PROFILES – WP 3

Stakeholders Involvement and Interaction

PROFILES

Curricular Delphi Study on Science Education

Interim Report on the First Round of the ISU Working Group

Prof. Dr. Marika Kapanadze, Ekaterine Slovinsky
Ilia State University, Georgia

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SEVENTH FRAMEWORK PROGRAMME

PROFILES

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1. Introduction

The central aim of a Curricular Delphi Study in the frame of PROFILES project is to collect the opinions and the knowledge of stakeholders (`experts`) from different areas on the aspects of Inquiry Based Science Education (IBSE) and classify them in a systematic and appropriate way (PROFILES Consortium, 2010). In general, a Delphi study involves a fixed group of participants (´experts`) who are asked about a certain topic in several rounds. After every round, statistically confirmed group answers of the respective preceding round are calculated and reported back to the participants.

The Curricular Delphi Study on Science Education in Georgia is structured into three rounds. The first round offers the participants the possibility to express their ideas about aspects of contemporary and pedagogically desired science education in three open questions regarding "motives, situations and contexts", "fields and methods" and "qualifications".

The PROFILES group of Georgia has used the same questionnaire as the FUB group of PROFILES project (Bolte, C. Schulte, T (2011)). The questionnaire has been translated into Georgian language and adopted to the Georgian context, but is still remaining as close as possible to the German version (Appendix).

The framework, procedure and results from the first round of the PROFILES Curricular Delphi Study on Science Education in Georgia, will be presented in this interim report.

2. Framework and data acquisition from the first round

2.1 Criteria for the selection of participants

The sample of participants for the PROFILES Delphi Study on Science Education was selected according to criteria derived from the WP3 leader, FUB in the project. According to these criteria, different parts of society should be represented.

The sample structure in Georgia is presented in Table 1.

Group	Sub-Group	Characteristics/features
Students	• Basic science course	• Biology • Chemistry • Physics
Science teachers	• Science education students at the university • Trainee science teachers • Science teachers • Trainee science teacher educators	• Biology • Chemistry • Physics • Elementary Science
Science educators		• Biology • Chemistry • Physics • Elementary Science
Scientists		• Biologists • Chemists • Physicists
Others		• Former Biologists • Former Chemists • Former Physicists

Table1: Sample structure – groups and characteristics

The students' group refers to students between the age of 15 and 17. Science education students at the university refer to students whose major subject is primary science, biology, physics and education respectively. Trainee science teachers are teachers who have just started their career as teachers; Science teachers are experienced teachers in the fields of biology, chemistry or physics. The teacher educators' group refers to teacher educators in the education department at universities, as well as education experts who work at the Teachers House (responsible for the teacher trainings) or at the curriculum department (responsible for curricula development) at the Ministry of Education and Sciences of Georgia. The scientists' group consists of scientists who work in the field of biology, chemistry or physics at the universities or different science institutes. Others, this group refers to the people, who worked in science (physics, chemistry, biology), but they left their profession for different reasons and they have other professions now.

2.2 Data acquisition and participation rate of the Curricular Delphi Study on Science Education conducted by the ISU

Between March and April 2012, a total of 186 potential participants ('experts') in Georgia were asked via e-mail to fill out the Delphi questionnaire.

Due to the low response rate of the participants after the first attempt we decided to send out questionnaires a second time, and after the second responses the third time.

The number of participants, the occupation of the groups and the response rate after all three attempts is shown in the table 2.

Group	Sub-Group	Number of questionnaires sent out	Number of responses	Response rate
Students		46	34	76 %
Science teachers	Science education students at the university	8	6	61 %
	Trainee science teachers	2	2	
	Science teachers	29	14	
	Trainee science teacher educators	10	8	
Science educators		40	13	33 %
Scientists		35	27	77 %
Others		16	6	38 %
Total		**186**	**110**	**59 %**

Table 2: Structure of the sample, amount of participants for each group and participation rate after the first, second and third attempt

2.3 Final sample composition of the first round of the Curricular Delphi Study on Science Education conducted by ISU

A detailed overview of the final sample of the first round of the Curricular Delphi Study on Science Education conducted by ISU is given in Table 3. As shown there, 110 stakeholders took part in the first round of the Curricular Delphi Study on Science Education in Georgia, which makes up to 59% of all questionnaires sent out.

With a total of 34 participants, the group of students makes up 31% of the sample. The group of teachers consists of 30 participants altogether, making up the second largest group of the sample (27 %). The group of science educators consists of 13 participants (12 %). The number of participants in the group of scientists consists of 27 participants (25 %). Others (former science specialists) is a smaller part of the sample, only 5% of participants.

Group	Sub-Group	Number of participants	%
Students		34	31 %
Science teachers	Science education students at the university	6	27 %
	Trainee science teachers	2	
	Science teachers	14	
	Trainee science teacher educators	8	
Science educators		13	12 %
Scientists		27	25 %
Others		6	5 %
Total		**110**	**100 %**

Table 3: Sample structure of the first round of ISU Curricular Delphi Study on Science Education

3. Qualitative analysis of the statements

3.1 Procedure and method of the qualitative data analysis

The statements we received from the 110 participants in the first round of the Curricular Delphi Study in Science Education was analyzed step-by-step as indicated in Figure 1. following Bolte (2003). This procedure was the same as by the FUB – leader of this work package.

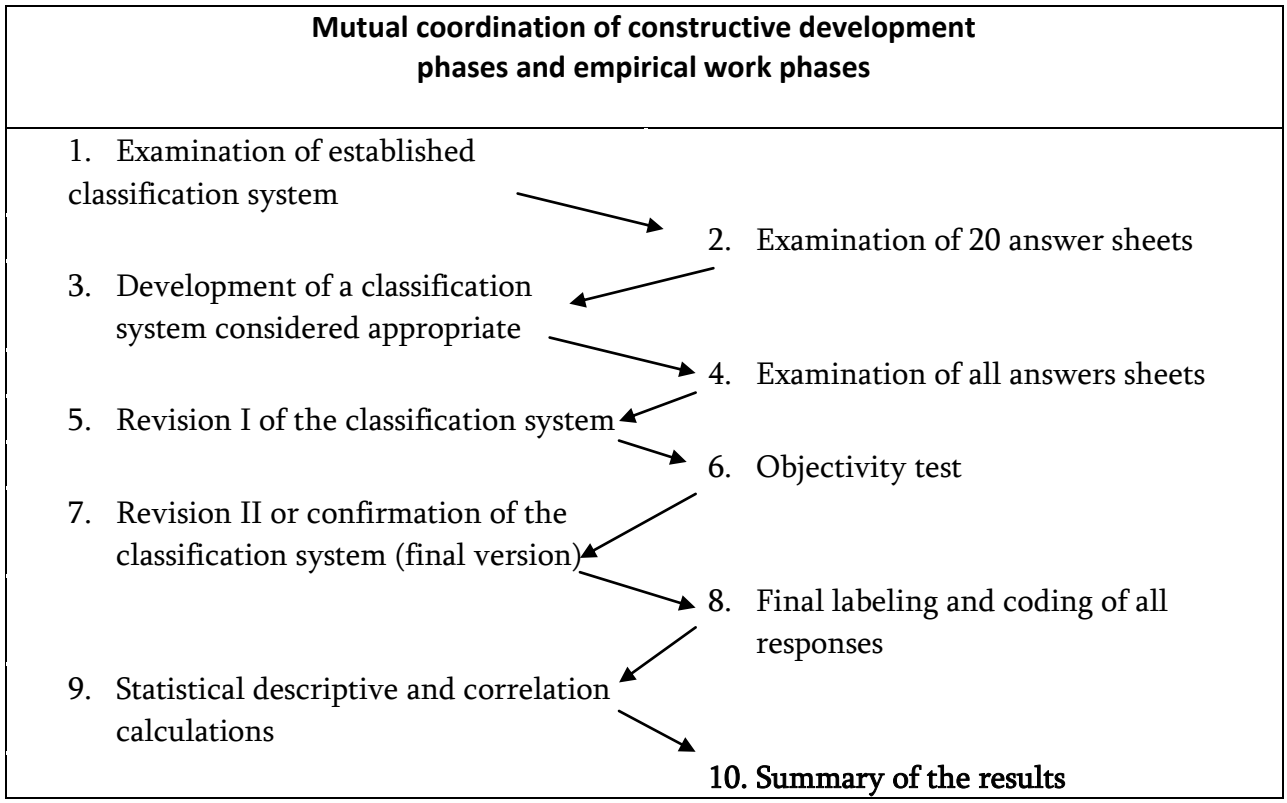

Figure 1: Overview of the procedure of the data analysis in the first round of the Curricular Delphi Study on Science Education conducted by the ISU

As a first step, the classification systems of previous curricular Delphi studies were examined (Bolte, 2008; Häußler u. a., 1980). The statements of the response sheets were prepared following the qualitative content analysis approach according to Mayring (1983). All statements from the questionnaires were paraphrasing, grouped, summarized and systematized due to classification system. After a detailed examination of 20 questionnaires (step 2), the prior classification system was modified and completed (step 3). The set of categories was subdivided into four different parts (I - situations, contexts and motives, II - fields and III- qualifications, IV - methodical aspects). The part II according to FUB system

was subdivided into part IIa (scientific concepts and topics) and part IIb (scientific fields and perspectives), also part IV (methodical aspects) was established as an additional part (Table 4) based on FUB system.

In the following course of the data analysis, the participants' statements were examined by applying the modified category system to the statements of all answer sheets in order to assign those statements to the respective category (step 4). In some cases an assignment and classification of a statement to one of the existing categories was not possible, that's why the list of categories had to be revised again by either modifying existing categories or adding new categories (step 5). After examining all statements with the revised list of categories, for applying an objectivity test a set of 20 questionnaires was randomly chosen and examined by two independent coders (step 6). The established classification system (Table 4) was confirmed (step 7) and maintained for final labeling and coding of all statements concerning that data transformation into SPSS (step 8). In the next step (step 9), the data was analyzed by statistical methods and the results were summarized (step 10).

3.2 Results of the qualitative analysis

A final classification system for the analysis of the participants' statements was developed and established on the basis of the FUB system. The classification system consists of 100(+9); the categories are listed in Table 4.

In most cases, the categories, which we've got in Georgia, agree with categories established in previous Delphi studies (Bolte, 2008; Häußler u. a., 1980; Mayer, 1992) and refer to aspects of modern science education (Bybee, McCrae & Laurie, 2009; Fensham, 2009). As the FUB category system was a basis for Georgian system (Bolte et al., 2011), Table 4 presents the overview of the categories after 1st Round, where the additional categories of ISU are indicated in blue color.

I: Situations, contexts, motives	II: field		III: Qualification	IV (Addition): Methodical aspects
	IIa: (Basic) concepts and topics	IIb: Scientific fields and perspectives		
N = 19	N = 21	N = 35	N = 25	N = 9
• Education /general pers. development • Emotional personality development • Intellectual personality development • Students' interests • Curriculum framework • Nature / natural Phenomena • Everyday life • Medicine / health • Technology • Society / public concerns • Global references • Occupation • Science - biology • Science - chemistry • Science - physics • Science – interdisciplinarity • Out-of-school Learning • Science development perspectives • Experiments, practical works	• Matter / particle concept • Structure / function / properties • Chemical reactions • Energy • Scientific Inquiry • Cycle of matter • Food / nutrition • Health / medicine • Matter in everyday life • Technical devices • Environment • Safety and risks • Occupations /occupational fields • New Technology and its Application/Industrial processes • Modern scientific achievements/scientific investigations • Agriculture • Universal science laws • life processes • Physical Phenomena • Chemical Phenomena • Connections between phenomena	• Botany • Zoology • Human biology • Genetics / molecular biology • Microbiology • Evolutionary biology • Ecology • Inorganic chemistry • Organic chemistry • Biochemistry • Mechanics • Thermodynamics • Atomic / nuclear physics • Astronomy / space system • Earth sciences • Mathematics • Interdisciplinarity • Consequences of technol. development • History of the sciences • Ethics / values • General chemistry • Applied Chemistry • Cell biology • Life science • General biology • Relativistic theory • Electricity • Optics • Molecular physics • General Physics • Quantum mechanics • Biophysics • Biochemistry • Cosmetology • Pharmacology	• (Specialized) knowledge • Applying knowledge / thinking abstractly • Judgment /opinion-forming / reflection • Formulating scientific questions /hypotheses • Being able to experiment • Rational thinking / analyzing / drawing conclusions • Working selfdependently/structuredly /precisely • Reading comprehension • Communication skills • Social skills / teamwork • Motivation / interest / curiosity • Critical questioning • Acting reflectedly and responsibly • Inquiry skills • Civic • Environmental awareness • Observation, perception • Classification • Finding information • Creativity • Safety skills • Life skills/ First-aid • Problem solving • Numeracy • Metacognition	• Interdisciplinary learning • Inquiry-based science learning • Using new media • Learning based on previous knowledge • Project learning • Learning in small groups • Individual works • Using visual resources • Students based learning

Table 4: Overview of the categories for the analysis of the experts' statements – final version of the ISU team

3.3 Discussion

According to the requirement the statements must be processed in such a way that they were as differentiated as necessary but also as summarized as possible, the number of categories in the Georgian data was not limited to 60 but was extended to a total number of 100(+9) (Table 4). In order to differentiate categories of methodical aspects from part II (contents and fields), an additional part (part VI: methodical aspects, 9 categories) was also developed.

When comparing our results to the German results, the main differences are apparent in some categories characterizing more pure scientific fields such as optics or biochemistry/biophysics and also in some categories of concepts and topics, characterizing more new technologies and connection between phenomena; There are some differences visible also in qualification and methodological aspects. Georgian experts has given in more details the categories of inquiry skills in qualification and also stressed some methodological aspects on students based learning.

4. Quantitative analysis

4.1 Method

For the objectivity of the qualitative analysis of the statements was used the method of calculating the inter-rater agreement (Bolte (2003), Häußler et al. (1980) and Mayer (1992)). The inter-rater agreement was determined according to the following formula:

$q=2N_{+}/2N_{+} + N_{-}$

With N_{+} being the number of cases in which the positive coding of the two different coders matches, and N_{-} being the number of cases in which only one coder coded a category positively, this quotient takes only into account positive coding and is thus considered as a rather strict measure for the inter-rater agreement (Häußler u. a., 1980). The results of the objectivity test will be shown in the next chapter.

As mentioned at the beginning, the first round offered the participants the opportunity to express their ideas in three open questions. In doing so, they had the choice to fill out up to 5 form sheets. In order to prepare the results of the qualitative analysis for quantitative statistical analyses, the data was coded following Bolte (2003).

Although a category could have been referred to several times on one form sheet, a stating a certain category was only counted once per form sheet. A category stated on a form sheet was coded with "1", every category that was not mentioned was coded with "0". When calculating the relative frequency, multiple entries of the same category of a person were not considered. In this way, the empirical results were standardized.

In order to get a more differentiated overview over the empirical data, descriptive statistical analyses were carried out, taking into account both the total sample and the four sample groups. In the quantitative analyses we focused on categories that were mentioned rarely ($\leq$5%) or often ($\geq$20%). The analyses of the frequencies were done by the questions which general statements could be got from the participants' responses and which distinctive features appeared after the analyses regarding the different sample groups. In order to get the answer on those questions, the characteristic values, which are given below, were taken into account:

- Number of all form sheets filled out by the participants
- Average number of form sheets per person
- Number of all categories mentioned by the participants

- Average number categories mentioned per person
- Relative frequencies of the categories regarding
  - the total sample
  - the different four sample groups

4.2 Results of the quantitative analysis

4.2.1 Objectivity of the data analysis

As was already mentioned, the inter-rater agreement was determined following Bolte (2003), Häußler et al. (1980) and Mayer (1992). The inter-rater quotients according to the different parts of the category system are shown in Table 5. The inter-rater quotients range between 75 and 84 percent that means that the procedure of the qualitative data analysis met the demands for objectivity.

I: Situations, contexts, motives	IIa: concepts and topics	IIb: fields and perspectives	III: Qualification	IV: methodical aspects
$q_1 = .75$	$q_1 = .80$	$q_1 = .84$	$q_1 = .82$	$q_1 = .78$
$q_1 = .80$				

Table 5: Results of the inter-rater agreement of two different coders after coding 20 questionnaires

4.2.2 Findings of the quantitative descriptive-statistical analysis of the sample

The participants used the opportunity to fill out up to 5 form sheets to a very different degree, the average number of different categories mentioned per participant were considered as well in order to determine how differentiated the participants' statements were. For this purpose, it was only taken into account if a category was mentioned and not how many times it was mentioned by a person on different form sheets. The results are shown in Table 6. As it can be seen in the table, the average number of different categories mentioned by a participant regarding the total sample was 10,01. The greatest difference between the average number of different categories mentioned per person regarding the sample groups can be found among the group of students (7,2 different categories per person on an average) and others (13,3 different categories person on an average).

Group	Sum	Average	Median	Minimum	Maximum
Students	245	7,2	7,0	2	15
Science teachers	360	12,0	11,0	3	26
Science educators	147	11,3	13,0	4	16
Scientists	271	10,0	9,0	1	23
Other	80	13,3	13,5	10	17
Total	1103	10,0	9,0	1	26

Table 6. Number of different statements per participant – total sample and sample groups

4.2.3 Findings of the quantitative analysis regarding the relative frequencies of categories

In the following part we present the frequencies of the categories which were mentioned by the stakeholders. In the analyses we focused on the categories that were mentioned rarely (≤5%) or particularly often (≥20%). The following descriptions are structured according to the different parts of the classification system, focusing on the results regarding the whole sample as well as regarding the different sample groups.

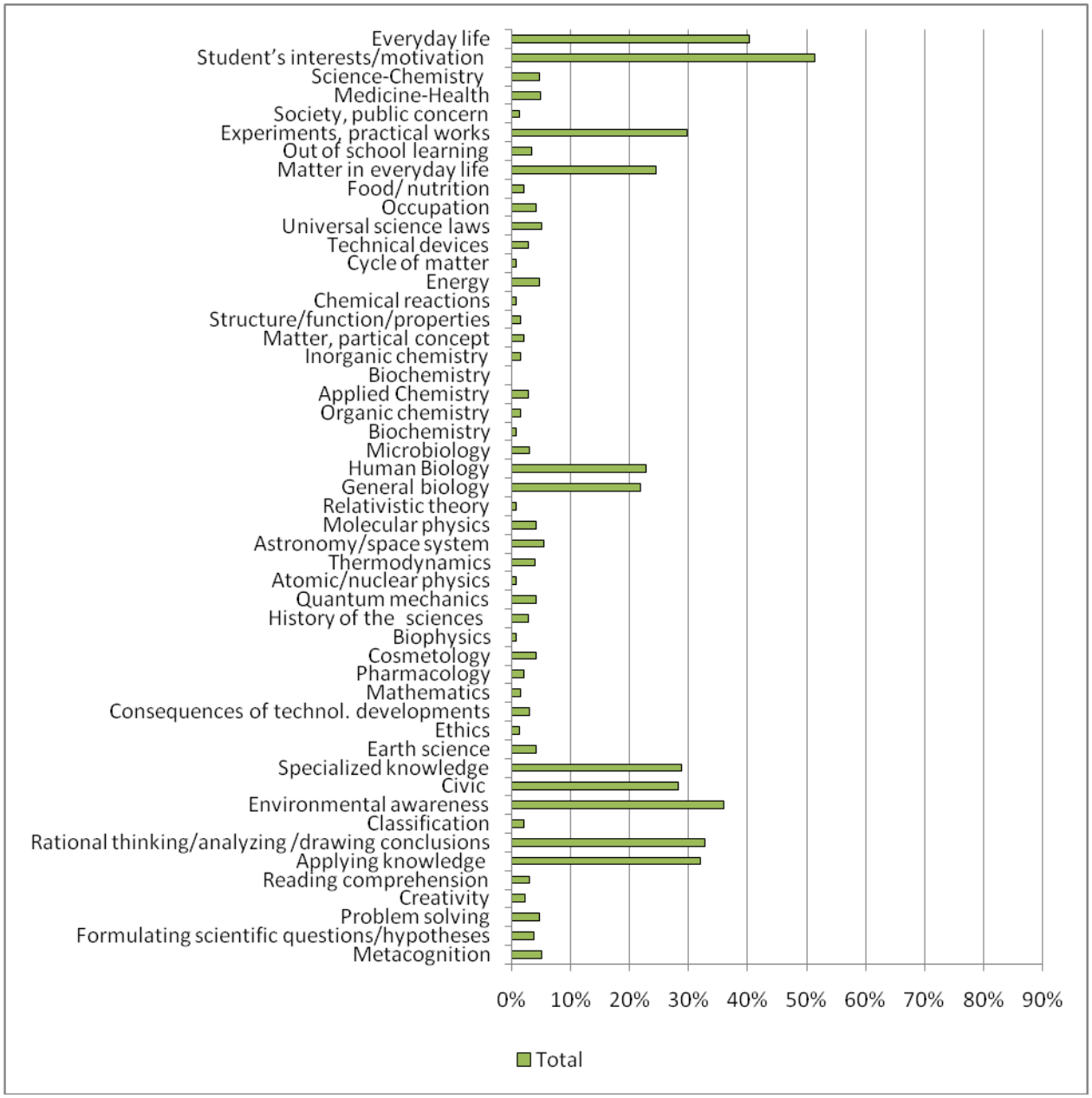

Figure 2: Overview over the categories that were mentioned rarely (≤5%) or often (≥20%): Mean percentages regarding the whole sample

Figure 3. Overview over the categories that were mentioned rarely (≤5%) or often (≥20%): Mean percentages regarding the group of students

After analyzing these frequencies, it can be seen that for the group of students only a total number of 10 categories are mentioned more than 20% of the participating students and 23 categories are mentioned only less than 5% of the students. 42 categories are not mentioned at all.

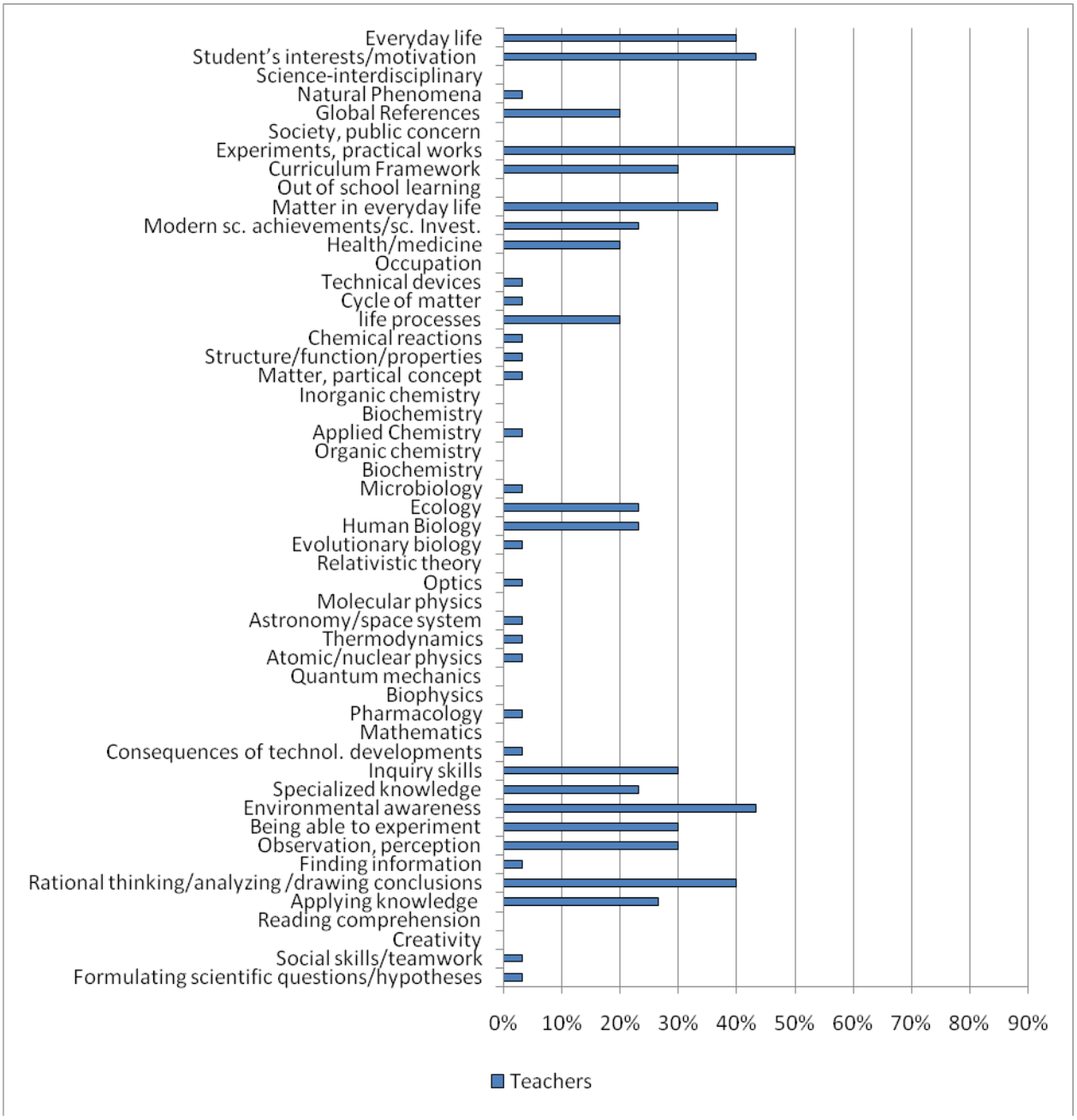

Figure 4: Overview over the categories that were mentioned rarely (≤5%) or often (≥20%): Mean percentages regarding the group of teachers

Regarding the teachers it is visible that 18 categories are mentioned by more than 20% of the participating teachers and 18 categories were mentioned by only less than 5% of the teachers. 16 categories are not mentioned at all.

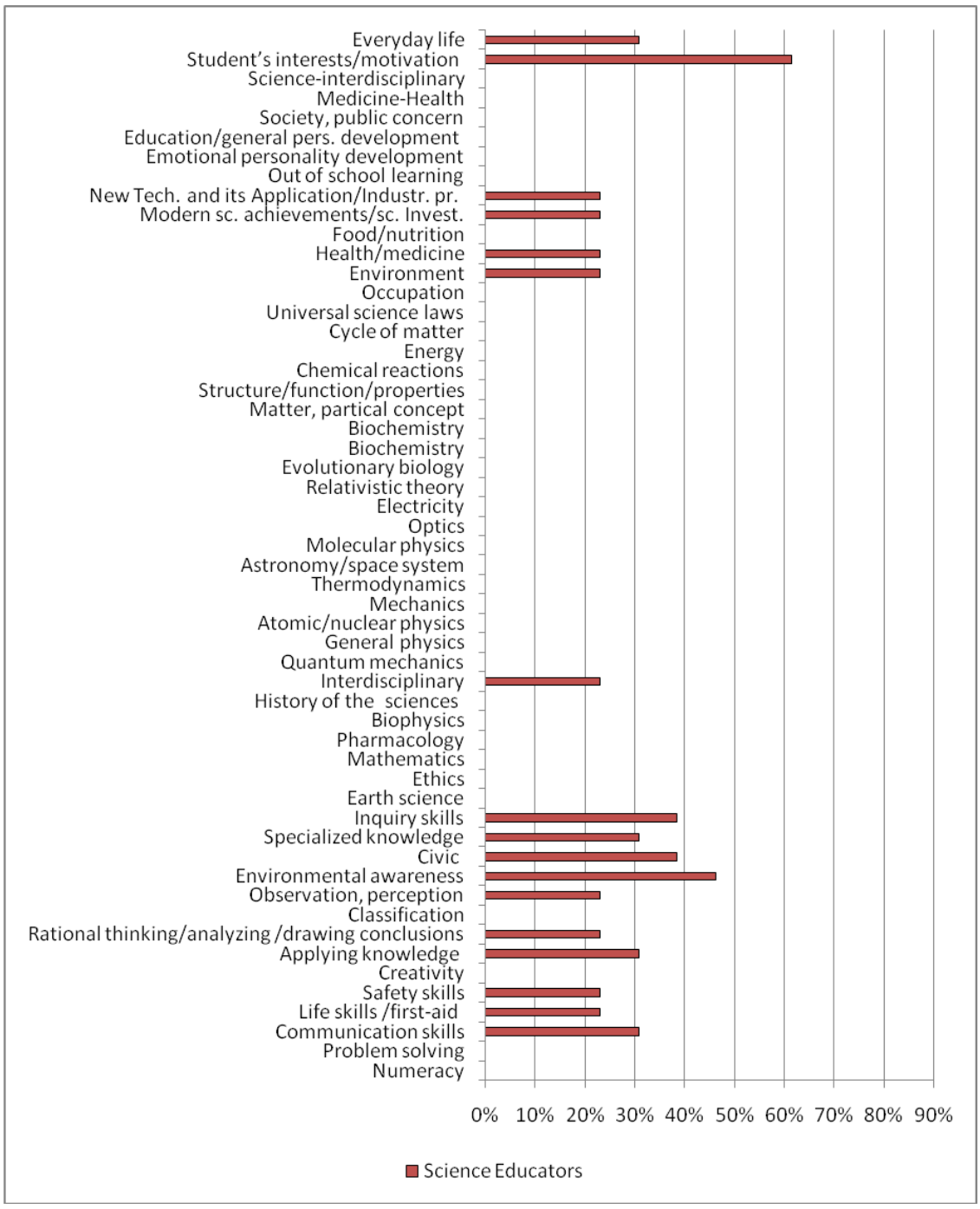

Figure 5: Overview over the categories that were mentioned rarely (≤5%) or often (≥20%): Mean percentages regarding the group of science educators

Regarding the group of science educators the total number of 17 categories are mentioned more than 20% of the participating science educators. 37 categories are not mentioned at all.

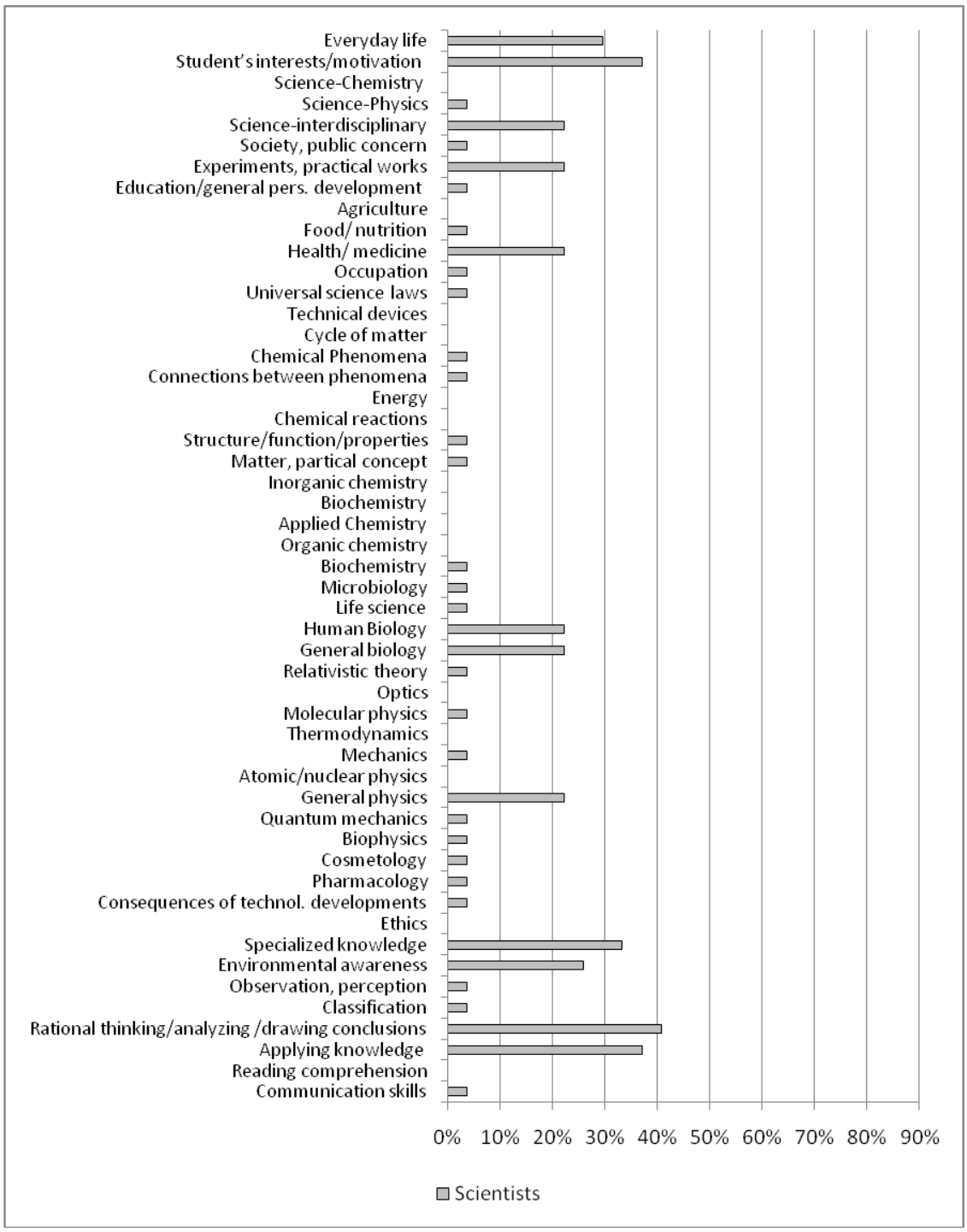

Figure 6: Overview over the categories that were mentioned rarely (≤5%) or often (≥20%): Mean percentages regarding the group of scientists

In the group of scientists a total number of 12 categories were mentioned more than 20% of scientists, and 24 categories were mentioned less than 5% of the participants, while 15 categories were not mentioned at all.

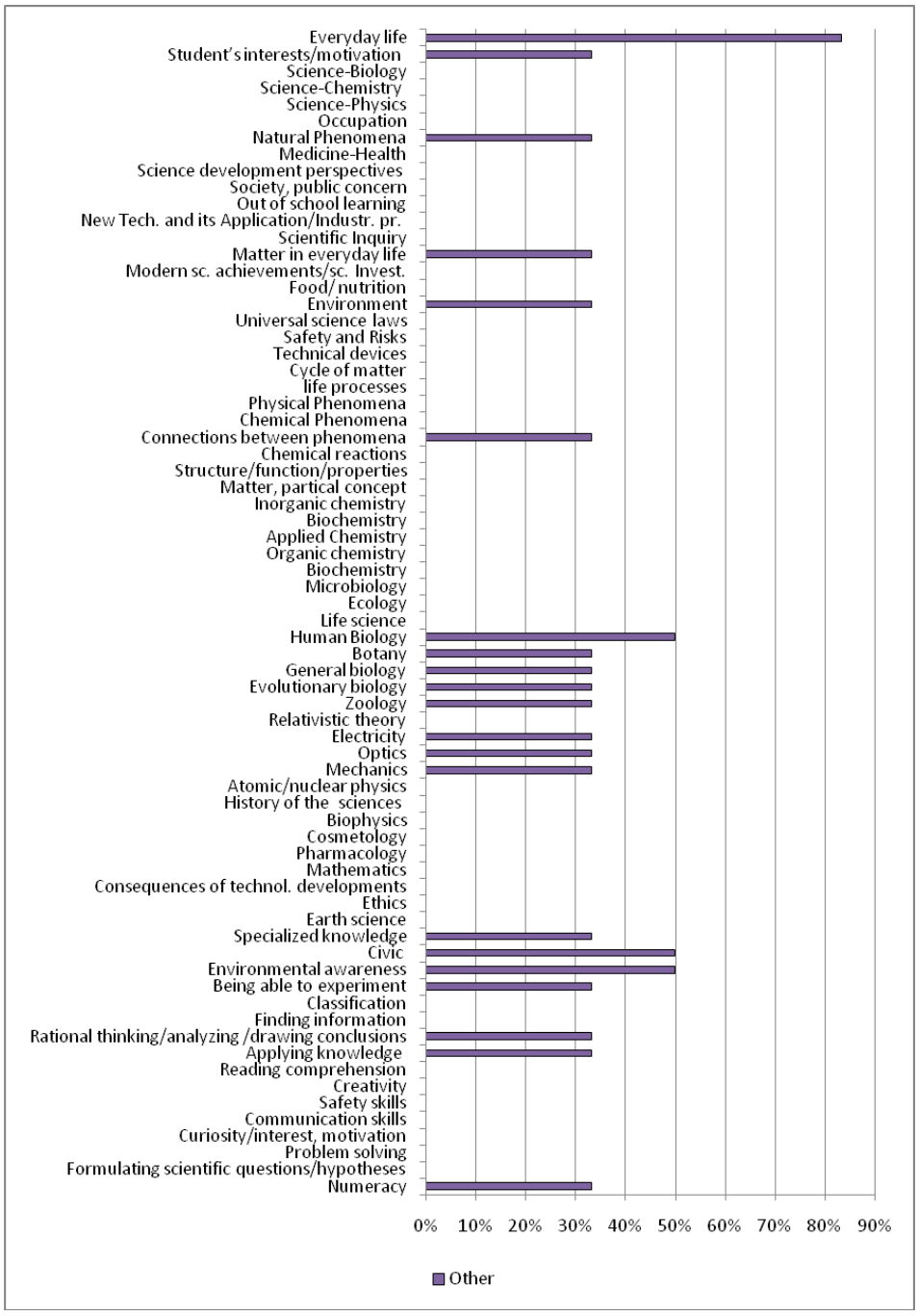

Figure 7: Overview over the categories that were mentioned rarely (≤5%) or often (≥20%): Mean percentages regarding the group of others

In the group of others a total number of 21 categories were mentioned more than 20% of the participants of this group, and no categories were mentioned less than 5% of the participants, while 50 categories were not mentioned at all.

Group	Number of categories that are mentioned 0%	Number of categories that are mentioned (0% < categories ≤ 5%)	Number of categories that are mentioned (20% ≤ categories)
Students	42	23	10
Science teachers	16	18	18
Science educators	37	0	17
Scientists	15	24	12
Other	50	0	21

Table 7 : Overview the distribution of categories by groups

4.3 Discussions

The aim of the analyses described in the previous part of this report was to gain information about characteristic descriptive-statistical values and about the frequency of mentioning the categories. The calculation of the different frequencies illustrates the emphases made in the statements of all participants. A differentiated view on the category frequencies of the different sample groups shows that the different groups feature different focuses and thus deviate in several cases from each other regarding the relative frequency of mentioning the different categories. In general, students' interest and motivation, as well as rational thinking, analyzing, drawing conclusions and applying knowledge were pointed by all groups of participants. Students highlighted more general science subjects – physics, chemistry and biology, teachers pointed more experimental work, inquiry skills and environmental awareness. Environmental awareness was highlighted also by science educators and scientists, as well as by others.

5. Summary

In the first round of curricular Delphi Study were asked 186 stakeholders for the participation and questionnaires were sent to them. A total number of 110 from them sent us their responses regarding aspects of the science education considered relevant and pedagogically desirable.

The procedure of the qualitative analysis met the demands for objectivity (q = .80). After the qualitative analysis of the participants' statements we've got a classification system consisting of 3(+1) parts, where the second part was additionally subdivided into two parts (IIa and IIb). All in all, it contains a number of 100(+9) categories. In most cases, the categories agree with categories given in previous Delphi studies (Bolte, 2008; Häußler u. a., 1980; Mayer, 1992) and also with the categories from FUB.

The analyses were done of the categories which were mentioned by 20% or more than 20% and the categories which were mentioned by 5% or less than 5% of the participants of Curricular Delphi Study.

The results of the analyses show general tendencies as well as specific focuses from the different groups of participants. From the total sample group only 10 categories were mentioned from 20% or more than 20% of the participants and 38 categories from 5% or less than 5% of the participants. In general, students' interest and motivation, as well as rational thinking, analyzing, drawing conclusions and applying knowledge were pointed by all groups of participants.

The second round will clarify the questions if the categories were mentioned rarely are generally less relevant or the categories mentioned rather often are actually realized in education practice.

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Appendix

I.Tables

Group	Students	Science teachers	Science educators	Scientists	Others	Total
Everyday life	18%	40%	31%	30%	83%	40%
Student's interests/motivation	82%	43%	62%	37%	33%	52%
Science-Biology	15%	13%	15%	11%	0%	11%
Science-Chemistry	6%	10%	8%	0%	0%	5%
Science-Physics	12%	10%	15%	4%	0%	8%
Science-interdisciplinary	0%	0%	0%	22%	17%	8%
Occupation	26%	13%	8%	11%	0%	12%
Natural Phenomena	0%	3%	15%	11%	33%	13%
Medicine-Health	0%	10%	0%	15%	0%	5%
Global References	3%	20%	15%	15%	17%	14%
Technology	6%	7%	8%	7%	17%	9%
Science development perspectives	0%	10%	15%	11%	0%	7%
Society, public concern	3%	0%	0%	4%	0%	1%
Experiments, practical works	44%	50%	15%	22%	17%	30%
Education/general pers. development	3%	17%	0%	4%	17%	8%
Emotional personality development	6%	13%	0%	11%	17%	9%
Intellectual personality development	3%	13%	8%	15%	17%	11%
Curriculum Framework	12%	30%	15%	15%	17%	18%
Out of school learning	6%	0%	0%	11%	0%	3%

Table 8. Percentages of the categories mentioned in part I – whole sample and sample groups

Group	Students	Science teachers	Science educators	Scientists	Others	Total
New Technology and its Application / Industrial processes	3%	7%	23%	15%	0%	10%
Scientific Inquiry	6%	13%	8%	15%	0%	8%
Matter in everyday life	29%	37%	15%	7%	33%	24%
Modern scientific achievements / scientific investigations	6%	23%	23%	19%	0%	14%
Agriculture	0%	7%	8%	0%	17%	6%
Food/ nutrition	0%	7%	0%	4%	0%	2%
Health/ medicine	15%	20%	23%	22%	17%	19%
Environment	3%	17%	23%	11%	33%	17%
Occupation	0%	0%	0%	4%	17%	4%
Universal science laws	12%	10%	0%	4%	0%	5%
Safety and Risks	0%	10%	8%	11%	0%	6%

Technical devices	3%	3%	8%	0%	0%	3%
Cycle of matter	0%	3%	0%	0%	0%	1%
life processes	9%	20%	15%	7%	0%	10%
Physical Phenomena	9%	7%	15%	11%	0%	8%
Chemical Phenomena	12%	7%	15%	4%	0%	8%
Connections between phenomena	0%	10%	8%	4%	33%	11%
Energy	0%	7%	0%	0%	17%	5%
Chemical reactions	0%	3%	0%	0%	0%	1%
Structure/function/properties	0%	3%	0%	4%	0%	1%
Matter, practical concept	3%	3%	0%	4%	0%	2%

Table 9: Percentages of the categories mentioned in part IIa – whole sample and sample groups

Group	Students	Science teachers	Science educators	Scientists	Others	Total
General chemistry	32%	17%	8%	15%	17%	18%
Inorganic chemistry	0%	0%	8%	0%	0%	2%
Biochemistry	0%	0%	0%	0%	0%	0%
Applied Chemistry	3%	3%	8%	0%	0%	3%
Organic chemistry	0%	0%	8%	0%	0%	2%
Cell biology	3%	13%	15%	7%	17%	11%
Genetics/molecular biology	3%	13%	15%	19%	17%	13%
Biochemistry	0%	0%	0%	4%	0%	1%
Microbiology	0%	3%	8%	4%	0%	3%
Ecology	3%	23%	8%	11%	0%	9%
Life science	0%	10%	15%	4%	0%	6%
Human Biology	3%	23%	15%	22%	50%	23%
Botany	3%	7%	8%	7%	33%	12%
General biology	32%	13%	8%	22%	33%	22%
Evolutionary biology	0%	3%	0%	11%	33%	10%
Zoology	0%	7%	8%	7%	33%	11%
Relativistic theory	0%	0%	0%	4%	0%	1%
Electricity	0%	7%	0%	7%	33%	9%
Optics	0%	3%	0%	0%	33%	7%
Molecular physics	0%	0%	0%	4%	17%	4%
Astronomy/space system	0%	3%	0%	7%	17%	5%
Thermodynamics	0%	3%	0%	0%	17%	4%
Mechanics	3%	7%	0%	4%	33%	9%
Atomic/nuclear physics	0%	3%	0%	0%	0%	1%
General physics	29%	10%	0%	22%	17%	16%
Quantum mechanics	0%	0%	0%	4%	17%	4%
Interdisciplinary	0%	10%	23%	19%	17%	14%
History of the sciences	0%	7%	0%	7%	0%	3%
Biophysics	0%	0%	0%	4%	0%	1%
Cosmetology	3%	7%	8%	4%	0%	4%

Pharmacology	3%	3%	0%	4%	0%	2%
Mathematics	0%	0%	0%	7%	0%	1%
Consequences of technol. developments	0%	3%	8%	4%	0%	3%
Ethics	0%	7%	0%	0%	0%	1%
Earth science	3%	10%	0%	7%	0%	4%

Table 10: Percentages of the categories mentioned in part IIb – whole sample and sample groups

Group	Students	Science teachers	Science educators	Scientists	Others	Total
Inquiry skills	0%	30%	38%	7%	17%	19%
Specialized knowledge	24%	23%	31%	33%	33%	29%
Civic	18%	17%	38%	19%	50%	28%
Environmental awareness	15%	43%	46%	26%	50%	36%
Being able to experiment	3%	30%	15%	7%	33%	18%
Observation, perception	0%	30%	23%	4%	17%	15%
Classification	0%	7%	0%	4%	0%	2%
Finding information	3%	3%	15%	7%	0%	6%
Judgment/opinion-Forming/reflection	12%	13%	15%	11%	17%	14%
Rational thinking/analyzing /drawing conclusions	26%	40%	23%	41%	33%	33%
Applying knowledge	32%	27%	31%	37%	33%	32%
Reading comprehension	0%	0%	15%	0%	0%	3%
Creativity	0%	0%	0%	11%	0%	2%
Safety skills	0%	10%	23%	15%	0%	10%
Critical questioning	9%	10%	8%	7%	17%	10%
Life skills /first-aid	12%	17%	23%	19%	17%	17%
Communication skills	3%	10%	31%	4%	0%	9%
Acting reflectively and responsibly	12%	10%	8%	7%	17%	11%
Curiosity/interest, motivation	12%	13%	15%	11%	0%	10%
working self-dependently/structuredly/precisely	12%	13%	8%	7%	17%	11%
Social skills/teamwork	18%	3%	8%	7%	17%	11%
Problem solving	6%	7%	0%	11%	0%	5%
Formulating scientific questions/hypotheses	0%	3%	8%	7%	0%	4%
Numeracy	3%	17%	0%	19%	33%	14%
Metacognition	3%	0%	15%	7%	0%	5%

Table 11: Percentages of the categories mentioned in part III – whole sample and sample groups

Group	Students	Science teachers	Science educators	Scientists	Others	Total
Learning based on previous knowledge	0%	0%	15%	7%	0%	5%
Inquiry-based science learning	6%	30%	23%	7%	33%	20%
Project learning	3%	7%	15%	0%	0%	5%
Learning in small groups	3%	7%	8%	0%	0%	3%
Individual works	0%	3%	8%	0%	0%	2%
Using visual resources	12%	10%	8%	11%	0%	8%
Students based learning	0%	7%	8%	4%	0%	4%
Using new media	0%	20%	8%	4%	0%	6%
interdisciplinary learning	0%	0%	8%	0%	17%	5%

Table 12: Percentages of the categories mentioned in part IV – whole sample and sample groups

II. Instructions and questionnaire for the first round of Curricular Delphi Study in Georgia

	Delphi -საბუნებისმეტყველო კვლევა
	ილიას სახელმწიფო უნივერსიტეტი, ბერლინის თავისუფალ უნივერსიტეტთან და ევროპის სხვა წამყვან უნივერსიტეტებთან ერთად, ჩართულია საერთაშორისო კვლევაში საბუნებისმეტყველო განათლების შესახებ. კვლევა ევროპული პროექტის -PROFILE (Professional Reflection Oriented Focus on Inquiry-based Learning and Education through Science) ერთ-ერთი ნაწილია. კვლევის მიზანია საბუნებისმეტყველო განათლებისადმი საზოგადოების იმ ნაწილის დამოკიდებულებებისა და მოსაზრებების გამორკვევა, რომელიც უშუალოდ ჩართულია საბუნებისმეტყველო განათლების პროცესში და ამ კვლევაში მონაწილებით შეუძლია საკუთარი წვლილი შეიტანოს საბუნებისმეტყველო განათლების განვითარებაში . გთხოვოთ, მონაწილეობა მიიღოთ კვლევაში, რომელიც რამოდენიმე ნაწილისაგან შედგება. თქვენ მიერ შეტანილი წვლილი მნიშვნელოვანი იქნება კვლევის შედეგებისათვის. კვლევა ანონიმურია . კვლევის ვებუზრუნველყოფას ახორციელებს ბერლინის უნივერსიტეტი. კვლევის მიზანია თქვენი მონაწილეობით დავადგინოთ დღევანდელი და მომავალი საზოგადოებისათვის საბუნებისმეტყველო განათლების რომელ ასპექტებზე უნდა გამახვილდეს ყურადღება.
	მონაცემების დამუშავების მიზნით პასუხების ერთიანი ფორმატი შემუშავდა. გთხოვთ, თქვენი მოსაზრებები შემდეგი სამი ძირითადი ასპექტის შესაბამისად ჩამოაყალიბოთ: I. ასპექტი: სწავლების მიდგომები (რას უნდა დაეფუძნოს სასწავლო პროცესი) II. ასპექტი: სწავლების შინაარსი, თემები, საკითხები და სამეცნიერო სფეროები (რა უნდა ვასწავლოთ) III. ასპექტი: მოსწავლეთა კომპეტენციები (რა უნდა შეეძლოს მოსწავლეს სწავლების შემდეგ).

წარმოდგენილი კითხვები ეხება 15-16 წლის მოსწავლეების საბუნებისმეტყველო საგნების სწავლებას (როგორც ცნობილია საქართველოში ამ ასაკის მოსწავლეები ამთავრებენ მე-9 კლასს, ანუ ასრულებენ სავალდებულო განათლებას).

გთავაზობთ ნიმუშს, რომელიც მოცემულია საგზაო უსაფრთხოების მაგალითზე და აჩვენებს, თუ რა იგულისხმება თითოეულ ქვეპუნქტში:

I. ასპექტი: სწავლების მიდგომები (რას უნდა დაეფუძნოს სასწავლო პროცესი)	/მოტივი/ _ ძალიან გახშირებულია ავტოსაგზაო ავარიების დროს მძიმე ტრავმები
II. ასპექტი: სწავლების შინაარსი, თემები, საკითხები და სამეცნიერო სფეროები (რა უნდა ვასწავლოთ)	/შინაარსი/ _ აქედან გამომდინარე, მნიშვნელოვანია საგზაო წესების სწავლება, როგორც მძღოლებისთვის, ასევე ფეხით მოსიარულეებისთვის. საჭიროა მძღოლის პროფესიული უნარების განვითარება.
III. ასპექტი: მოსწავლეთა კომპეტენციები (რა უნდა შეეძლოს სწავლების შემდეგ)	/ კომპეტენცია/ _ პასუხისმგებლობით მოეკიდოს როგორც საკუთარ, ისე სხვის სიცოცხლეს. არ შეუქმნას საფრთხე. შეძლოს უსაფრთხოდ გადაადგილება, შეძლოს უსაფრთხოდ მგზავრების გადაყვანა.

	მონაცემები
5.	გთხოვთ მონიშნოთ, რომელ ჯგუფს მიეკუთვნებით. მონიშნეთ მხოლოდ ერთი უჯრა
5.1	მოსწავლე
5.2	სტუდენტი
5.3	მაძიებელი მასწავლებელი
5.4	მასწავლებელი
5.5	მენტორი მასწავლებელი
5.6	დიდაქტიკოსი (ლექტორი, მწვრთნელი)
5.7	მეცნიერი
5.8	სხვა
6	რომელ საგანს სწავლობთ? გთხოვთ, აირჩიოთ ერთი ან რამდენიმე კურსი
6.1	ქიმია - ჩვეულებრივი სასკოლო კურსი
6.2	ქიმია - გაძლიერებული კურსი
6.3	ბიოლოგია - ჩვეულებრივი სასკოლო კურსი
6.4	ბიოლოგია - გაძლიერებული კურსი
6.5	ფიზიკა - ჩვეულებრივი სასკოლო კურსი
6.6	ფიზიკა - გაძლიერებული კურსი
	თქვენი ელექტრონული ფოსტის მისამართი:

	კითხვარი თქვენი აზრით, საბუნებისმეტყველო განათლების რომელ ასპექტებზე უნდა გამახვილდეს ყურადღება დღევანდელი და მომავალი საზოგადოებისათვის?
I	ასპექტი: სწავლების მიდგომები (რას უნდა დაეფუძნოს სასწავლო პროცესი) რა კონტექსტი და რა სამოტივაციო მიდგომები უნდა დაედოს საფუძვლად საბუნებისმეტყველო მეცნიერებების გაკვეთილებს, რომ მოსწავლეს მომავალში ამ დარგის მიმართ გაუჩნდეს პროფესიული ინტერესი?

II.	ასპექტი: სწავლების შინაარსი, თემები, საკითხები და სამეცნიერო სფეროები. (რა უნდა ვასწავლოთ) საბუნებისმეტყველო მეცნიერებებთან დაკავშირებულ რა შინაარსს, თემებს, საკითხებს და რა სამეცნიერო სფეროებს უნდა ფარავდეს საბუნებისმეტყველო მეცნიერებების სასკოლო კურსი?

III.	ასპექტი: მოსწავლეთა კომპეტენციები (რა უნდა შეეძლოს სწავლების შემდეგ) საბუნებისმეტყველო მეცნიერებების სწავლებისას მოსწავლეების რა უნარებისა და რა კომპეტენციების განვითარებას უნდა დაეთმოს ყურადღება. ასევე, მოსწავლეებში რა ტიპის დამოკიდებულებების (ღირებულებები, ეთიკური საკითხები) ჩამოყალიბება არის მნიშვნელოვანი საბუნებისმეტყველო მეცნიერერებების სწავლებისას.

	თუ გაქვთ რაიმე დამატებითი მოსაზრება, ან შენიშვნა, გთხოვთ, ქვემოთ განთავსებულ ფანჯარაში გაგვიზიაროთ.
	მადლობას გიხდით კვლევის პირველ ეტაპში მონაწილეობისათვის. მეორე ეტაპთან დაკავშირებით რამდენიმე კვირაში გაცნობებთ. ამ კვლევაში თქვენი მონაწილეობით დიდ დახმარებას უწევთ საბუნებისმეტყველო საგნების სწავლების განვითარებას. გისურვებთ წარმატებებს!