able to utilize any source of medical 3D data to digitally design a personalized medical device (e.g. an implant or a prosthesis).	3.97	0.79
PART C **Teaching and training methodology**		
STATEMENT 1 It is important to familiarize the bioengineering students with as much various specialized software as possible, even at the cost of limited hours spent per one software package.	3.38	1.08
STATEMENT 2 In learning of 3D anatomical data processing and design of medical devices, project method and group work is more important than laboratory exercises.	3.34	0.93
STATEMENT 3 Complementary to face to face discussion in relevance to journal papers as a teaching method should be integrated in a programme content.	3.69	0.98
STATEMENT 4 Brainstorming and teamwork as teaching methods should be integrated in a programme content.	3.98	0.72
STATEMENT 5 Case studies, films and presentations as teaching methods should be integrated in a programme content.	3.97	0.77
STATEMENT 6 Interactive lectures and discussions as teaching methods should be integrated in a programme content.	4.15	0.77

Table 6. Analysis of the results from the second round of Delphi method

Statement	Mean	Standard Deviation
PART A **Ergonomics and Bioengineering**		
STATEMENT 6 Force systems, resultant, equalities, equilibrium, planar force systems,	4.23	0.60

internal forces and moments, internal force diagrams and problems including friction should be integrated in a programme content.		
STATEMENT 30 Biomimetics and construction of biomimetic medical devices should be integrated in a programme content.	3.85	0.69
STATEMENT 44 Basic principles of operation of industrial robots should be integrated in a programme content.	3.71	1.07
STATEMENT 45 Design solutions and principles of work of advanced bionic upper limb prosthetics should be integrated in a programme content.	3.86	0.95
STATEMENT 46 Knowledge about organ transplantation methods, techniques and restrictions should be integrated in a programme content.	3.23	1.01
STATEMENT 48 Basic principles of operation and applications of pharmaceutical (drug) implants should be integrated in a programme content.	3.15	1.07
STATEMENT 54 Physiological person-environment fit: evolutionary and medical aspects should be integrated in a programme content.	3.46	0.97
STATEMENT 55 Holistic psychology and wellness of people with special needs should be integrated in a programme content.	3.33	1.15
STATEMENT 58 Building for equality: disability and the built environment, legal requirement of architecture of buildings for people with special needs should be integrated in a programme content.	3.57	0.94
STATEMENT 60 Quality management tools and systems in biomedical engineering should be integrated in a programme content.	3.79	0.89
PART B Software and digital tools		
STATEMENT 17 General robot programming course (online and offline programming) should be integrated in in practical activities.	3.54	1.27
STATEMENT 20 CAM software for planning of various manufacturing processes should be integrated in practical activities.	4.15	0.55
STATEMENT 23 Programming of augmented and mixed reality applications used in medicine should be integrated in practical activities.	3.85	0.55

STATEMENT 24 Principles of design of medical architecture (e.g. hospital rooms, care centers, surgery rooms etc.) along with dedicated software should be integrated in practical activities.	3.71	0.73
STATEMENT 25 Virtual reality applications aiding the design of medical architecture (e.g. VR hospital configurator) should be integrated in practical activities.	3.86	0.53
STATEMENT 26 Use of mesh processing software joined with haptic manipulators for design of personalized implants should be integrated in practical activities.	4.08	0.64
STATEMENT 29 Students should learn creating and programming advanced databases in the medical and bioengineering context.	3.77	0.60
STATEMENT 30 Principles of building and programming interactive websites using PHP and other web technologies, in the medical context, should be integrated in practical activities.	3.31	1.03
STATEMENT 31 Advanced use of MS Excel, including macro programming in VBA language, in the medical and bioengineering context, should be integrated in practical activities.	3.46	0.78
STATEMENT 37 Project management strategies and advanced task management software tools should be integrated in practical activities.	3.64	0.84
STATEMENT 38 As an outcome of studies, graduates should have skills in programming allowing them to create their own software applications for medical use.	3.71	0.73
PART C **Teaching and training methodology**		
STATEMENT 1 It is important to familiarize the bioengineering students with as much various specialized software as possible, even at the cost of limited hours spent per one software package.	3.64	1.01
STATEMENT 2 In learning of 3D anatomical data processing and design of medical devices, project method and group work is more important than laboratory exercises.	3.85	0.90

The calculated mean and standard deviation for both rounds will provide a support for further decisions in designing principles and curriculum. On their basis the decision will be taken which

topics should be treated as a priority in course. The mean and standard deviation shows a bigger perspective on the achieved results as do not only refer to the number of respondents who “agree” or “strongly agree” regarding one topic. When SD is low it indicates that the values tend to be close to the mean (also called the expected value) of the set, while a high standard deviation indicates that the values are spread out over a wider range. Therefore, we will pay more attention to the statements which received mean as high as possible while the lowest deviation as it is depicted in colours in Table 5 and 6. The first ten statements, where the mean is the highest and standard deviation is lower than 0.8 are:

- "STATEMENT 6: Interactive lectures and discussions as teaching methods should be integrated in a programme content. "
- "STATEMENT 4: Contactless measurement techniques for anthropometric data gathering (such as 3D scanning, photogrammetry etc.) should be integrated in a programme content."
- "STATEMENT 1: Ergonomics as a scientific and practical field: efficiency-safety-convenience in transforming, developing different environments, especially work environment adjusted to work with people with special needs should be integrated in a programme content.
- "STATEMENT 8: Knowledge engineering and expert systems should be integrated in a programme content. "
- "STATEMENT 3: Orthosis/prosthesis modeling software should be integrated in practical activities. "
- "STATEMENT 4: Brainstorming and teamwork as teaching methods should be integrated in a programme content. "
- "STATEMENT 22: Basic function and performance of passive and active implant materials should be integrated in a programme content."
- "STATEMENT 34: Technologies for measurement of motion kinematics: interfacing features; sensors; information recognition and extraction; signal processors; noise identification and suppression; off-line and real time tracking; calibration and 3D reconstruction should be integrated in a programme content."
- "STATEMENT 5: Case studies, films and presentations as teaching methods should be integrated in a programme content."
- "STATEMENT 39: As an outcome of studies, graduates should be able to utilize any source of medical 3D data to digitally design a personalized medical device (e.g. an implant or a prosthesis)."

CONCLUSIONS

The Delphi study was conducted in national and international level by 5 partner university countries. It allowed us to collect answers from 67 and 17 respondents, respectively. After checking our assumptions regarding the characteristics of the experts these numbers were decreased to 64 and 14 people, respectively. In spite of this fact, we achieved the indicators of the projects (at least 40 and 8 participants in each round). To our study we invited people from three sectors: academia, practitioners and students. Among them there were also respondents who work with the people with the special needs (31 respondents).

The study allowed us to outline topics/keywords defined as statements which are necessary to be included in the curriculum. Furthermore, it enabled to define possible methods and techniques which we can use to design the course. We achieved consensus for 83 statements after the first round of the Delphi study. The 23 statements were reassessed in the second round and finally, only 5 of them were not accepted (Part A: 46, 48 and 55; Part B: 30 and 31), and they will not be included in the designed course.

APPENDICES

Sygnatura czasowa	Adres e-mail	Please select your country:	Please indicate your expertise sector:
11.27.2022 12:18:29	di	Bulgaria	academia
11.28.2022 21:40:13	di	Bulgaria	medicine
11.28.2022 23:18:39	al	Greece	health care
11.29.2022 15:04:31	m	Bulgaria	academia, health care
11.30.2022 11:40:41	p.	Poland	engineering
11.30.2022 14:13:17	pi	Poland	engineering, IT, software engineering
11.30.2022 14:16:08	ka	Poland	engineering, IT, software engineering
11.30.2022 18:44:38	m	Poland	academia, education, engineering, ergonomic
12.1.2022 18:44:47	el	Greece	engineering
12.2.2022 8:24:23	ja	Poland	academia, education, engineering
12.5.2022 15:51:14	g.	Bulgaria	academia
12.6.2022 8:21:17	bo	Bulgaria	engineering
12.6.2022 11:53:48	ka	Poland	academia
12.6.2022 12:52:06	m	Poland	education, engineering, student
12.6.2022 21:00:28	ka	Greece	engineering
12.6.2022 21:33:20	jo	Slovakia	education
12.6.2022 23:10:45	kl	Slovakia	engineering
12.7.2022 9:23:53	pi	Slovakia	IT
12.7.2022 9:42:55	m	Slovakia	engineering
12.7.2022 10:03:53	pi	Slovakia	engineering
12.7.2022 12:26:27	m	Slovakia	education
12.7.2022 16:45:56	m	Poland	engineering, ergonomics, medicine
12.7.2022 20:10:16	sl	Slovakia	engineering
12.8.2022 18:08:46	ka	Hungary	academia
12.8.2022 18:16:00	ha	Hungary	academia
12.8.2022 20:21:04	ha	Hungary	academia, education, engineering
12.9.2022 9:12:50	n.	Hungary	software engineering
12.9.2022 13:00:40	al	Poland	academia, engineering
12.9.2022 17:21:06	m	Greece	engineering
12.9.2022 17:23:16	nl	Greece	academia, engineering
12.10.2022 20:55:00	na	Greece	engineering
12.10.2022 22:39:35	di	Slovakia	engineering
12.10.2022 22:54:07	ha	Slovakia	other
12.11.2022 19:27:38	sa	Greece	academia
12.12.2022 16:52:16	m	Greece	academia
12.12.2022 18:11:49	m	Bulgaria	education
12.12.2022 18:57:50	di	Bulgaria	dental, education, health care
12.12.2022 20:31:35	to	Bulgaria	engineering, other

12.12.2022 20:40:12	zl	Bulgaria	software engineering, technical device operat
12.13.2022 12:11:39	v	Greece	other
12.13.2022 19:05:38	p	Other	health care
12.13.2022 19:59:29	ja	Hungary	dental
12.14.2022 19:56:39	sl	Greece	engineering
12.15.2022 12:23:39	jc	Slovakia	education
12.16.2022 10:55:00	k	Hungary	academia
12.16.2022 11:05:54	o	Hungary	education, engineering, IT
12.16.2022 12:50:31	ri	Other	education, engineering, ergonomics, technica
12.16.2022 18:45:39	b	Hungary	academia, education
12.19.2022 13:16:00	jc	Hungary	education, rehabiltation
12.21.2022 16:49:58	ra	Hungary	engineering, student
12.22.2022 12:12:10	m	Slovakia	academia, student
12.22.2022 12:55:25	bi	Hungary	other
12.22.2022 15:21:35	k	Bulgaria	student
12.22.2022 15:24:12	a	Bulgaria	student
12.22.2022 15:32:26	k	Bulgaria	student
12.22.2022 15:33:17	m	Bulgaria	student
12.22.2022 15:36:46	te	Bulgaria	education, student
12.22.2022 15:46:24	c	Bulgaria	engineering, IT, software engineering, studen
12.22.2022 15:50:58	e	Bulgaria	IT
12.22.2022 15:52:38	k	Bulgaria	student
12.22.2022 15:55:26	d	Bulgaria	IT, student
12.22.2022 15:55:55	v	Bulgaria	engineering
12.22.2022 21:49:04	ra	Bulgaria	student
12.22.2022 23:41:08	m	Bulgaria	engineering
12.22.2022 23:46:19	C	Bulgaria	engineering
12.28.2022 13:19:34	a	Poland	academia, education, engineering, ergonomic
1.1.2023 17:29:18	e	Hungary	psychology

STATEMENT 1 Ergonomics as a scientific and practical field: efficiency-safety-convenience in transforming, developing different environments, especially work environment adjusted to work with people with special needs should be integrated in a programme content.	STATEMENT 2 Fundamental topics of muscle anatomy, physiology and treatment, and muscle modeling should be integrated in a programme content.	STATEMENT 3 Anthropometry: human body data in ergonomic assessments and developments should be integrated in a programme content.	STATEMENT 4 Contactless measurement techniques for anthropometric data gathering (such as 3D scanning, photogrammetry etc.) should be integrated in a programme content.
Strongly agree	Agree	Agree	Strongly agree
Agree	Neither agree nor disag	Neither agree nor disag	Agree
Agree	Strongly agree	Agree	Agree
Strongly agree	Strongly agree	Strongly agree	Strongly agree
Agree	Strongly agree	Agree	Strongly agree
Agree	Agree	Agree	Agree
Agree	Strongly agree	Agree	Strongly agree
Strongly agree	Agree	Strongly agree	Agree
Agree	Agree	Neither agree nor disag	Agree
Strongly agree	Agree	Strongly agree	Strongly agree
Agree	Disagree	Disagree	Neither agree nor disag
Neither agree nor disag	Disagree	Disagree	Neither agree nor disag
Agree	Agree	Agree	Agree
Agree	Agree	Agree	Agree
Strongly agree	Agree	No anwer	Agree
Agree	Agree	Strongly agree	Agree
Agree	Agree	Agree	Agree
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STATEMENT 5 Mechanical behavior of biological tissues and systems should be integrated in a programme content.	STATEMENT 6 Force systems, resultant, equalities, equilibrium, planar force systems, internal forces and moments, internal force diagrams and problems including friction should be integrated in a programme content.	STATEMENT 7 Kinematics and kinetics of movement and muscle force system in a programme content.	STATEMENT 8 Knowledge engineering and expert systems should be integrated in a programme content.
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STATEMENT 9 Fundamental mathematical models in medical simulations should be integrated in a programme content.	STATEMENT 10 Bioinformatics principles should be integrated in a programme content.	STATEMENT 11 Computational methods in biomedical technology using finite elements should be integrated in a programme content.	STATEMENT 12 Kinematics, dynamics and energetic aspects of human movement using biomechanical models should be integrated in a programme content.
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STATEMENT 13 Biomechanical models of the musculoskeletal system based on the anthropometry of the human body and the mechanical laws of movement should be integrated in a programme content.	STATEMENT 14 Biomechanical applications in human movement should be integrated in a programme content.	STATEMENT 15 Basic concepts on solids mechanics should be integrated in a programme content.	STATEMENT 16 Interaction of biomaterials with biological tissues and biological fluids should be integrated in a programme content.
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STATEMENT 17 Biomaterials in biomedical applications should be integrated in a programme content.	STATEMENT 18 Interaction of biomaterials with the human body, inflammation, trauma, infections, physiology, biomechanics, bioelectric phenomena, tissue engineering, cardiovascular models should be integrated in a programme content.	STATEMENT 19 Mechanical properties of materials should be integrated in a programme content.	STATEMENT 20 Physical, chemical and mechanical aspects of bulk and surface properties of metallic, polymer and ceramic biomaterials should be integrated in a programme content.
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STATEMENT 21 Selection of biomaterials based on function, biological environments, toxicity and economic aspects should be integrated in a programme content.	STATEMENT 22 Basic function and performance of passive and active implant materials should be integrated in a programme content.	STATEMENT 23 Corrosion and degradation mechanisms of biomaterials in different applications should be integrated in a programme content.	STATEMENT 24 Ergonomics of workstation design including the principles of work with screen monitors should be integrated in a programme content.
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STATEMENT 25 Principles of design and operation of medical equipment should be integrated in a programme content.	STATEMENT 26 Principles of design and operation of sensors should be integrated in a programme content.	STATEMENT 27 Ergonomic design of medical devices and tools should be integrated in a programme content.	STATEMENT 28 Basic principles of biomedicine, electronics and measurements with emphasis on operational characteristics and the selection of the inverters, instruments and systems for the collection and processing of biomedical data should be integrated in
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STATEMENT 29 Devices recording biosignal of (pressure, flow, bioelectric dynamics, temperature), and amplifiers should be integrated in a programme content.	STATEMENT 30 Biomimetics and construction of biomimetic medical devices should be integrated in a programme content.	STATEMENT 31 Medical device regulations should be integrated in a programme content.	STATEMENT 32 Technologies for measuring myoelectric activity: signal generation; electrodes; biological and environmental noise; amplifiers; sources of signal distortion should be integrated in a programme content.
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STATEMENT 33 Technologies for measuring forces exchanged between the subject and the environment: sensors and signal conditioning units; amplifiers; pressure maps; sources of signal distortions should be integrated in a programme content.	STATEMENT 34 Technologies for measurement of motion kinematics: interfacing features; sensors; information recognition and extraction; signal processors; noise identification and suppression; off-line and real time tracking; calibration and 3D reconstruction should be integrated in a	STATEMENT 35 Human motor behaviour simulation and virtualization; human body modelling; application of captured human motion data to virtual models and scene to simulate interaction should be integrated in a programme content.	STATEMENT 36 Technologies of additive (layered) manufacturing of organic shapes (also known as 3D printing) should be integrated in a programme content.
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STATEMENT 37 Technologies of 3D bioprinting of organic tissues and hydrogels should be integrated in a programme content.	STATEMENT 38 Technologies of rapid manufacturing and rapid prototyping of personalized medical devices (including, but not limited to 3D printing processes) should be integrated in a programme content.	STATEMENT 39 Medical imaging technologies (such as computed tomography, magnetic resonance imaging and ultrasound examination) should be integrated in a programme content.	STATEMENT 40 Principles of design, material selection and production of personalized implants and endoprostheses should be integrated in a programme content.
Agree	Neither agree nor disag	Neither agree nor disag	Strongly agree
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STATEMENT 41 Principles of design, material selection, production and programming of personalized artificial organs (such as hearing implants or cardiac implants) should be integrated in a programme content.	STATEMENT 42 Methodologies of design and production of personalized implants and endoprostheses basing on medical imaging data and additive manufacturing technologies should be integrated in a programme content.	STATEMENT 43 Basic principles of operation of medical (surgical) robots should be integrated in a programme content.	STATEMENT 44 Basic principles of operation of industrial robots should be integrated in a programme content.
Strongly agree	Strongly agree	Neither agree nor disag	Disagree
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STATEMENT 45 Design solutions and principles of work of advanced bionic upper limb prosthetics should be integrated in a programme content.	STATEMENT 46 Knowledge about organ transplantation methods, techniques and restrictions should be integrated in a programme content.	STATEMENT 47 Basic principles of work of electronic implants should be integrated in a programme content.	STATEMENT 48 Basic principles of operation and applications of pharmaceutical (drug) implants should be integrated in a programme content.
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STATEMENT 49 Surgical and general medical requirements and restrictions concerning personalized implants and endoprostheses should be integrated in a programme content.	STATEMENT 50 Future possibilities, development trends and potential, but not yet available solutions in personalized implants and artificial implants should be discussed with students and integrated in a programme content.	STATEMENT 51 Principles of conducting clinical studies of medical products should be integrated in a programme content.	STATEMENT 52 Medical standards and rules of certification of medical products should be integrated in a programme content.
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STATEMENT 53 Patenting and intellectual property protection in context of innovative medical devices should be integrated in a programme content.	STATEMENT 54 Physiological person-environment fit: evolutionary and medical aspects should be integrated in a programme content.	STATEMENT 55 Holistic psychology and wellness of people with special needs should be integrated in a programme content.	STATEMENT 56 Soft skills for contact with people with special needs should be integrated in a programme content.
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Strongly agree	Strongly agree	Strongly agree	Neither agree nor disag
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STATEMENT 57 Accessibility for people with special needs should be integrated in a programme content.	STATEMENT 58 Building for equality: disability and the built environment, legal requirement of architecture of buildings for people with special needs should be integrated in a programme content.	STATEMENT 59 Management skills and other soft skills should be practiced and integrated in a programme content.	STATEMENT 60 Quality management tools and systems in biomedical engineering should be integrated in a programme content.
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Neither agree nor disag	Agree	Agree	Strongly agree
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STATEMENT 1 Both knowledge of software and hardware should be integrated in practical activities.	STATEMENT 2 Software for medical devices, which will be integrated in a programme content, should be in the native language.	STATEMENT 3 Orthosis/prosthesis modeling software should be integrated in practical activities.	STATEMENT 4 Software to analyze the scan of a healthy arm / leg of a patient with an arm / leg after injury should be integrated in practical activities.
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Agree	Neither agree or disagr	Agree	Disagree
Agree	No answer	Agree	Agree
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STATEMENT 26 Software to analyze the mechanics of movement from real measurements in a biomechanical laboratory should be integrated in a programme content.	STATEMENT 6 Operation, inspection and maintainance of diagnostic and therapeutic equipment and software within the healthcare facility, including assistance to physicians during the examination of patients should be integrated in in practical activities.	STATEMENT 7 Registration and operation of medical equipment, to evaluate cases of failure and to create concepts of preventative measures against these failures should be integrated in practical activities.	STATEMENT 8 Intelligent (automated) computer aided design models in medicine should be integrated in practical activities.
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STATEMENT 9 Basic types of 3D modelling (wireframe, solid, surface, mesh) should be integrated in practical activities.	STATEMENT 10 Both freeware and commercial software for medical imaging and digital mesh processing should be considered for use during the classes.	STATEMENT 11 Both freeware and commercial CAD software should be considered for use during the classes.	STATEMENT 12 Algorithms of automation of processing of medical data should be integrated in practical activities.
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STATEMENT 13 Information and communication technologies applications for innovative solutions in dentistry should be integrated in practical activities.	STATEMENT 14 Technologies for affordable and high-speed connectivity for patient data exchange should be integrated in practical activities.	STATEMENT 15 Human-centered design, offering holistic methodologies for defining, solving problems and innovating in oral healthcare should be integrated in practical activities.	STATEMENT 16 Basic principles of programming of medical robots should be integrated in practical activities.
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STATEMENT 17 General robot programming course (online and offline programming) should be integrated in in practical activities.	STATEMENT 18 Advanced 3D parametric surface modelling over reverse-engineered 3D data (of medical imaging or 3D scanning) should be integrated in practical activities.	STATEMENT 19 Telemedicine, telediagnostics and telesurgery software should be included in practical activities.	STATEMENT 20 CAM software for planning of various manufacturing processes should be integrated in practical activities.
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Disagree	Agree	No answer	No answer
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STATEMENT 21 Basic principles of Computer Aided Engineering (CAE) applications for medical devices, including Finite Element Analysis, should be integrated in practical activities.	STATEMENT 22 Programming of augmented and mixed reality applications used in medicine should be integrated in practical activities.	STATEMENT 23 Programming of augmented and mixed reality applications used in medicine should be integrated in practical activities.	STATEMENT 24 Principles of design of medical architecture (e.g. hospital rooms, care centers, surgery rooms etc.) along with dedicated software should be integrated in practical activities.
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STATEMENT 25 Virtual reality applications aiding the design of medical architecture (e.g. VR hospital configurator) should be integrated in practical activities.	STATEMENT 26 Use of mesh processing software joined with haptic manipulators for design of personalized implants should be integrated in practical activities.	STATEMENT 27 CAx (CAD/CAM/CAE) software is very important part of bioengineering course and should not be limited to just the basics.	STATEMENT 28 Basic courses in popular programming languages (C#, Python, Java and others) should be integrated in practical activities.
Disagree	Agree	Agree	Neither agree or disagr
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Agree	No answer	Strongly agree	Strongly agree
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Agree	Agree	Agree	Disagree
Agree	No answer	Agree	Agree
Strongly agree	Strongly agree	Strongly agree	Strongly agree
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
Disagree	Neither agree or disagr	Neither agree or disagr	Disagree
Agree	Agree	Agree	Agree
Strongly disagree	Strongly disagree	Strongly disagree	Strongly agree
Strongly agree	No answer	Strongly agree	Strongly agree
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Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Disagree
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Disagree	Agree	Neither agree or disagr	Agree
Neither agree or disagr	Agree	Agree	Agree
Strongly agree	Agree	Agree	Agree
Strongly disagree	No answer	Strongly agree	Agree
Agree	Neither agree or disagr	Agree	Agree
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No answer	No answer	No answer	Agree
Agree	Strongly agree	Agree	Strongly agree
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No answer	No answer	No answer	Strongly agree
Agree	Neither agree or disagr	Agree	Agree
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No answer	Strongly agree	Disagree	Agree
Disagree	Neither agree or disagr	Strongly agree	Strongly disagree
Agree	Disagree	Agree	Neither agree or disagr
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No answer	No answer	No answer	No answer
Agree	Agree	Agree	Agree
Agree	Neither agree or disagr	Agree	Strongly agree
Neither agree or disagr	No answer	Strongly agree	Neither agree or disagr
Agree	Neither agree or disagr	Disagree	Neither agree or disagr
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Disagree

STATEMENT 29 Students should learn creating and programming advanced databases in the medical and bioengineering context.	STATEMENT 30 Principles of building and programming interactive websites using PHP and other web technologies, in the medical context, should be integrated in practical activities.	STATEMENT 31 Advanced use of MS Excel, including macro programming in VBA language, in the medical and bioengineering context, should be integrated in practical activities.	STATEMENT 32 Hybrid 3D modelling techniques of anatomical shapes in advanced CAD systems should be integrated in practical activities.
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
Neither agree or disagr	Disagree	Neither agree or disagr	Neither agree or disagr
Neither agree or disagr	No answer	Neither agree or disagr	Agree
Strongly agree	Agree	Agree	Strongly agree
Agree	Agree	Agree	Strongly agree
Neither agree or disagr	Strongly disagree	Disagree	Agree
Neither agree or disagr	Strongly disagree	Disagree	Agree
Disagree	Disagree	Disagree	Disagree
Strongly agree	No answer	Agree	Agree
Strongly agree	Strongly agree	Agree	Strongly agree
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
Agree	Neither agree or disagr	Agree	Neither agree or disagr
Agree	Agree	Agree	Agree
Strongly agree	Strongly agree	Strongly agree	Strongly disagree
Agree	Agree	Strongly agree	Strongly agree
Neither agree or disagr	Agree	Agree	Agree
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Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Agree
Neither agree or disagr	Neither agree or disagr	Strongly agree	Agree
Neither agree or disagr	Neither agree or disagr	Agree	Strongly agree
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Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Agree
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Agree	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
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Neither agree or disagr	Disagree	Disagree	Agree
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Disagree	Disagree	Disagree	Agree
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Agree	Agree	Agree	No answer
Agree	Agree	Strongly agree	Agree
Agree	Agree	Agree	Agree
Agree	Neither agree or disagr	Strongly disagree	Neither agree or disagr
Strongly agree	Strongly agree	Strongly agree	Strongly agree
Neither agree or disagr	Agree	Neither agree or disagr	Neither agree or disagr
No answer	Agree	Disagree	No answer
No answer	Strongly agree	Disagree	Strongly agree
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Disagree
Disagree	Disagree	Neither agree or disagr	Neither agree or disagr
No answer	No answer	No answer	No answer
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
No answer	No answer	No answer	No answer
Agree	Agree	Agree	No answer
Strongly agree	Strongly agree	Strongly agree	Agree
Neither agree or disagr	Agree	Neither agree or disagr	Strongly agree
Strongly disagree	Strongly disagree	Neither agree or disagr	Strongly disagree
Disagree	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr

STATEMENT 33 Applications of advanced dynamic simulation systems (e.g. fluid dynamics, thermodynamics) in medical context should be integrated in practical activities.	STATEMENT 34 Graphics design and UX design for medical software applications should be integrated in practical activities.	STATEMENT 35 Nature inspired artificial intelligence algorithms should be integrated in practical activities.	STATEMENT 36 Software tools for visualization of medical data should be integrated in practical activities.
Disagree	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
Disagree	Disagree	Disagree	Neither agree or disagr
Agree	No answer	Agree	Agree
Strongly agree	Agree	Strongly agree	Strongly agree
Agree	Agree	Neither agree or disagr	Agree
Agree	Agree	Agree	Strongly agree
Agree	Neither agree or disagr	Agree	Agree
Disagree	Disagree	Disagree	Disagree
Strongly agree	Agree	Neither agree or disagr	Agree
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Strongly agree	Strongly agree	Strongly agree	Strongly agree
Strongly agree	Neither agree or disagr	Strongly agree	Agree
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Neither agree or disagr	Agree	Disagree	Agree
Neither agree or disagr	Neither agree or disagr	Agree	Agree
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Agree	Agree	Neither agree or disagr	Neither agree or disagr
Agree	Strongly agree	Strongly agree	Strongly disagree
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No answer	No answer	Agree	Agree
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Neither agree or disagr	Strongly agree	Disagree	Agree
Neither agree or disagr	Neither agree or disagr	Strongly disagree	Strongly agree
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Agree	Strongly agree	Agree	Strongly agree
Agree	Neither agree or disagr	Strongly agree	Strongly agree
Neither agree or disagr	Strongly disagree	Agree	Agree
Neither agree or disagr	Neither agree or disagr	Disagree	Neither agree or disagr

STATEMENT 37 Project management strategies and advanced task management software tools should be integrated in practical activities.	STATEMENT 38 As an outcome of studies, graduates should have skills in programming allowing them to create their own software applications for medical use.	STATEMENT 39 As an outcome of studies, graduates should be able to utilize any source of medical 3D data to digitally design a personalized medical device (e.g. an implant or a prosthesis).	STATEMENT 1 It is important to familiarize the bioengineering students with as much various specialized software as possible, even at the cost of limited hours spent per one software package.
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Agree
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
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Strongly agree	Strongly agree	Strongly agree	Strongly agree
Agree	Agree	Strongly agree	Agree
Neither agree or disagr	Strongly agree	Strongly agree	Disagree
Neither agree or disagr	Strongly agree	Strongly agree	Disagree
Disagree	Disagree	Disagree	Strongly disagree
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Disagree	Neither agree or disagr	Strongly agree	Agree
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Agree	Agree	Agree	Neither agree or disagr
Strongly disagree	Strongly agree	Strongly agree	Strongly disagree
Agree	Strongly agree	Agree	Strongly agree
Agree	Agree	Strongly agree	Disagree
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Neither agree or disagr	Agree	Agree	Agree
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Neither agree or disagr	Agree	Agree	Strongly agree
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Strongly agree	No answer	No answer	Disagree
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Agree	Agree	Agree	Neither agree or disagr
Neither agree or disagr	Neither agree or disagr	Agree	Disagree
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
Strongly disagree	Strongly agree	Neither agree or disagr	Strongly disagree
No answer	Neither agree or disagr	Agree	No answer
Agree	Strongly disagree	No answer	Agree
Agree	Agree	Disagree	Neither agree or disagr
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Strongly agree	Neither agree or disagr	Agree	Agree
Neither agree or disagr	Disagree	No answer	Disagree
Agree	Agree	Agree	Disagree

STATEMENT 2 In learning of 3D anatomical data processing and design of medical devices, project method and group work is more important than laboratory exercises.	STATEMENT 3 Complementary to face to face discussion in relevance to journal papers as a teaching method should be integrated in a programme content.	STATEMENT 4 Brainstorming and teamwork as teaching methods should be integrated in a programme content.	STATEMENT 5 Case studies, films and presentations as teaching methods should be integrated in a programme content.
Agree	Agree	Agree	Agree
Agree	Agree	Agree	Agree
Disagree	Agree	Agree	Agree
Strongly agree	Strongly agree	Strongly agree	Strongly agree
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Disagree	Agree	Disagree	Neither agree or disagr
Disagree	Neither agree or disagr	Neither agree or disagr	Agree
Strongly disagree	Strongly disagree	Agree	Agree
Disagree	Agree	Strongly agree	Strongly agree
Agree	Strongly agree	Strongly agree	Strongly agree
Disagree	Disagree	Agree	Agree
Neither agree or disagr	Disagree	Agree	Agree
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Agree	Neither agree or disagr	Agree	Agree
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Strongly agree
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Disagree	Neither agree or disagr	Neither agree or disagr	Agree
Neither agree or disagr	Agree	Agree	Agree
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Disagree	Disagree	Agree	Agree
Neither agree or disagr	Neither agree or disagr	Strongly agree	Agree
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Strongly agree	Strongly agree	Strongly agree	Agree
Neither agree or disagr	Agree	Strongly agree	Agree
Neither agree or disagr	Neither agree or disagr	Strongly agree	Neither agree or disagr
Disagree	Strongly disagree	No answer	Disagree
Agree	Agree	Agree	Agree
Strongly agree	Strongly disagree	Disagree	Strongly disagree
Neither agree or disagr	Agree	Disagree	Neither agree or disagr
Agree	Strongly agree	Disagree	Neither agree or disagr
Agree	Neither agree or disagr	Agree	Neither agree or disagr
No answer	No answer	No answer	No answer
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
No answer	No answer	No answer	No answer
Neither agree or disagr	Agree	Agree	Agree
Agree	Strongly agree	Agree	Strongly agree
Neither agree or disagr	Agree	Agree	Strongly agree
Strongly disagree	Strongly agree	Agree	Strongly agree
Neither agree or disagr	Strongly agree	Agree	Strongly agree

STATEMENT 6 Interactive lectures and discussions as teaching methods should be integrated in a programme content.	Do have experience in working with people with special needs (individuals who require assistance for disabilities that may be medical, mental, or psychological)?
Agree	
Agree	
Agree	
Strongly agree	
Strongly agree	Yes
Agree	Yes
Agree	No
Agree	Yes
Agree	No
Strongly agree	Yes
Agree	No
Agree	No
Agree	Yes
Agree	Yes
Strongly agree	No
Agree	No
Agree	No
Agree	Yes
Agree	No
Neither agree or disagr	No
Agree	Yes
Agree	Yes
Agree	No
Agree	No
Agree	No
Agree	No
Strongly agree	No
Agree	No
Strongly agree	No
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Strongly agree	No
Strongly agree	Yes
Strongly agree	Yes
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Strongly agree	Yes
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Strongly agree	Yes
Agree	Yes
Agree	No
Agree	Yes
Agree	Yes
Agree	No
Strongly agree	Yes
Strongly agree	No
Strongly disagree	Yes
Agree	No
No answer	No
Agree	No
Strongly disagree	No
Agree	No
No answer	No
Neither agree or disagr	No
No answer	No
Strongly agree	No
Strongly agree	No
Strongly agree	No
Strongly agree	No
Strongly agree	Yes

Sygnatura czasowa	Ad r	Please provide the name of your country:	Please indicate your expertise sector:	Do have experience in working with people with special needs
1.5.2023 13:00:50	n	Estonia	academia, engineering,	Yes
1.5.2023 13:07:18	n	Malaysia	academia	No
1.7.2023 18:55:26	n	Türkiye	academia, education, I	Yes
1.8.2023 17:54:33	h	Latvia	academia, ergonomics	Yes
1.8.2023 19:50:26	s	Turkey	academia	Yes
1.9.2023 10:28:56	c	Romania	academia	No
1.9.2023 23:38:01	n	Turkey	academia	Yes
1.11.2023 20:07:47	i.	England	academia, education, e	Yes
1.11.2023 20:16:22	g	Greece	engineering	No
1.11.2023 20:58:14	a	Greece	engineering	No
1.12.2023 8:28:49	k	Tunisia	academia, education, e	No
1.12.2023 9:34:42	d	Croatia	academia, education, e	No
1.12.2023 12:02:31	s	Greece	engineering	No
1.12.2023 13:43:24	c	Romania	engineering, medicine	Yes
1.12.2023 16:57:30	rı	Italy	academia	No
1.13.2023 2:01:00	tj	Croatia	academia, education, e	Yes
1.13.2023 9:27:08	p	Croatia	academia	No

STATEMENT 6 Force systems, resultant, equalities,	STATEMENT 30 Biomimetics and construction of	STATEMENT 44 Basic principles of operation of industrial	STATEMENT 45 Design solutions and principles of work of
Agree	Neither agree nor disag	Agree	Strongly agree
Agree	Strongly agree	Agree	Neither agree nor disag
Strongly agree	Neither agree nor disag	Agree	Agree
Agree	Agree	Strongly agree	Agree
Agree	Agree	Agree	Agree
No answer	No answer	Agree	Agree
Agree	Agree	Agree	Agree
Neither agree nor disag	Neither agree nor disag	Strongly disagree	Strongly disagree
Strongly agree	Strongly agree	Strongly agree	Strongly agree
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Strongly agree	Agree	Agree	Agree
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Agree	Agree	Disagree	Agree
Strongly agree	Neither agree nor disag	Agree	Agree
Strongly agree	Agree	Neither agree nor disag	Agree
Agree	Agree	Agree	Agree

STATEMENT 46 Knowledge about organ transplantation	STATEMENT 48 Basic principles of operation and	STATEMENT 54 Physiological person-environment fit:	STATEMENT 55 Holistic psychology and wellness of people
Disagree	Disagree	Neither agree nor disag	Neither agree nor disag
Neither agree nor disag	Neither agree nor disag	Agree	Agree
Agree	Agree	Agree	Agree
Agree	Neither agree nor disag	Agree	Agree
Agree	Agree	Agree	Agree
No answer	No answer	No answer	No answer
Agree	Agree	Agree	Agree
Strongly disagree	Strongly disagree	Strongly disagree	Strongly disagree
Strongly agree	Strongly agree	Strongly agree	Strongly agree
Agree	Agree	Neither agree nor disag	Agree
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Agree	Agree	Agree	Agree
Neither agree nor disag	Agree	Neither agree nor disag	Strongly disagree
Neither agree nor disag	Disagree	Disagree	No answer
Disagree	Disagree	Agree	Neither agree nor disag
Agree	Agree	Agree	Agree

STATEMENT 58 Building for equality: disability and the built	STATEMENT 60 Quality management tools and systems in	STATEMENT 17 General robot programming course	STATEMENT 20 CAM software for planning of various
Agree	Agree	Neither agree or disagr	Strongly agree
Agree	Neither agree nor disag	Agree	Agree
Agree	Strongly agree	Strongly agree	Agree
Agree	Agree	Strongly agree	Agree
Agree	Agree	Agree	Agree
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Strongly disagree	Strongly disagree	Strongly disagree	Neither agree or disagr
Strongly agree	Strongly agree	Strongly agree	Strongly agree
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Disagree	Agree	Strongly disagree	Strongly agree
Neither agree nor disag	Agree	Agree	Agree
Agree	Agree	Neither agree or disagr	Agree
Agree	Agree	Agree	Strongly agree

STATEMENT 23 Programming of augmented and mixed	STATEMENT 24 Principles of design of medical architecture	STATEMENT 25 Virtual reality applications aiding the	STATEMENT 26 Use of mesh processing software
Agree	Agree	Agree	Neither agree or disagr
Agree	Agree	Agree	Agree
Agree	Strongly agree	Strongly agree	Strongly agree
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Disagree	Neither agree or disagr	Neither agree or disagr	Neither agree or disagr
Strongly agree	Strongly agree	Strongly agree	Strongly agree
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Agree	Disagree	Neither agree or disagr	Strongly agree
Agree	Neither agree or disagr	Agree	Strongly agree
Agree	Agree	Agree	Agree
Agree	Neither agree or disagr	Neither agree or disagr	Agree

STATEMENT 29 Students should learn creating and	STATEMENT 30 Principles of building and programming	STATEMENT 31 Advanced use of MS Excel, including macro	STATEMENT 37 Project management strategies and
Agree	Disagree	Agree	Strongly agree
Neither agree or disagr	Neither agree or disagr	Neither agree or disagr	Disagree
Agree	Strongly agree	Agree	Agree
Agree	Agree	Agree	Agree
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No answer	No answer	No answer	Agree
Agree	Agree	Agree	Agree
Disagree	Disagree	Disagree	Disagree
Strongly agree	Strongly agree	Strongly agree	Strongly agree
Neither agree or disagr	Neither agree or disagr	Agree	Agree
Agree	Agree	Agree	Agree
Agree	Agree	Agree	Agree
Agree	Agree	Agree	Agree
Agree	Neither agree or disagr	Neither agree or disagr	Agree
Agree	Disagree	Disagree	Neither agree or disagr
Agree	Agree	Agree	Neither agree or disagr
Agree	Disagree	Neither agree or disagr	Agree

STATEMENT 38 As an outcome of studies, graduates	STATEMENT 1 It is important to familiarize the	STATEMENT 2 In learning of 3D anatomical data
Neither agree or disagr	Strongly disagree	Neither agree or disagree
Neither agree or disagr	Agree	Strongly agree
Strongly agree	Strongly agree	Strongly agree
Agree	Agree	Agree
Agree	Agree	Neither agree or disagree
Agree	Agree	No answer
Agree	Agree	Agree
Disagree	Disagree	Disagree
Strongly agree	Strongly agree	Strongly agree
Agree	Agree	Agree
Agree	Agree	Agree
Agree	Agree	Neither agree or disagree
Agree	Agree	Agree
Neither agree or disagr	Agree	Strongly agree
Agree	Agree	Agree
Agree	Neither agree or disagr	Agree
Agree	Agree	Agree