

## **Advice and guidelines for the data analysis and the interim report of the second round of the PROFILES Curricular Delphi Study on Science Education Latvia**

### **1 Introduction**

Subject of the second round is the identification of aspects and fields where priority and realization in science education practice drift apart in the opinions of the participants. Another subject of the second round is to identify – by means of cluster analyses – empirically based conceptions regarding desirable and contemporary science education that the participants consider as important and relevant.

### **2 Leading questions of the second round**

1. Which characteristics of a desirable science education do the participants consider as being important?
2. Which conceptual frameworks are considered as being necessary and important for science education?

### **3 Method**

#### Part I:

In part 1 of round 2, the participants were asked to assess the categories established in the course of the first round analyses of the FUB PROFILES Curricular Delphi Study on Science Education from two different perspectives.

The coding of the answers, following the six-tier scale, ranged from 1 to 6 (1: “very low priority” / “to a very low extent”; 2: “low priority” / “to a low extent”; 3: “rather low priority” / “to a rather low extent”; 4: “rather high priority / to a rather high extent”; 5: “high priority” / “to a high extent”; 6: “very high priority” / “to a very high extent”).

The questionnaire for the assessment of the categories of science education was adopted into the Latvian language and together with the covering letter of the study sent to 6 groups of participants: students; science teachers (studying teacher; teachers and training teachers (experienced teachers)); educators, didactics, and in-service teacher educators; scientists; education politicians; people not directly involved in science.

#### Part II:

What kind of empirically based conceptions regarding desirable and contemporary science education can be identified on the basis of the participants' statements?

<b>I daļa:</b> <b>Situācijas, konteksti un motīvi</b> Lūdzu, novērtējiet katru kategoriju pēc diviem dotajiem jautājumiem!	<b>Norādiet aspektanozīmību dabaszinātņu izglītībā!</b>	<b>Norādiet, cik lielā mērā šie aspekti jau tiek realizēti dabaszinātņu izglītībā!</b>
	<b>1 = ļoti maznozīmīgs</b> <b>2 = maznozīmīgs</b> <b>3 = samērā maznozīmīgs</b> <b>4 = samērā nozīmīgs</b> <b>5 = nozīmīgs</b> <b>6 = ļoti nozīmīgs</b>	<b>1 = ļoti mazāmērā</b> <b>2 = mazāmērā</b> <b>3 = samērā mazāmērā</b> <b>4 = samērā lielāmērā</b> <b>5 = lielāmērā</b> <b>6 = ļoti lielāmērā</b>
<b>Vispārējā personības attīstība</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Emocionālā personības attīstība</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Intelektuālā personības attīstība</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Skolēnu interese</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Mācības saturs struktūra</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Mācīšanās ārpus klases</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Mediju izmantošana/Aktuālas problēmas</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Daba/Dabas parādības</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Ikdienas dzīve</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Medikamenti/Veselība</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Tehnoloģijas</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Sabiedrības aktuālas problēmas</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Vides problēmas/Indivīda un sabiedrības ietekme uz apkārtni</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Globālas problēmas</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Amats/Karjeras veidošana</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Bioloģiskā zinātne</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Ķīmiskā zinātne</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Fiziskā zinātne</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]
<b>Zinātņu starpdisciplinārība</b>	[1] [2] [3] [4] [5] [6]	[1] [2] [3] [4] [5] [6]

Table 1: Extract from part I of the FUB questionnaire of the second round (the Latvian language).

#### 4 Sample structure and form of the responses

From November 2011 to the beginning of January 2012, e-mails asking to fill out the questionnaires for the second round were sent out to a total of 122 participants who had already participated in the first round. The number of respondents per each group as well as the total number is indicated in the following table.

Group		Number of participants round 1	Number of participants round 2	Number of form sheets (part II) round 2
<b>Students</b>		30	27	48
<b>Science teachers</b>	Studying teachers	12	12	101
	trainee teachers;	0	0	
	teachers	11	11	
	training teachers (experienced teachers)	12	12	
<b>Educators, didactics, and in-service teacher educators</b>		22	21	51
<b>Scientists</b>		20	20	43
<b>Education politicians</b>		3	3	9
<b>People not directly involved in science</b>		12	11	33
<b>Total</b>		<b>122</b>	<b>117</b>	<b>285</b>

Table 2: Structure of the sample, amount of participants for each group and participation rate.

#### 5. Results

The table shows those categories that feature particularly high or particularly low mean values, listing the top ten and low ten categories in descending order.

1. Which **priority** should the respective aspects have in science education?

<b>Category</b>	<b>Mean value</b>
<b>Comprehension / understanding</b>	5,65
<b>Applying knowledge, thinking creatively / abstractly</b>	5,51
<b>Intellectual personality development</b>	5.59
<b>Rational thinking / analysing / drawing conclusions</b>	5.58
<b>Motivation and interest</b>	5.48
<b>Working self-dependently / structuredly / precisely</b>	5.49
<b>Judgement /opinion-forming / reflection</b>	5,45
<b>Students' interests</b>	5.40
<b>Mathematics</b>	5.38
<b>Nature / natural phenomena</b>	5.37
...	
<b>Astronomy / space system</b>	4.25
<b>Analytical Chemistry</b>	4.24
<b>Industrial processes</b>	4.24
<b>Limits of scientific knowledge</b>	4.20
<b>Microbiology</b>	4.07
<b>(Specialized) knowledge</b>	4.01
<b>Neurobiology</b>	3.97
<b>History of the science</b>	3.76
<b>Role play</b>	3.63
<b>Learning in mixed-aged classes</b>	2.75

Table 3:Top ten and low ten categories of the priority assessments by the total sample

The highest mean value with regard to the priority the participants assigned to this aspect appears with the categories “Comprehension / understanding” (mean value = 5,65) and “Applying knowledge, thinking creatively / abstractly“ (mean value = 5,51), a rather low priority “Learning in mixed-aged classes“(mean value = 2,75) and the category “role play”(mean values 3,63).

### 5.1 Descriptive statistics concerning the priority-assessment differentiated according to the groups of students, teachers, educators, scientists and adults.

The following tables (Tables 4 to 8) show a comparison of the mean values and standard deviation of the different groups.

The tables are divided into different parts according to the different parts of the category system: contexts, motives and situations (Table 4), basic concepts and topics (Table 5), fields and perspectives (Table 6), qualifications (Table 7) and methods (Table 8).

Tables contain the descriptive statistics (mean, standard deviation, n) regarding the priority-assessment differentiated according to the groups of students, teachers, educators, scientists and adults (including the groups of teachers, educators and scientists).

1st Question	Which priority should the respective aspects have in science education?													
Groups	Students 27		People who are not directly involved with sciences 11		Teachers 35		Education politicians 3		Scientists 20		Educators, didactics, and in-service teacher educators 21		Mean values Total	not answer
Part 1: Situations, contexts and motives	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation		
Education / general pers. development	4.82	1.02	5.00	0.67	5.26	1.04	5.00	1.00	5.05	0.62	5.24	0.77	5.06155	1
Emotional personality development	4.25	1.11	4.10	0.88	4.54	1.15	4.33	1.15	4.05	0.91	4.33	1.11	4.268693	1
Intellectual personality development	5.36	0.87	5.70	0.48	5.60	0.81	5.67	0.58	5.55	0.60	5.67	0.48	5.590079	0
Students' interests	4.96	1.23	5.60	0.52	5.43	0.81	5.67	0.58	5.10	0.91	5.67	0.58	5.404365	0
Curriculum framework	5.11	0.93	5.30	0.67	5.17	0.89	4.33	0.58	4.85	1.04	4.90	1.00	4.945106	1
Out-of-school learning	4.48	1.22	4.90	0.88	4.94	0.91	3.67	1.15	4.70	1.08	4.52	1.17	4.535802	1
Media / current issues	4.39	0.99	4.90	0.88	4.80	1.13	4.67	0.58	4.20	1.20	5.10	0.89	4.675794	0

Nature / natural phenomena	4.67	1.18	6.00	0.00	5.46	0.82	5.33	0.58	5.11	0.81	5.67	0.58	5.371512	2
Everyday life	4.67	1.04	5.56	0.73	5.17	0.86	4.00	1.73	4.80	0.70	5.52	0.60	4.95291	2
Medicine / health	5.11	1.17	4.90	0.74	4.83	1.12	4.33	1.53	4.65	1.04	4.90	0.89	4.787302	0
Technology	5.14	1.04	5.60	0.70	5.23	1.03	5.33	1.15	5.00	0.73	5.29	0.72	5.265079	0
Society / public concerns	4.36	1.10	4.60	0.70	4.66	1.03	3.67	1.15	4.40	0.94	5.05	1.02	4.454762	0
Environment issues/ Individual's and society's impact on the environment	4.82	0.98	5.80	0.42	5.15	0.86	5.00	1.00	4.95	0.83	5.62	0.59	5.222923	1
Global references	4.68	1.12	5.70	0.48	4.80	1.02	5.00	1.00	4.60	1.10	5.05	0.67	4.971032	0
Occupation / career	4.70	1.23	4.80	0.79	4.71	1.06	3.00	0.00	4.45	1.05	4.81	0.87	4.411518	2
Science - biology	4.86	0.93	5.00	1.05	4.91	1.12	5.33	1.15	4.68	0.75	4.76	0.89	4.925146	1
Science - chemistry	4.93	1.12	5.10	0.99	4.97	1.06	5.33	1.15	4.85	0.88	4.76	0.89	4.990733	0
Science - physics	4.79	1.34	5.10	0.99	5.12	0.78	5.33	1.15	4.95	0.71	4.90	0.77	5.032065	3
Science - interdisciplinarity	4.58	1.10	5.10	0.99	4.82	1.27	5.67	0.58	5.30	0.66	5.38	0.67	5.141345	3

Table4

Part IIa:	Students 27		People who are not directly involved with sciences 11		Teachers 35		Education politicians 3		Scientists 20		Educators, didactics, and in – service teacher educators 21		Mean values Total	not answer
	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation		
(Basic) concepts and topics														
Matter / particle concept	4.29	1.08	5.11	1.05	4.71	1.02	4.33	0.58	5.15	0.81	4.57	0.93	4.694312	1
Structure / function / properties	4.61	1.23	5.67	0.50	5.14	0.85	4.67	0.58	5.30	0.57	5.00	0.84	5.063889	1
Chemical reactions	4.78	1.05	5.56	1.01	4.80	1.16	4.67	0.58	4.95	0.69	4.67	0.86	4.902778	2
Energy	4.71	0.98	5.56	0.88	5.11	0.72	5.33	0.58	4.90	0.79	5.29	0.64	5.150529	1

<b>System</b>	4.11	1.10	5.00	0.87	4.91	0.72	5.00	0.00	4.42	0.90	5.10	0.79	4.756214	5
<b>Interaction</b>	4.25	1.24	5.44	0.88	5.20	0.87	5.33	0.58	4.85	0.81	5.33	0.73	5.068519	1
<b>Models</b>	4.21	1.17	5.00	1.12	5.86	4.80	5.00	0.00	4.68	0.82	4.62	0.74	4.895781	2
<b>Terminology</b>	4.48	0.98	5.11	1.17	4.71	1.02	4.33	0.58	4.45	0.76	4.60	0.99	4.615035	3
<b>Scientific inquiry</b>	5.32	0.90	5.67	0.50	5.54	0.92	5.00	0.00	4.80	1.06	5.57	0.68	5.317063	1
<b>Limits of scientific knowledge</b>	3.93	1.30	4.67	1.22	4.03	1.14	4.67	0.58	3.79	0.92	4.15	1.27	4.205132	4
<b>Cycle of matter</b>	4.43	1.17	5.00	1.32	5.00	0.84	4.33	0.58	4.40	0.82	4.81	0.87	4.661905	1
<b>Food / nutrition</b>	4.96	1.14	5.44	0.73	5.14	0.94	3.67	0.58	4.40	1.10	5.14	0.79	4.793519	1
<b>Health / medicine</b>	5.29	0.98	5.33	0.87	5.40	0.77	4.00	0.00	4.50	0.83	5.29	0.56	4.96746	1
<b>Matter in everyday life</b>	4.82	1.02	5.22	1.09	5.40	0.74	4.00	0.00	4.95	0.83	5.43	0.68	4.97037	1
<b>Technical devices</b>	4.57	1.32	4.67	1.22	4.71	1.05	4.33	0.58	4.20	1.06	4.14	1.11	4.438095	1
<b>Environment</b>	5.32	0.98	5.89	0.33	5.43	0.81	4.33	1.53	4.75	0.79	5.52	0.75	5.207672	1
<b>Industrial processes</b>	4.29	1.21	4.44	1.13	4.54	1.07	4.33	1.53	3.85	0.67	4.00	1.18	4.242725	1
<b>Safety and risks</b>	5.29	0.94	5.50	0.53	5.37	0.81	4.00	0.00	4.40	0.99	5.57	0.60	5.021429	2
<b>Occupations / occupational fields</b>	4.64	1.10	4.75	0.71	4.89	0.93	4.00	1.00	4.05	1.32	4.76	0.94	4.515079	2

Table 5

Part IIb:	Students 27		People who are not directly involved with sciences 11		Teachers 35		Education politicians 3		Scientists 20		Educators, didactics, and in – service teacher educators 21		Mean values Total	not answer
	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation		
<b>Scientific disciplines and perspectives</b>														
<b>Botany</b>	4.79	1.03	4.89	1.27	4.56	0.99	4.33	1.15	4.20	0.95	4.75	0.97	4.586127	3
<b>Zoology</b>	4.79	1.13	4.89	1.27	4.58	1.06	4.33	1.15	4.10	0.91	4.75	0.97	4.572282	4

<b>Human biology</b>	5.21	1.07	5.67	0.50	5.15	0.89	4.33	1.15	4.75	0.91	5.20	0.83	5.051891	3
<b>Genetics / molecular biology</b>	4.52	1.12	5.00	1.22	4.62	1.13	4.00	1.00	4.50	1.19	4.75	1.16	4.564361	4
<b>Microbiology</b>	4.25	1.14	4.33	1.12	4.56	1.11	3.33	0.58	4.05	1.19	3.95	1.23	4.079248	3
<b>Evolutionary biology</b>	4.54	1.14	4.67	1.12	4.26	1.19	5.00	1.00	3.95	1.05	4.45	1.00	4.477848	3
<b>Neurobiology</b>	4.12	1.53	4.22	1.20	4.41	1.23	4.00	0.00	3.75	1.45	3.37	1.42	3.977965	6
<b>Ecology</b>	5.00	0.90	5.56	0.73	5.37	0.73	4.67	0.58	4.65	0.88	5.33	0.73	5.096164	1
<b>Inorganic chemistry</b>	4.50	1.29	5.11	0.93	4.91	0.87	4.67	0.58	4.65	0.59	4.86	0.79	4.782781	2
<b>Organic chemistry</b>	4.63	1.21	5.00	1.00	4.91	1.03	5.00	1.00	4.90	0.79	5.00	0.89	4.906899	3
<b>Analytical Chemistry</b>	4.14	1.21	4.38	1.19	4.24	0.96	4.33	0.58	4.35	1.09	4.05	1.20	4.247351	3
<b>Biochemistry</b>	4.75	0.97	4.11	1.45	4.33	1.31	4.33	0.58	4.45	0.83	3.95	1.20	4.321693	3
<b>Mechanics</b>	4.82	1.02	5.11	0.60	4.63	1.03	4.67	0.58	4.55	0.83	4.65	0.75	4.737963	2
<b>Electrodynamics</b>	4.11	1.20	5.11	0.93	4.80	1.05	4.67	0.58	4.45	0.76	4.55	0.76	4.614153	2
<b>Thermodynamics</b>	4.14	1.24	4.89	0.93	4.54	0.98	4.67	0.58	4.50	0.61	4.30	0.80	4.506878	2
<b>Atomic / nuclear physics</b>	4.37	1.42	4.44	1.51	4.23	1.17	4.67	0.58	4.47	1.02	3.90	1.21	4.34729	4
<b>Astronomy / space system</b>	4.64	1.22	4.44	1.24	4.40	0.95	3.67	0.58	4.30	0.73	4.05	1.15	4.250661	2
<b>Earth sciences</b>	4.82	0.98	4.89	0.93	4.65	1.07	4.67	1.15	4.10	1.17	4.65	1.04	4.629007	3
<b>Mathematics</b>	5.32	0.90	5.50	0.76	5.03	1.25	5.67	0.58	5.50	0.69	5.29	0.72	5.38373	2
<b>Interdisciplinarity</b>	4.36	1.25	5.50	0.71	4.85	1.16	5.00	0.00	5.10	0.85	5.38	0.86	5.031839	2
<b>Current scientific research</b>	4.89	1.13	4.90	1.29	4.91	0.95	5.33	1.15	4.55	0.89	4.86	1.01	4.907937	1
<b>Consequences of technological Developments</b>	5.00	1.31	5.10	0.88	5.09	0.79	5.33	1.15	4.63	0.90	5.00	1.05	5.025525	3



<b>History of the sciences</b>	4.07	1.25	3.50	1.20	3.88	1.09	4.00	0.00	3.60	0.88	3.52	1.33	3.762932	2
<b>Ethics / values</b>	4.43	1.26	5.11	0.93	4.91	1.16	4.67	0.58	4.20	0.83	4.95	1.12	4.711749	2

Table 6

<b>Part III:</b>	<b>Students 27</b>		<b>People who are not directly involved with sciences 11</b>		<b>Teachers 35</b>		<b>Education politicians 3</b>		<b>Scientists 20</b>		<b>Educators, didactics, and in – service teacher educators 21</b>		<b>Mean values Total</b>	<b>not answer</b>
	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>		
<b>Qualifications</b>														
<b>Empathy / sensibility</b>	4.82	1.31	5.56	0.73	5.23	0.97	4.33	0.58	4.80	0.95	5.14	0.73	4.980291	1
<b>Motivation and interest</b>	5.25	1.00	5.78	0.44	5.63	0.60	5.33	0.58	5.25	0.72	5.67	0.58	5.484392	1
<b>Critical questioning</b>	4.61	1.26	5.44	0.53	4.82	0.97	5.50	0.71	4.47	0.90	5.38	0.74	5.038292	4
<b>Acting reflectedly and responsibly</b>	5.07	1.05	5.67	0.71	5.21	0.77	5.00	0.00	4.85	1.04	5.52	0.68	5.219631	3
<b>Knowledge about science-related occupations</b>	4.64	0.95	4.89	0.78	4.86	1.03	4.00	0.00	4.20	0.95	4.43	0.98	4.50291	1
<b>(Specialized) knowledge</b>	4.82	1.22	3.89	1.45	4.20	1.13	4.00	0.00	3.75	0.91	3.43	1.03	4.014815	1
<b>Comprehension / understanding</b>	5.46	0.92	6.00	0.00	5.49	0.66	5.67	0.58	5.60	0.68	5.70	0.57	5.652778	2
<b>Applying knowledge, thinking creatively / abstractly</b>	5.21	1.03	5.89	0.33	5.49	0.74	6.00	0.00	5.40	0.75	5.67	0.58	5.609259	1
<b>Judgement /opinion-forming / reflection</b>	5.14	1.01	5.78	0.44	5.29	0.96	5.67	0.58	5.20	0.95	5.62	0.74	5.448677	1
<b>Finding information</b>	5.04	0.74	5.78	0.44	5.17	0.89	5.33	0.58	4.95	0.76	5.67	0.48	5.322487	1
<b>Reading comprehension</b>	4.93	0.98	5.67	0.71	5.37	0.77	5.67	0.58	4.95	1.00	5.57	0.81	5.359127	1
<b>Communication skills</b>	4.93	1.02	5.78	0.44	5.26	0.90	5.00	1.00	4.80	0.83	5.38	0.80	5.192001	2
<b>Social skills / teamwork</b>	5.04	1.04	5.56	0.73	5.20	0.76	4.33	1.15	4.75	0.97	5.38	0.80	5.042593	1
<b>Perception / awareness</b>	5.11	0.97	5.44	0.73	5.03	0.79	5.50	0.71	4.30	1.08	5.40	0.60	5.130688	4

<b>Formulating scientific questions / hypotheses</b>	5.07	0.86	5.11	0.93	5.09	0.82	5.00	0.00	4.55	0.83	4.81	0.93	4.937963	1
<b>Experimenting</b>	5.29	0.90	5.78	0.44	5.29	0.86	4.67	0.58	5.10	0.79	5.38	0.74	5.249471	1
<b>Rational thinking / analysing / drawing conclusions</b>	5.30	0.87	5.89	0.33	5.57	0.85	5.67	0.58	5.45	0.51	5.67	0.48	5.589991	2
<b>working self-dependently / structuredly / precisely</b>	5.32	0.77	6.00	0.00	5.60	0.65	5.33	0.58	5.15	0.75	5.55	0.60	5.49246	2

Table7

<b>Part IV:</b>	<b>Students 27</b>		<b>People who are not directly involved with sciences 11</b>		<b>Teachers 35</b>		<b>Education politicians 3</b>		<b>Scientists 20</b>		<b>Educators, didactics, and in – service teacher educators 21</b>		<b>Mean values Total</b>	<b>not answer</b>
	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>		
<b>Methodical Aspects</b>														
<b>Cooperative Learning</b>	5.07	1.05	5.11	0.93	4.68	0.91	4.33	0.58	4.10	1.07	4.57	0.98	4.643962	2
<b>Learning in mixed-aged classes</b>	3.43	1.40	2.11	1.45	3.29	1.47	2.33	1.53	2.95	1.00	2.39	1.20	2.751004	5
<b>Interdisciplinary learning</b>	4.22	0.93	4.89	0.93	4.43	1.12	5.00	1.00	4.60	1.31	4.86	1.01	4.666138	2
<b>Inquiry-based science learning</b>	4.85	1.06	4.89	0.93	5.06	1.08	5.00	0.00	4.60	1.27	5.33	0.80	4.955203	2
<b>Learning at stations</b>	4.43	1.14	4.78	0.97	4.69	1.02	3.33	0.58	4.05	1.00	4.40	1.05	4.279233	2
<b>Role play</b>	3.75	1.24	4.00	0.87	4.14	1.09	2.67	0.58	3.30	1.38	3.95	0.89	3.634921	2
<b>Discussion / debate</b>	5.00	1.02	5.44	0.73	4.80	0.80	4.67	0.58	4.45	0.89	4.95	0.97	4.885582	1
<b>Project method</b>	4.82	0.90	4.78	0.44	4.83	0.89	4.33	0.58	4.45	1.15	4.80	0.70	4.668519	2
<b>Organization of excursions</b>	5.07	0.98	5.44	0.53	4.94	0.84	4.00	1.00	3.95	0.89	4.90	1.00	4.718915	1
<b>Using new media</b>	4.96	0.96	4.67	1.22	4.74	1.04	3.67	0.58	4.45	1.10	4.57	1.21	4.510317	1

Table 8

**5.2 Descriptive statistics concerning the practice-assessment differentiated according to the groups of students, teachers, educators, scientists and adults.**

2. To what extent are the respective aspects realized in current science education?

<b>Category</b>	<b>Mean value</b>
<b>Mathematics</b>	4.98
<b>Structure / function / properties</b>	4,76
<b>Inorganic chemistry</b>	4.74
<b>Chemical reactions</b>	4,73
<b>Terminology</b>	4.62
<b>Human biology</b>	4.58
<b>Science-physics</b>	4.57
<b>Mechanics</b>	4.55
<b>Nature / natural phenomena</b>	4.50
<b>Organic chemistry</b>	4.48
...	
<b>Ethics / values</b>	3.32
<b>History of the science</b>	3.26
<b>Current scientific research</b>	3.23
<b>Limits of scientific knowledge</b>	3.23
<b>Biochemistry</b>	3.22
<b>Learning at stations</b>	3.19

<b>Interdisciplinary learning</b>	3.11
<b>Neurobiology</b>	2.82
<b>Role play</b>	2,71
<b>Learning in mixed-aged classes</b>	2.25

Table9

Table 9 displays the ten highest and ten lowest mean values of the categories. The aspects that was assessed as most realized in science education is “mathematics” (mean value: 4,98) and “Structure / function / properties“ (mean value: 4,76). The lowest mean values are “Learning in mixed-aged classes” (mean values 2,25) and the category “role play”(mean values 2,71).

Tables contain the descriptive statistics (mean, standard deviation, n) regarding the practice-assessment differentiated according to the groups of students, teachers, educators, scientists and adults (including the groups of teachers, educators and scientists).

The tables are divided into different parts according to the different parts of the category system: contexts, motives and situations (Table 10), basic concepts and topics (Table 11), fields and perspectives (Table 12), qualifications (Table 13) and methods (Table 14).

2nd Question	To what extent are the respective aspects realized in current science education?												Mean values Total	not answer
	Students 27		People who are not directly involved with sciences 11		Teachers 35		Education politicians 3		Scientists 20		Educators, didactics, and in – service teacher educators 21			
Groups	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation		
<b>Part 1: Situations, contexts and motives</b>														
<b>Education / general pers. development</b>	4.07	0.90	4.11	0.60	4.17	1.15	3.33	1.15	3.93	0.83	3.95	0.86	3.928042	7
<b>Emotional personality development</b>	3.59	1.05	3.44	0.73	3.71	1.27	3.33	1.53	2.93	1.03	2.95	1.02	3.328395	7
<b>Intellectual personality development</b>	4.63	0.93	4.33	0.87	4.46	1.12	4.67	0.58	4.53	1.25	4.10	0.83	4.452557	7
<b>Students' interests</b>	4.14	1.11	4.00	1.00	4.06	1.06	4.33	1.15	3.87	0.83	3.81	1.08	4.034921	6
<b>Curriculum framework</b>	4.59	1.01	5.00	0.71	4.43	1.17	4.00	1.00	4.27	0.80	4.38	0.97	4.444797	7
<b>Out-of-school learning</b>	3.48	1.22	3.33	1.32	3.49	1.07	3.67	0.58	3.64	1.50	3.14	0.91	3.458818	8

Media / current issues	3.96	1.19	3.44	0.88	3.86	1.22	3.33	1.15	3.40	0.91	3.62	1.12	3.602822	7
Nature / natural phenomena	4.07	0.94	4.78	0.97	4.54	1.01	4.67	1.15	4.29	1.14	4.71	0.78	4.509788	7
Everyday life	3.92	1.09	4.11	1.17	4.06	1.16	4.33	2.08	3.47	0.74	3.95	1.07	3.973952	8
Medicine / health	4.04	1.17	3.75	0.71	3.86	1.35	4.00	1.00	3.13	1.19	3.48	1.17	3.70873	7
Technology	4.36	1.13	5.11	1.05	4.46	0.98	3.67	1.15	3.53	1.13	4.10	1.04	4.203439	6
Society / public concerns	3.75	1.00	3.56	0.53	3.86	1.06	3.67	1.53	3.13	0.99	3.38	1.16	3.557275	6
Environment issues/ Individual's and society's impact on the environment	4.14	0.93	4.67	0.50	4.41	1.10	4.33	1.15	4.27	1.03	4.38	1.07	4.36704	7
Global references	3.89	1.13	4.33	1.00	4.09	1.01	3.67	0.58	3.80	0.77	3.71	1.15	3.915476	6
Occupation / career	3.79	1.34	4.11	0.78	3.60	1.31	2.33	0.58	3.13	0.92	3.14	0.85	3.351058	6
Science - biology	4.36	1.06	4.67	1.22	4.54	1.01	4.67	1.15	3.93	1.14	4.33	0.73	4.415873	6
Science - chemistry	4.54	1.00	4.78	1.20	4.47	1.08	4.67	1.15	3.93	1.10	4.29	0.90	4.444966	7
Science - physics	4.54	1.04	4.78	1.20	4.42	0.97	5.00	1.00	4.43	0.85	4.29	0.85	4.575337	9
Science - interdisciplinarity	3.65	1.16	4.00	0.87	4.06	1.27	3.67	1.53	3.20	1.01	3.38	1.12	3.660345	10

Table 10

Part IIa:	Students 27		People who are not directly involved with sciences 11		Teachers 35		Education politicians 3		Scientists 20		Educators, didactics, and in – service teacher educators 21		Mean values Total	not answer
	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation		
(Basic) concepts and topics														
Matter / particle concept	4.07	1.12	4.63	1.06	4.37	0.91	4.33	0.58	4.47	1.19	4.52	0.87	4.398611	7
Structure / function / properties	4.46	1.04	5.50	0.53	4.54	0.74	4.67	0.58	4.87	0.64	4.57	0.75	4.768651	3
Chemical reactions	4.67	0.96	5.75	0.71	4.46	1.12	4.33	0.58	4.50	1.09	4.71	0.72	4.736905	5
Energy	4.32	0.98	4.88	1.13	4.43	0.88	4.67	0.58	4.47	0.99	4.05	1.16	4.467659	3

<b>System</b>	3.93	1.02	4.38	0.92	4.32	1.01	3.67	1.15	3.93	1.00	4.10	0.91	4.053723	6
<b>Interaction</b>	3.96	1.14	4.63	1.06	4.41	1.02	4.33	0.58	4.07	0.92	4.10	1.00	4.250175	5
<b>Models</b>	3.96	0.92	4.75	1.04	4.26	1.04	4.67	0.58	3.79	0.89	4.10	1.04	4.253175	4
<b>Terminology</b>	4.30	1.10	5.25	0.71	4.60	1.22	5.00	1.00	4.33	0.98	4.29	1.01	4.627557	4
<b>Scientific inquiry</b>	4.69	0.84	5.13	0.83	4.57	1.12	4.00	1.00	3.73	1.33	4.00	1.10	4.353678	5
<b>Limits of scientific knowledge</b>	3.68	1.09	3.25	1.16	3.56	0.91	3.00	1.73	3.00	1.11	2.90	1.45	3.231845	8
<b>Cycle of matter</b>	4.00	1.22	4.00	1.20	4.38	1.07	3.33	0.58	3.93	0.88	4.24	0.70	3.981186	4
<b>Food / nutrition</b>	3.96	1.20	4.38	0.74	4.09	1.29	3.33	0.58	3.73	1.16	3.95	1.07	3.907761	4
<b>Health / medicine</b>	4.48	1.19	4.25	0.89	4.12	1.19	3.33	0.58	3.53	1.06	3.81	1.08	3.921481	6
<b>Matter in everyday life</b>	4.32	1.16	4.38	0.92	4.44	1.08	3.33	0.58	3.71	0.83	3.86	1.11	4.006448	7
<b>Technical devices</b>	3.89	1.28	4.25	0.71	3.86	0.94	3.00	0.00	3.27	1.03	3.43	0.93	3.615212	4
<b>Environment</b>	4.50	1.14	5.00	0.76	4.69	0.96	4.00	1.00	4.27	0.59	4.29	0.96	4.456349	3
<b>Industrial processes</b>	3.71	1.12	3.50	0.76	3.80	1.11	3.33	0.58	3.07	0.70	3.57	1.12	3.497619	3
<b>Safety and risks</b>	4.54	1.17	4.50	1.20	4.37	1.06	3.33	0.58	3.67	1.18	4.43	0.81	4.139286	3
<b>Occupations / occupational fields</b>	3.86	1.24	3.75	0.89	3.77	1.19	2.67	0.58	3.20	0.68	3.57	1.08	3.469444	3

Table 11

Part IIb:	Students 27		People who are not directly involved with sciences 11		Teachers 35		Education politicians 3		Scientists 20		Educators, didactics, and in – service teacher educators 21		Mean values Total	not answer
	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation		
<b>Scientific disciplines and perspectives</b>														
<b>Botany</b>	4.36	1.10	4.75	1.04	4.44	0.99	4.33	0.58	4.27	1.28	4.75	1.12	4.483053	9
<b>Zoology</b>	4.50	1.00	4.71	0.76	4.53	0.90	4.00	1.00	4.20	1.32	4.80	1.01	4.457283	10

<b>Human biology</b>	4.88	1.03	4.86	0.69	4.68	1.07	4.00	1.00	4.20	1.21	4.90	0.91	4.586371	12
<b>Genetics / molecular biology</b>	3.96	1.10	4.13	0.83	4.18	1.31	3.67	0.58	3.67	1.11	3.84	1.26	3.907757	11
<b>Microbiology</b>	3.75	1.14	3.38	0.92	4.09	1.07	3.33	0.58	3.36	1.45	3.17	1.25	3.512175	13
<b>Evolutionary biology</b>	3.81	1.36	4.38	1.06	4.00	1.03	3.33	0.58	3.73	1.22	3.67	0.97	3.820525	13
<b>Neurobiology</b>	3.04	1.28	2.88	0.83	3.52	1.33	2.67	0.58	2.64	1.15	2.22	1.35	2.826727	15
<b>Ecology</b>	4.32	1.16	4.88	1.13	4.62	0.92	3.33	1.15	4.00	1.13	4.30	0.86	4.241235	9
<b>Inorganic chemistry</b>	4.32	1.33	4.88	0.64	4.88	1.02	4.67	0.58	4.80	0.68	4.90	0.89	4.741108	9
<b>Organic chemistry</b>	4.19	1.21	4.75	0.71	4.73	1.07	4.33	0.58	4.33	1.18	4.57	0.98	4.483426	10
<b>Analytical Chemistry</b>	3.68	1.12	3.43	0.98	3.79	1.49	3.67	1.15	4.00	0.85	3.43	1.16	3.665043	10
<b>Biochemistry</b>	3.71	0.98	3.25	1.28	3.43	1.45	3.33	0.58	3.07	1.39	2.57	1.33	3.228175	12
<b>Mechanics</b>	4.11	1.34	4.75	0.89	4.24	1.13	4.67	0.58	4.80	0.94	4.75	0.85	4.551517	9
<b>Electrodynamics</b>	3.78	1.22	4.63	0.74	4.21	1.17	4.33	0.58	4.27	1.10	4.39	0.92	4.266258	12
<b>Thermodynamics</b>	3.61	1.26	4.50	0.93	4.09	1.23	4.33	0.58	4.33	1.05	4.28	1.02	4.190416	12
<b>Atomic / nuclear physics</b>	3.54	1.55	3.38	1.06	4.03	1.10	4.33	0.58	3.07	1.39	3.42	1.17	3.627012	11
<b>Astronomy / space system</b>	3.64	1.45	2.88	0.83	3.85	1.26	3.33	0.58	3.00	1.20	3.42	1.26	3.354197	10
<b>Earth sciences</b>	3.75	1.21	3.88	1.25	4.16	1.19	3.33	0.58	3.50	1.02	3.95	1.27	3.760325	13
<b>Mathematics</b>	5.18	1.12	5.00	1.15	4.73	1.18	5.00	1.00	4.93	0.92	5.10	0.91	4.989069	12
<b>Interdisciplinarity</b>	4.00	1.31	3.75	1.04	3.91	1.11	3.67	1.15	3.33	1.05	3.05	1.28	3.618627	9
<b>Current scientific research</b>	3.71	1.15	3.25	0.89	3.71	1.18	2.67	1.53	3.07	1.49	3.00	1.22	3.235317	7
<b>Consequences of technological Developments</b>	3.96	1.48	3.50	0.76	4.24	0.96	3.00	1.00	3.13	1.19	3.45	1.00	3.547152	9

History of the sciences	3.96	1.17	2.88	1.13	3.65	1.04	3.00	0.00	3.27	1.10	2.86	1.24	3.268359	8
Ethics / values	3.86	1.41	3.25	1.04	3.82	1.11	3.00	1.00	3.07	1.16	2.95	1.12	3.324953	8

Table 12

Part III: Qualifications	Students 27		People who are not directly involved with sciences 11		Teachers 35		Education politicians 3		Scientists 20		Educators, didactics, and in – service teacher educators 21		Mean values Total	not answer
	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation	mean	standard deviation		
Empathy / sensibility	4.04	1.26	4.00	0.76	3.91	0.82	4.00	1.00	4.40	1.06	3.55	0.76	3.983333	8
Motivation and interest	4.11	1.13	4.25	0.71	4.06	1.11	3.33	1.15	3.87	0.92	3.55	1.05	3.860714	8
Critical questioning	4.00	1.22	4.00	0.53	3.66	1.14	4.00	1.41	4.29	1.27	3.20	0.89	3.857143	10
Acting reflectedly and responsibly	4.26	1.10	4.13	0.83	4.00	1.03	3.50	0.71	3.93	1.33	3.35	1.18	3.861265	10
Knowledge about science-related occupations	3.75	1.14	3.50	0.93	3.62	1.04	3.00	1.00	3.53	1.13	3.48	1.03	3.479528	8
(Specialized) knowledge	3.79	1.32	3.38	1.30	3.51	1.36	4.00	1.00	3.47	1.41	3.71	1.19	3.642659	7
Comprehension / understanding	4.32	1.02	4.63	0.92	3.89	1.05	4.33	1.53	4.60	1.06	3.65	1.23	4.235913	8
Applying knowledge, thinking creatively / abstractly	4.32	1.06	4.25	1.67	3.89	1.05	5.33	1.15	4.13	0.92	3.52	0.98	4.24127	7
Judgement /opinion-forming / reflection	4.57	1.10	4.88	1.13	4.14	0.94	4.00	1.73	3.80	0.86	3.57	1.03	4.160119	7
Finding information	4.52	1.05	4.63	0.92	4.54	0.92	4.00	1.73	4.27	1.10	4.14	1.06	4.349317	8
Reading comprehension	4.29	1.24	3.75	1.67	3.97	1.07	4.67	1.15	3.93	0.83	3.33	1.11	3.989286	8
Communication skills	4.54	1.10	4.38	1.06	4.35	0.92	3.00	1.73	3.60	0.63	3.81	1.29	3.94553	8
Social skills / teamwork	4.63	1.18	4.63	0.92	4.40	1.06	3.33	1.53	3.73	0.88	3.76	1.22	4.080534	8
Perception / awareness	4.54	0.92	3.88	0.99	4.14	1.00	4.00	#DIV/0!	3.93	0.92	3.70	0.92	4.030357	11
Formulating scientific questions / hypotheses	4.71	0.81	4.38	0.74	4.11	0.96	3.67	1.53	4.13	1.25	3.67	1.15	4.111706	7



<b>Experimenting</b>	4.46	0.84	4.75	1.04	4.23	1.29	3.67	0.58	3.93	1.22	4.15	0.81	4.19881	8
<b>Rational thinking / analysing / drawing conclusions</b>	4.44	1.05	4.38	1.06	4.06	0.94	4.00	0.00	4.27	1.16	3.76	0.94	4.15086	8
<b>working self-dependently / structuredly / precisely</b>	4.54	1.14	4.00	0.93	4.21	1.12	4.00	0.00	3.93	1.16	3.60	0.88	4.045822	9

Table 13

<b>Part IV:</b>	<b>Students 27</b>		<b>People who are not directly involved with sciences 11</b>		<b>Teachers 35</b>		<b>Education politicians 3</b>		<b>Scientists 20</b>		<b>Educators, didactics, and in – service teacher educators 21</b>			<b>not answer</b>
	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>	<b>mean</b>	<b>standard deviation</b>		
<b>Methodical Aspects</b>														
<b>Cooperative Learning</b>	4.29	1.33	4.38	0.74	4.00	1.14	3.33	0.58	3.33	1.11	3.29	1.15	3.768849	7
<b>Learning in mixed-aged classes</b>	2.81	1.59	1.43	0.79	2.64	1.54	2.33	0.58	2.53	1.06	1.79	0.85	2.255982	12
<b>Interdisciplinary learning</b>	3.70	1.03	3.43	1.27	3.57	1.22	2.33	0.58	2.86	1.17	2.81	0.98	3.117284	10
<b>Inquiry-based science learning</b>	4.29	0.90	4.00	1.07	3.88	1.23	3.33	0.58	3.53	1.19	3.57	1.16	3.767694	8
<b>Learning at stations</b>	3.41	1.19	3.25	0.46	3.62	1.21	2.67	0.58	3.21	1.19	3.00	1.08	3.192668	11
<b>Role play</b>	2.85	1.29	2.50	0.76	3.77	1.26	2.00	0.00	2.57	1.28	2.58	0.96	2.712276	11
<b>Discussion / debate</b>	4.46	1.23	3.75	1.28	4.09	1.29	2.67	0.58	3.13	1.06	3.00	1.10	3.516667	7
<b>Project method</b>	4.29	1.01	4.14	0.69	4.06	0.97	3.67	1.15	3.40	1.24	3.60	1.23	3.85873	9
<b>Organization of excursions</b>	3.57	1.64	4.00	1.07	3.94	1.41	3.67	1.15	3.73	0.96	3.00	1.00	3.652381	7
<b>Using new media</b>	4.00	1.41	3.50	1.41	3.97	1.12	3.00	1.00	3.53	0.74	3.00	1.10	3.500794	7

Table 14

### 5.3 Descriptive statistics concerning the priority-practice-difference differentiated according to the groups of students, teachers, educators, scientists and adults.

In this part, the results from the analyses with regard to the priority-practice differences are shown. The priority-practice differences result from subtracting the practice values from the priority values ( $x_P - x_R = \Delta PPD$ ).

#### 3. The priority-practice-difference

<b>Category</b>	<b>Mean value</b>
<b>Students' interests</b>	1.87
<b>Science - interdisciplinarity</b>	1.84
<b>Intellectual personality development</b>	1.68
<b>Current scientific research</b>	1.67
<b>Education / general pers. development</b>	1.65
<b>Motivation and interest</b>	1.62
<b>Global references</b>	1.55
<b>Interdisciplinary learning</b>	1.54
<b>Media / current issues</b>	1.48
<b>Consequences of technological Developments</b>	1.47
...	
<b>Electrodynamics</b>	0.34
<b>Thermodynamics</b>	0.31
<b>Matter / particle concept</b>	0.29
<b>Structure / function / properties</b>	0.29
<b>Mechanics</b>	0.18
<b>Chemical reactions</b>	0.16

<b>Zoology</b>	0.11
<b>Botany</b>	0.10
<b>Inorganic chemistry</b>	0.04
<b>Terminology</b>	-0.01

Table 15

It can be seen that nine out of the ten largest priority-practice differences feature values 1,47 – 1,87. Nine out of the ten smallest priority-practice differences feature values ranging between 0,04 and 0,34. A notable finding is that the priority-practice difference of the category “Terminology” features a negative value (-0,01).

Tables contain the descriptive statistics (mean, standard deviation, n) regarding the priority-practice-difference differentiated according to the groups of students, teachers, educators, scientists and adults (including the groups of teachers, educators and scientists).

the priority-practice-difference																			
Groups	Students 27			People who are not directly involved with sciences 11			Teachers 35			Education politicians 3			Scientists 20			Educators, didactics, and in-service teacher educators 21			Mean values
Part 1: Situations, contexts and motives	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	
<b>Education / general pers. development</b>	4.82	4.07	0.75	5.00	4.11	0.89	5.26	4.17	1.09	5.00	3.33	1.67	5.05	0.83	4.22	5.24	3.95	1.29	1.650146
<b>Emotional personality development</b>	4.25	3.59	0.66	4.10	3.44	0.66	4.54	3.71	0.83	4.33	3.33	1.00	4.05	1.03	3.02	4.33	2.95	1.38	1.257054
<b>Intellectual personality development</b>	5.36	4.63	0.73	5.70	4.33	1.37	5.60	4.46	1.14	5.67	4.67	1.00	5.55	1.25	4.30	5.67	4.10	1.57	1.68542
<b>Students' interests</b>	4.96	4.14	0.82	5.60	4.00	1.60	5.43	4.06	1.37	5.67	4.33	1.33	5.10	0.83	4.27	5.67	3.81	1.86	1.874921
<b>Curriculum framework</b>	5.11	4.59	0.52	5.30	5.00	0.30	5.17	4.43	0.74	4.33	4.00	0.33	4.85	0.80	4.05	4.90	4.38	0.52	1.078285
<b>Out-of-school learning</b>	4.48	3.48	1.00	4.90	3.33	1.57	4.94	3.49	1.46	3.67	3.67	0.00	4.70	1.50	3.20	4.52	3.14	1.38	1.43428
<b>Media / current issues</b>	4.39	3.96	0.43	4.90	3.44	1.46	4.80	3.86	0.94	4.67	3.33	1.33	4.20	0.91	3.29	5.10	3.62	1.48	1.487929

Nature / natural phenomena	4.67	4.07	0.60	6.00	4.78	1.22	5.46	4.54	0.91	5.33	4.67	0.67	5.11	1.14	3.97	5.67	4.71	0.95	1.386221
Everyday life	4.67	3.92	0.74	5.56	4.11	1.44	5.17	4.06	1.11	4.00	4.33	-0.33	4.80	0.74	4.06	5.52	3.95	1.57	1.432865
Medicine / health	5.11	4.04	1.07	4.90	3.75	1.15	4.83	3.86	0.97	4.33	4.00	0.33	4.65	1.19	3.46	4.90	3.48	1.43	1.402921
Technology	5.14	4.36	0.79	5.60	5.11	0.49	5.23	4.46	0.77	5.33	3.67	1.67	5.00	1.13	3.87	5.29	4.10	1.19	1.462952
Society / public concerns	4.36	3.75	0.61	4.60	3.56	1.04	4.66	3.86	0.80	3.67	3.67	0.00	4.40	0.99	3.41	5.05	3.38	1.67	1.254637
Environment issues/ Individual's and society's impact on the environment	4.82	4.14	0.68	5.80	4.67	1.13	5.15	4.41	0.74	5.00	4.33	0.67	4.95	1.03	3.92	5.62	4.38	1.24	1.394861
Global references	4.68	3.89	0.79	5.70	4.33	1.37	4.80	4.09	0.71	5.00	3.67	1.33	4.60	0.77	3.83	5.05	3.71	1.33	1.559789
Occupation / career	4.70	3.79	0.92	4.80	4.11	0.69	4.71	3.60	1.11	3.00	2.33	0.67	4.45	0.92	3.53	4.81	3.14	1.67	1.430103
Science - biology	4.86	4.36	0.50	5.00	4.67	0.33	4.91	4.54	0.37	5.33	4.67	0.67	4.68	1.14	3.54	4.76	4.33	0.43	0.973845
Science - chemistry	4.93	4.54	0.39	5.10	4.78	0.32	4.97	4.47	0.50	5.33	4.67	0.67	4.85	1.10	3.75	4.76	4.29	0.48	1.018025
Science - physics	4.79	4.54	0.25	5.10	4.78	0.32	5.12	4.42	0.70	5.33	5.00	0.33	4.95	0.85	4.10	4.90	4.29	0.62	1.052885
Science - interdisciplinarity	4.58	3.65	0.92	5.10	4.00	1.10	4.82	4.06	0.76	5.67	3.67	2.00	5.30	1.01	4.29	5.38	3.38	2.00	1.845303

Table 16

Part IIa:	Students 27			People who are not directly involved with sciences 11			Teachers 35			Education politicians 3			Scientists 20			Educators, didactics, and in – service teacher educators 21			Mean values
	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	
Matter / particle concept	4.29	4.07	0.21	5.11	4.63	0.49	4.71	4.37	0.34	4.33	4.33	0.00	5.15	4.47	0.68	4.57	4.52	0.05	0.295701
Structure / function / properties	4.61	4.46	0.14	5.67	5.50	0.17	5.14	4.54	0.60	4.67	4.67	0.00	5.30	4.87	0.43	5.00	4.57	0.43	0.295238
Chemical reactions	4.78	4.67	0.11	5.56	5.75	-0.19	4.80	4.46	0.34	4.67	4.33	0.33	4.95	4.50	0.45	4.67	4.71	-0.05	0.165873
Energy	4.71	4.32	0.39	5.56	4.88	0.68	5.11	4.43	0.69	5.33	4.67	0.67	4.90	4.47	0.43	5.29	4.05	1.24	0.68287

<b>System</b>	4.11	3.93	0.18	5.00	4.38	0.63	4.91	4.32	0.59	5.00	3.67	1.33	4.42	3.93	0.49	5.10	4.10	1.00	0.702491
<b>Interaction</b>	4.25	3.96	0.29	5.44	4.63	0.82	5.20	4.41	0.79	5.33	4.33	1.00	4.85	4.07	0.78	5.33	4.10	1.24	0.818343
<b>Models</b>	4.21	3.96	0.25	5.00	4.75	0.25	5.86	4.26	1.60	5.00	4.67	0.33	4.68	3.79	0.90	4.62	4.10	0.52	0.642607
<b>Terminology</b>	4.48	4.30	0.19	5.11	5.25	-0.14	4.71	4.60	0.11	4.33	5.00	-0.67	4.45	4.33	0.12	4.60	4.29	0.31	-0.01252
<b>Scientific inquiry</b>	5.32	4.69	0.63	5.67	5.13	0.54	5.54	4.57	0.97	5.00	4.00	1.00	4.80	3.73	1.07	5.57	4.00	1.57	0.963385
<b>Limits of scientific knowledge</b>	3.93	3.68	0.25	4.67	3.25	1.42	4.03	3.56	0.47	4.67	3.00	1.67	3.79	3.00	0.79	4.15	2.90	1.25	0.973286
<b>Cycle of matter</b>	4.43	4.00	0.43	5.00	4.00	1.00	5.00	4.38	0.62	4.33	3.33	1.00	4.40	3.93	0.47	4.81	4.24	0.57	0.680719
<b>Food / nutrition</b>	4.96	3.96	1.00	5.44	4.38	1.07	5.14	4.09	1.05	3.67	3.33	0.33	4.40	3.73	0.67	5.14	3.95	1.19	0.885757
<b>Health / medicine</b>	5.29	4.48	0.80	5.33	4.25	1.08	5.40	4.12	1.28	4.00	3.33	0.67	4.50	3.53	0.97	5.29	3.81	1.48	1.04598
<b>Matter in everyday life</b>	4.82	4.32	0.50	5.22	4.38	0.85	5.40	4.44	0.96	4.00	3.33	0.67	4.95	3.71	1.24	5.43	3.86	1.57	0.963922
<b>Technical devices</b>	4.57	3.89	0.68	4.67	4.25	0.42	4.71	3.86	0.86	4.33	3.00	1.33	4.20	3.27	0.93	4.14	3.43	0.71	0.822884
<b>Environment</b>	5.32	4.50	0.82	5.89	5.00	0.89	5.43	4.69	0.74	4.33	4.00	0.33	4.75	4.27	0.48	5.52	4.29	1.24	0.751323
<b>Industrial processes</b>	4.29	3.71	0.57	4.44	3.50	0.94	4.54	3.80	0.74	4.33	3.33	1.00	3.85	3.07	0.78	4.00	3.57	0.43	0.745106
<b>Safety and risks</b>	5.29	4.54	0.75	5.50	4.50	1.00	5.37	4.37	1.00	4.00	3.33	0.67	4.40	3.67	0.73	5.57	4.43	1.14	0.882143
<b>Occupations / occupational fields</b>	4.64	3.86	0.79	4.75	3.75	1.00	4.89	3.77	1.11	4.00	2.67	1.33	4.05	3.20	0.85	4.76	3.57	1.19	1.045635

Table 17

Part IIb:	Students 27			People who are not directly involved with sciences 11			Teachers 35			Education politicians 3			Scientists 20			Educators, didactics, and in – service teacher educators 21			Mean values
	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	
<b>Scientific disciplines and perspectives</b>																			
<b>Botany</b>	4.79	4.36	0.43	4.89	4.75	0.14	4.56	4.44	0.12	4.33	4.33	0.00	4.20	4.27	-0.07	4.75	4.75	0.00	0.103073

<b>Zoology</b>	4.79	4.50	0.29	4.89	4.71	0.17	4.58	4.53	0.05	4.33	4.00	0.33	4.10	4.20	-0.10	4.75	4.80	-0.05	0.114999
<b>Human biology</b>	5.21	4.88	0.33	5.67	4.86	0.81	5.15	4.68	0.47	4.33	4.00	0.33	4.75	4.20	0.55	5.20	4.90	0.30	0.465519
<b>Genetics / molecular biology</b>	4.52	3.96	0.55	5.00	4.13	0.88	4.62	4.18	0.44	4.00	3.67	0.33	4.50	3.67	0.83	4.75	3.84	0.91	0.656604
<b>Microbiology</b>	4.25	3.75	0.50	4.33	3.38	0.96	4.56	4.09	0.47	3.33	3.33	0.00	4.05	3.36	0.69	3.95	3.17	0.78	0.567073
<b>Evolutionary biology</b>	4.54	3.81	0.72	4.67	4.38	0.29	4.26	4.00	0.26	5.00	3.33	1.67	3.95	3.73	0.22	4.45	3.67	0.78	0.657323
<b>Neurobiology</b>	4.12	3.04	1.08	4.22	2.88	1.35	4.41	3.52	0.90	4.00	2.67	1.33	3.75	2.64	1.11	3.37	2.22	1.15	1.151239
<b>Ecology</b>	5.00	4.32	0.68	5.56	4.88	0.68	5.37	4.62	0.75	4.67	3.33	1.33	4.65	4.00	0.65	5.33	4.30	1.03	0.854929
<b>Inorganic chemistry</b>	4.50	4.32	0.18	5.11	4.88	0.24	4.91	4.88	0.03	4.67	4.67	0.00	4.65	4.80	-0.15	4.86	4.90	-0.05	0.041673
<b>Organic chemistry</b>	4.63	4.19	0.44	5.00	4.75	0.25	4.91	4.73	0.18	5.00	4.33	0.67	4.90	4.33	0.57	5.00	4.57	0.43	0.423474
<b>Analytical Chemistry</b>	4.14	3.68	0.46	4.38	3.43	0.95	4.24	3.79	0.45	4.33	3.67	0.67	4.35	4.00	0.35	4.05	3.43	0.62	0.582307
<b>Biochemistry</b>	4.75	3.71	1.04	4.11	3.25	0.86	4.33	3.43	0.90	4.33	3.33	1.00	4.45	3.07	1.38	3.95	2.57	1.38	1.093519
<b>Mechanics</b>	4.82	4.11	0.71	5.11	4.75	0.36	4.63	4.24	0.39	4.67	4.67	0.00	4.55	4.80	-0.25	4.65	4.75	-0.10	0.186446
<b>Electrodynamics</b>	4.11	3.78	0.33	5.11	4.63	0.49	4.80	4.21	0.59	4.67	4.33	0.33	4.45	4.27	0.18	4.55	4.39	0.16	0.347895
<b>Thermodynamics</b>	4.14	3.61	0.54	4.89	4.50	0.39	4.54	4.09	0.45	4.67	4.33	0.33	4.50	4.33	0.17	4.30	4.28	0.02	0.316462
<b>Atomic / nuclear physics</b>	4.37	3.54	0.83	4.44	3.38	1.07	4.23	4.03	0.20	4.67	4.33	0.33	4.47	3.07	1.41	3.90	3.42	0.48	0.720278
<b>Astronomy / space system</b>	4.64	3.64	1.00	4.44	2.88	1.57	4.40	3.85	0.55	3.67	3.33	0.33	4.30	3.00	1.30	4.05	3.42	0.63	0.896464
<b>Earth sciences</b>	4.82	3.75	1.07	4.89	3.88	1.01	4.65	4.16	0.49	4.67	3.33	1.33	4.10	3.50	0.60	4.65	3.95	0.70	0.868682
<b>Mathematics</b>	5.32	5.18	0.14	5.50	5.00	0.50	5.03	4.73	0.30	5.67	5.00	0.67	5.50	4.93	0.57	5.29	5.10	0.19	0.394661
<b>Interdisciplinarity</b>	4.36	4.00	0.36	5.50	3.75	1.75	4.85	3.91	0.94	5.00	3.67	1.33	5.10	3.33	1.77	5.38	3.05	2.33	1.413212
<b>Current scientific research</b>	4.89	3.71	1.18	4.90	3.25	1.65	4.91	3.71	1.20	5.33	2.67	2.67	4.55	3.07	1.48	4.86	3.00	1.86	1.672619

<b>Consequences of technological Developments</b>	5.00	3.96	1.04	5.10	3.50	1.60	5.09	4.24	0.85	5.33	3.00	2.33	4.63	3.13	1.50	5.00	3.45	1.55	1.478372
<b>History of the sciences</b>	4.07	3.96	0.11	3.50	2.88	0.63	3.88	3.65	0.24	4.00	3.00	1.00	3.60	3.27	0.33	3.52	2.86	0.67	0.494573
<b>Ethics / values</b>	4.43	3.86	0.57	5.11	3.25		4.91	3.82	1.09	4.67	3.00	1.67	4.20	3.07	1.13	4.95	2.95		0.743277

Table 18

<b>Part III:</b>	<b>Students 27</b>			<b>People who are not directly involved with sciences 11</b>			<b>Teachers 35</b>			<b>Education politicians 3</b>			<b>Scientists 20</b>			<b>Educators, didactics, and in – service teacher educators 21</b>			<b>Mean values</b>
	<b>mean (Priority)</b>	<b>mean (practice)</b>	<b>difference</b>	<b>mean (Priority)</b>	<b>mean (practice)</b>	<b>difference</b>	<b>mean (Priority)</b>	<b>mean (practice)</b>	<b>difference</b>	<b>mean (Priority)</b>	<b>mean (practice)</b>	<b>difference</b>	<b>mean (Priority)</b>	<b>mean (practice)</b>	<b>difference</b>	<b>mean (Priority)</b>	<b>mean (practice)</b>	<b>difference</b>	
<b>Qualifications</b>																			
<b>Empathy / sensibility</b>	4.82	4.04	0.79	5.56	4.00	1.56	5.23	3.91	1.31	4.33	4.00	0.33	4.80	4.40	0.40	5.14	3.55	1.59	0.996958
<b>Motivation and interest</b>	5.25	4.11	1.14	5.78	4.25	1.53	5.63	4.06	1.57	5.33	3.33	2.00	5.25	3.87	1.38	5.67	3.55	2.12	1.623677
<b>Critical questioning</b>	4.61	4.00	0.61	5.44	4.00	1.44	4.82	3.66	1.17	5.50	4.00	1.50	4.47	4.29	0.19	5.38	3.20	2.18	1.181149
<b>Acting reflectedly and responsibly</b>	5.07	4.26	0.81	5.67	4.13	1.54	5.21	4.00	1.21	5.00	3.50	1.50	4.85	3.93	0.92	5.52	3.35	2.17	1.358366
<b>Knowledge about science-related occupations</b>	4.64	3.75	0.89	4.89	3.50	1.39	4.86	3.62	1.24	4.00	3.00	1.00	4.20	3.53	0.67	4.43	3.48	0.95	1.023382
<b>(Specialized) knowledge</b>	4.82	3.79	1.04	3.89	3.38	0.51	4.20	3.51	0.69	4.00	4.00	0.00	3.75	3.47	0.28	3.43	3.71	-0.29	0.372156
<b>Comprehension / understanding</b>	5.46	4.32	1.14	6.00	4.63	1.38	5.49	3.89	1.60	5.67	4.33	1.33	5.60	4.60	1.00	5.70	3.65	2.05	1.416865
<b>Applying knowledge, thinking creatively / abstractly</b>	5.21	4.32	0.89	5.89	4.25	1.64	5.49	3.89	1.60	6.00	5.33	0.67	5.40	4.13	1.27	5.67	3.52	2.14	1.367989
<b>Judgement /opinion-forming / reflection</b>	5.14	4.57	0.57	5.78	4.88	0.90	5.29	4.14	1.14	5.67	4.00	1.67	5.20	3.80	1.40	5.62	3.57	2.05	1.288558
<b>Finding information</b>	5.04	4.52	0.52	5.78	4.63	1.15	5.17	4.54	0.63	5.33	4.00	1.33	4.95	4.27	0.68	5.67	4.14	1.52	0.97317
<b>Reading comprehension</b>	4.93	4.29	0.64	5.67	3.75	1.92	5.37	3.97	1.40	5.67	4.67	1.00	4.95	3.93	1.02	5.57	3.33	2.24	1.369841
<b>Communication skills</b>	4.93	4.54	0.39	5.78	4.38	1.40	5.26	4.35	0.91	5.00	3.00	2.00	4.80	3.60	1.20	5.38	3.81	1.57	1.246471
<b>Social skills / teamwork</b>	5.04	4.63	0.41	5.56	4.63	0.93	5.20	4.40	0.80	4.33	3.33	1.00	4.75	3.73	1.02	5.38	3.76	1.62	0.962059

<b>Perception / awareness</b>	5.11	4.54	0.58	5.44	3.88	1.57	5.03	4.14	0.89	5.50	4.00	1.50	4.30	3.93	0.37	5.40	3.70	1.70	1.100331
<b>Formulating scientific questions / hypotheses</b>	5.07	4.71	0.36	5.11	4.38	0.74	5.09	4.11	0.97	5.00	3.67	1.33	4.55	4.13	0.42	4.81	3.67	1.14	0.826257
<b>Experimenting</b>	5.29	4.46	0.82	5.78	4.75	1.03	5.29	4.23	1.06	4.67	3.67	1.00	5.10	3.93	1.17	5.38	4.15	1.23	1.050661
<b>Rational thinking / analysing / drawing conclusions</b>	5.30	4.44	0.85	5.89	4.38	1.51	5.57	4.06	1.51	5.67	4.00	1.67	5.45	4.27	1.18	5.67	3.76	1.90	1.439131
<b>working self-dependently / structuredly / precisely</b>	5.32	4.54	0.79	6.00	4.00	2.00	5.60	4.21	1.39	5.33	4.00	1.33	5.15	3.93	1.22	5.55	3.60	1.95	1.446639

Table 19

Part IV: Methodical Aspects	Students 27			People who are not directly involved with sciences 11			Teachers 35			Education politicians 3			Scientists 20			Educators, didactics, and in-service teacher educators 21			
	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	mean (Priority)	mean (practice)	difference	
<b>Cooperative Learning</b>	5.07	4.29	0.79	5.11	4.38	0.74	4.68	4.00	0.68	4.33	3.33	1.00	4.10	3.33	0.77	4.57	3.29	1.29	0.875113
<b>Learning in mixed-aged classes</b>	3.43	2.81	0.61	2.11	1.43	0.68	3.29	2.64	0.66	2.33	2.33	0.00	2.95	2.53	0.42	2.39	1.79	0.60	0.495022
<b>Interdisciplinary learning</b>	4.22	3.70	0.52	4.89	3.43	1.46	4.43	3.57	0.86	5.00	2.33	2.67	4.60	2.86	1.74	4.86	2.81	2.05	1.548854
<b>Inquiry-based science learning</b>	4.85	4.29	0.57	4.89	4.00	0.89	5.06	3.88	1.17	5.00	3.33	1.67	4.60	3.53	1.07	5.33	3.57	1.76	1.187509
<b>Learning at stations</b>	4.43	3.41	1.02	4.78	3.25	1.53	4.69	3.62	1.07	3.33	2.67	0.67	4.05	3.21	0.84	4.40	3.00	1.40	1.086565
<b>Role play</b>	3.75	2.85	0.90	4.00	2.50	1.50	4.14	3.77	0.37	2.67	2.00	0.67	3.30	2.57	0.73	3.95	2.58	1.37	0.922645
<b>Discussion / debate</b>	5.00	4.46	0.54	5.44	3.75	1.69	4.80	4.09	0.71	4.67	2.67	2.00	4.45	3.13	1.32	4.95	3.00	1.95	1.368915
<b>Project method</b>	4.82	4.29	0.54	4.78	4.14	0.63	4.83	4.06	0.77	4.33	3.67	0.67	4.45	3.40	1.05	4.80	3.60	1.20	0.809788
<b>Organization of excursions</b>	5.07	3.57	1.50	5.44	4.00	1.44	4.94	3.94	1.00	4.00	3.67	0.33	3.95	3.73	0.22	4.90	3.00	1.90	1.066534
<b>Using new media</b>	4.96	4.00	0.96	4.67	3.50	1.17	4.74	3.97	0.77	3.67	3.00	0.67	4.45	3.53	0.92	4.57	3.00	1.57	1.009524

Table 20



## 6 Results of the cluster analyses

The questionnaire for the assessment of the categories of science education was adopted into the Latvian language and together with the covering letter of the study sent to 6 groups of participants: students; science teachers (studying teacher; teachers and training teachers (experienced teachers)); educators, didactics, and in-service teacher educators; scientists; education politicians; people not directly involved in science.

<i>Categories of part I (Situations, contexts and motives that can be taken as a basis to stimulate science-related educational processes)</i>	Categories of part IIa (Basic concepts and topics that should be taught in science lessons)	Categories of part IIb (Fields and perspectives from which science-related issues can be considered)	Categories of part III (Qualifications that can be enhanced through engaging in the sciences)
<input checked="" type="checkbox"/> <b>Education / general pers. development</b> <input type="checkbox"/> Emotional personality development <input type="checkbox"/> Intellectual personality development  <input type="checkbox"/> Students' interests <input type="checkbox"/> Curriculum framework <input type="checkbox"/> Out-of-school learning <input type="checkbox"/> Media / current issues  <input type="checkbox"/> Nature/natural phenomena <input checked="" type="checkbox"/> <b>Everyday life</b> <input checked="" type="checkbox"/> <b>Medicine / health</b> <input type="checkbox"/> Technology <input type="checkbox"/> Society / public concerns <input type="checkbox"/> Global references <input type="checkbox"/> Occupation / career  <input type="checkbox"/> Science - biology <input type="checkbox"/> Science - chemistry <input type="checkbox"/> Science - physics <input type="checkbox"/> Science - interdisciplinarity	<input type="checkbox"/> Matter / particle concept <input checked="" type="checkbox"/> <b>Structure / function / properties</b> <input type="checkbox"/> Chemical reactions <input type="checkbox"/> Energy <input type="checkbox"/> System <input type="checkbox"/> Interaction <input type="checkbox"/> Development / growth <input type="checkbox"/> Models <input type="checkbox"/> Terminology <input type="checkbox"/> Scientific Inquiry <input type="checkbox"/> Limits of scientific knowledge  <input type="checkbox"/> Cycle of matter <input checked="" type="checkbox"/> <b>Food / nutrition</b> <input checked="" type="checkbox"/> <b>Health / medicine</b> <input type="checkbox"/> Matter in everyday life <input type="checkbox"/> Technical devices <input type="checkbox"/> Environment <input type="checkbox"/> Industrial processes <input type="checkbox"/> Safety and risks <input type="checkbox"/> Occupations / occupational fields	<input type="checkbox"/> Botany <input type="checkbox"/> Zoology <input type="checkbox"/> Human biology <input type="checkbox"/> Genetics /molecular biology <input type="checkbox"/> Microbiology <input type="checkbox"/> Evolutionarybiology <input type="checkbox"/> Neurobiology <input type="checkbox"/> Ecology <input type="checkbox"/> Inorganic chemistry <input type="checkbox"/> Organic chemistry <input type="checkbox"/> Analyticalchemistry <input checked="" type="checkbox"/> <b>Biochemistry</b> <input type="checkbox"/> Mechanics <input type="checkbox"/> Electrodynamics <input type="checkbox"/> Thermodynamics <input type="checkbox"/> Atomic / nuclearphysics <input type="checkbox"/> Astronomy / spacesystem <input type="checkbox"/> Earth sciences <input type="checkbox"/> Mathematics <input type="checkbox"/> Interdisciplinarity <input type="checkbox"/> Current scientificresearch <input type="checkbox"/> Consequences oftechnol.Developments <input type="checkbox"/> History of thesciences <input type="checkbox"/> Ethics / values	<input type="checkbox"/> Empathy Sensibility / <input type="checkbox"/> Motivation and interest <input type="checkbox"/> Critical questioning <input checked="" type="checkbox"/> <b>Acting reflectedly and responsibly</b>  <input type="checkbox"/> Knowledge about scientific occupations <input checked="" type="checkbox"/> <b>(Specialized) knowledge</b> <input type="checkbox"/> Comprehension / understandin <input type="checkbox"/> Applying knowledge, thinking creatively / abstractly <input checked="" type="checkbox"/> <b>Judgement /opinion-forming / reflection</b> <input type="checkbox"/> Finding information <input type="checkbox"/> Reading comprehension <input type="checkbox"/> Communication skills <input type="checkbox"/> Social skills / teamwork  <input type="checkbox"/> Perception / awareness <input type="checkbox"/> Formulating scientific questions / hypotheses <input type="checkbox"/> Experimentation <input type="checkbox"/> Rational thinking / analysing / drawing conclusions <input type="checkbox"/> working self-dependently / structuredly / precisely
<p>Please note: every category combination should contain at least one and at most five categories per column.</p>			

### Numbers of completed form sheets concerning part II of the questionnaire

In order to identify concepts regarding science education that are considered important, the participants in part II of round 2 were asked to combine from the given set of 80 categories those categories that seem especially important to them *in their combination*. The results of the hierarchical cluster analyses are based on the form sheets which the participants were asked to fill out in the second part of the questionnaire.

Sample group	Number of form sheets	Average number of form sheets per participant
Students n=16	48	3
Science teachers n=30	101	3,4
Educators, didactics, and in-service teacher educators n=18	51	2,8
Scientists n=15	43	2,8
Education politicians n=3	9	3
People not directly involved in science n=10	33	3,3
Total n=92	285	3,0

Table 21: Numbers of completed form sheets – total sample and sample groups

Number of form sheets	Absolute frequency	Percentage	Cumulative percentage
1	3	3.3	3.3
2	2	2.2	5.5
3	79	85.8	91.3
4	4	4.3	95.6
5	3	3.3	98.9
7	1	1.1	100.0

Table 22: Numbers of completed form sheets and percentages

In Table 21, it can be seen that a total number 285 form sheets were filled out by the participants. On average, every participant filled out 3.0 form sheets. The average number of form sheets filled out by the group of *students* is 3. The group of *teachers and educators* features the lowest average (2.8 form sheets per person). With 3,4 form sheets filled out on average, the group of *science teachers* features the highest average 3.4.

Table 23 shows the distribution and allocation of the different categories to the respective clusters, taking into account the number of categories (ncat), the number of cases (ncases) and the relative frequency regarding all cases (n%cases) in each cluster. Cluster A contains 19 categories and 770 cases respectively (accounting for 23.47% of all cases). Cluster B contains 23 clusters and 1373 cases respectively (accounting for 41.85% of all cases) and Cluster C contains 18 categories and 1335 cases respectively (accounting for 34.68% of all cases)

Cluster A	Cluster B	Cluster C
<ul style="list-style-type: none"> <li>• Emotional personality development</li> <li>• Media / current issues</li> <li>• Global references</li> <li>• Empathy / sensibility</li> <li>• Perception / awareness / observation</li> <li>• History of the sciences</li> <li>• Out-of-school learning</li> <li>• Curriculum framework</li> <li>• Communication skills</li> <li>• Reading comprehension</li> <li>• Finding information</li> <li>• Social skills / teamwork</li> <li>• Occupations / occupational fields               <ul style="list-style-type: none"> <li>• Knowledge about science-related occupations</li> </ul> </li> <li>• Occupation / career</li> <li>• Earth sciences</li> <li>• Industrial processes</li> <li>• Cycle of matter</li> <li>• Development / growth</li> </ul>	<ul style="list-style-type: none"> <li>• Intellectual personality development</li> <li>• Science - interdisciplinarity</li> <li>• Interdisciplinarity</li> <li>• Current scientific research</li> <li>• Scientific inquiry</li> <li>• Critical questioning</li> <li>• Rational thinking / analysing / drawing conclusions</li> <li>• Applying knowledge / creative and abstract thinking</li> <li>• Factual knowledge</li> <li>• Formulating scientific questions / hypotheses</li> <li>• Terminology</li> <li>• Matter / particle concept</li> <li>• Structure / function / properties</li> <li>• Chemical reactions</li> <li>• Experimenting</li> <li>• Models</li> <li>• Limits of scientific knowledge</li> <li>• Technology</li> <li>• Technical devices</li> <li>• System</li> <li>• Interaction</li> <li>• Energy</li> <li>• Mathematics</li> </ul>	<ul style="list-style-type: none"> <li>• Education / general personality development</li> <li>• Students' interests</li> <li>• Motivation and interest</li> <li>• Everyday life</li> <li>• Society / public concerns</li> <li>• Nature / natural phenomena</li> <li>• Comprehension / understanding</li> <li>• Acting reflectedly and responsibly</li> <li>• Judgement / opinion-forming / reflection</li> <li>• Ethics / values</li> <li>• Food / nutrition</li> <li>• Health</li> <li>• Medicine</li> <li>• Matter in everyday life</li> <li>• Environment</li> <li>• Consequences of technol. developments</li> <li>• Safety and risks</li> <li>• working self-dependently / structuredly / precisely</li> </ul>
N cat = 19 N cases = 770 N % cases = 23.47%	N cat = 23 N cases = 1373 N % cases = 41.85%	N cat = 18 N cases = 1138 N % cases = 34.68%

Table 23: Distribution of the categories among the clusters of the three-cluster solution

As Table 24 shows, the total number of cases regarding the category allocations is 3281. The cases are distributed among the three clusters, featuring a total of 770 cases in cluster A, 1373 cases in cluster B and 1138 cases in cluster C. The cases in cluster A account for 23.47%, the cases in cluster B account for 41.85% and the cases in cluster C account for 34.68% of the total number of cases.

**Category frequencies in the different clusters**

Category	Cluster A			Cluster B			Cluster C		
	n	C%	Σ%	n	C%	Σ%	n	C%	Σ%
Education / general pers. development							n = 45	3.95%	1.37%
Emotional personality development	n = 18	2.34%	0.55%						
Intellectual personality development				n = 48	3.49%	1.46%			
Students' interests							n = 53	4.66%	1.61%
Curriculum framework	n = 17	2.21%	0.52%						
Nature / natural phenomena							n = 54	4.74%	1.65%
Everyday life							n = 54	4.74%	1.65%
Medicine /health							n = 44	3.87%	1.35%
Technology				n = 44	3.20%	1.34%			
Media / current issues	n = 29	3.77%	0.88%						
Society / public concerns							n = 46	4.04%	1.40%
Global references	n = 51	6.62%	1.55%						
Occupation / career	n = 27	3.51%	0.82%						
Science – interdisciplinarity				n = 42	3.56%	1.28%			
Out-of-school learning	n = 30	3.90%	0.91%						
Matter / particle concept				n = 34	2.48%	1.04%			
Structure / function / properties				n = 59	4.30%	1.80%			
Chemical reactions				n = 30	2.18%	0.92%			

Energy				n = 36	2.62%	1.10%			
System				n = 71	5.17%	2.16%			
Interaction				n = 79	5.75%	2.41%			
Development / growth	n = 0	0%	0%						
Models				n = 57	4.15%	1.74%			
Terminology				n = 36	2.62%	1.10%			
Scientific Inquiry				n = 113	8.23%	3.45%			
Limits of scientific knowledge				n = 30	2.18%	0.92%			
Cycle of matter	n = 51	6.62%	1.55%						
Food / nutrition							n = 41	3.60%	1.25%
Matter in everyday life							n = 71	6.24%	2.16%
Technical devices				n = 47	3.42%	1.43%			
Environment							n = 104	9.14%	3.17%
Industrial processes	n = 48	6.23%	1.46%						
Safety and risks							n = 63	5.54%	1.92%
Occupations / occupational fields	n = 69	8.96%	2.10%						
Earth sciences	n = 45	5.84%	1.37%						
Mathematics				n = 30	2.18%	0.92%			
Interdisciplinarity				n = 100	7.28%	3.05%			
Current scientific research				n = 114	8.30%	3.48%			
Consequences of technol. Developments							n = 97	8.52%	2.96%
History of the sciences	n = 31	4.02%	0.94%						
Ethics / values							n = 70	6.15%	2.13%
Factual knowledge				n = 52	3.79%	1.59%			

Comprehension / understanding							n = 86	7.56%	2.62%
Applying knowledge, thinking creatively / abstractly				n = 97	7.06%	2.96%			
Judgement /opinion-forming / reflection							n = 74	6.50%	2.25%
Formulating scientific questions / hypotheses				n = 61	4.44%	1.86%			
Experimenting				n = 64	4.66%	1.95%			
Rational thinking / analysing / drawing conclusions				n = 92	6.70%	2.80%			
Working self-dependently / structuredly / precisely							n = 56	4.92%	1.71%
Finding information	n = 81	10.52%	2.47%						
Reading comprehension	n = 21	2.73%	0.64%						
Communication skills	n = 31	4.02%	0.94%						
Knowledge about science-related occupations	n = 71	9.22%	2.16%						
Perception / awareness	n = 77	10.00%	2.35%						
Empathy / sensibility	n = 28	3.64%	0.85%						
Social skills / teamwork	n = 45	5.84%	1.37%						
Motivation and interest							n = 95	8.35%	2.89%
Critical questioning				n = 37	2.69%	1.13%			
Acting reflectedly and responsibly							n = 85	7.47%	2.59%
<b>Total</b>	<b>770</b>	<b>100,00%</b>	<b>23.47%</b>	<b>1373</b>	<b>100,00%</b>	<b>41.85%</b>	<b>1138</b>	<b>100,00%</b>	<b>34.68%</b>
<b>Total number of all cases</b>	<b>3281</b>								

Table 24: Category allocations: Total numbers and relative frequencies

**During the second round of the cluster analysis we made use of the already provided FUB concepts.**

- 1. The cluster analytical calculations of concept A “Awareness of the sciences in current, social, globally relevant and occupational contexts relevant in both educational and out-of-school settings” lead to the grouping of the following categories:**

**Situations, contexts, motives:**

Global references, Out-of-school learning, Media / current issues, Occupation / career, Emotional personality development, Curriculum framework

**(Basic) concepts, themes and perspectives:**

Occupations / occupational fields, Cycle of matter, Industrial processes, Earth sciences, History of the sciences.

**Qualifications:**

Finding information, Perception / awareness / observation, Knowledge about science-related occupations, Social skills / teamwork, Communication skills, Empathy / sensibility, Reading comprehension.

- 2. The cluster analytical calculations of concept B “Intellectual education in interdisciplinary scientific contexts” lead to the grouping of the following categories:**

**Situations, contexts, motives:**

Intellectual personality development, Technology, Science –interdisciplinarity.

**(Basic) concepts, themes and perspectives:**

Current scientific research, Scientific inquiry, Interdisciplinarity, Interaction, System, Structure / function / properties, Models, Technical devices, Terminology, Energy, Matter / particle concept, Limits of scientific knowledge, Chemical reactions, Mathematics

**Qualifications:**

Applying knowledge / creative and abstract thinking, Rational thinking / analysing / drawing conclusions, Experimenting, Formulating scientific questions / hypotheses, Factual knowledge, Critical questioning.

- 3. The cluster analytical calculations of concept C “General science-related education and facilitation of interest in contexts of nature, everyday life and living environment” lead to the grouping of the following categories:**

**Situations, contexts, motives:**

Nature / natural phenomena, Everyday life, Students' interests, Society / public concerns, Education / general personality development, Medicine/Health

**(Basic) concepts, themes and perspectives:**

Environment, Consequences of technological developments, Matter in everyday life, Ethics / values, Safety and risks Food / nutrition.

**Qualifications:**

Motivation and interest, Comprehension / understanding, Acting reflectedly and responsibly, Judgement / opinion-forming / reflection, Working self-dependently / structuredly / precisely.

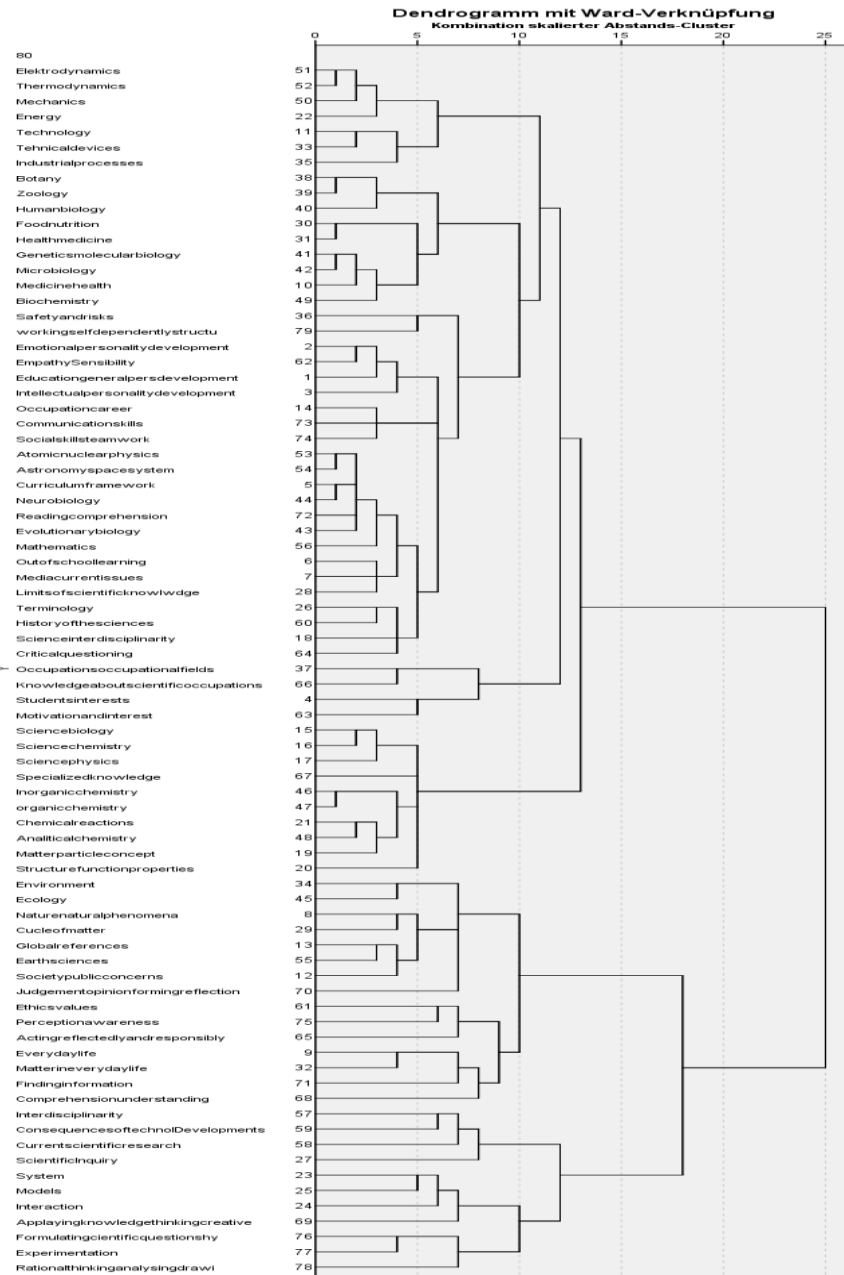


Table 25