

## **D3.1 Analytical Report related to students' views on scenarios**

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<b>Prepared by:</b>	Miia Rannikmäe, Jack Holbrook, Tormi Kotkas & Regina Soobard (UT), with  John Connolly (UCL), Inês Direito (UCL), Irene Drymiotou (UCY), Anu Hartikainen-Ahia (UEF), Jonathan Hense (UBO), Jingoo Kang (UEF), Tuula Keinonen (UEF), Sirpa Kärkkäinen (UEF), Joanne Nicholl (UCL), Nicos Papadouris (UCY), Anssi Salonen (UEF), Annette Scheersoi (UBO), Shirley Simon (UCL), Kari Sormunen (UEF), Troodia Theodorou (UCY), Jillian Trevethan (UCL), Katri Varis (UEF), Lara Weiser (UBO).
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## Introduction

This document is written as a component of the EU H2020 project “MultiCO - Promoting Youth Scientific Career Awareness and its Attractiveness through Multi-stakeholder Cooperation” giving the outcome of Task 3.5 (Deliver students’ perceptions on scenarios, an analysis of their perceptions of these scenarios and the creation of a consortium-wide report on outcomes from the student students perceptions against scenarios).

The aim of the MultiCO-project is to raise students’ awareness of careers in science and their aspirations regarding choosing science as an area for study. The project focuses on developing scenarios for science learning environments, where discussions on careers in research and industry in the STEM fields are taken to be an integral part of science study. The project further focuses on counselling students and incorporating working life skills in action.

All created scenarios (Task 3.2 and Task 3.3) were presented to students. Students’ perceptions were collected through a validated questionnaire (Task 3.4) and through group discussions within workshops (20 students in a classroom, and 20 in an after-school, context). Discussions of student groups (3-5 students per group) during the workshops were audiotaped. The outcome was a report on students’ perceptions on issues addressed in the questionnaire and in-group discussions in a classroom, and in an after-school, student workshop.

*Task 3.3: Students’ scenarios. Leading partner: UT. Participating partners: All other partners.*

The idea of creating scenario was presented to students via a workshop: in the classroom (20 students) and in an after-school context (20 students). Students then created their own scenarios, at least four scenarios per country. In the next phase, the aim was to undertake classroom interventions, to compare student interests, between students who created scenarios and those who did not.

*Task 3.4: Questionnaire to collect students’ perceptions of scenarios. Leading partner: UT. Participating partners: All other partners.*

A questionnaire was developed, piloted and used to collect students’ perceptions on scenarios. The questionnaire aimed to survey students’ opinion on the use of science-related, career-based scenarios, designed to be motivational for students. The outcome was a validated questionnaire (Deliverable D3.3).



# 1. Scenario Evaluation Methodology

## 1.1. Scenario Evaluation Questionnaire: Theoretical Background

The aim of the scenarios is to motivate students to learn science-related topics in science classes and influence students to consider STEM-related careers as a career choice. There can be several reasons why students perceive a learning activity as motivating. Certainly, a major factor is student interest. Nonetheless, the impact of relevance on motivation is empirically under-studied. For this reason, the questionnaire contains items about both interest and relevance, identified separately. Also, in order to establish the connection between motivation, interest, relevance and 'like', in the eyes of 7<sup>th</sup> grade students, open-ended questions are included.

The scenario evaluation instrument, in which items are categorised based on theory, is given in Appendix 1, Table 1. This questionnaire contains 28 items, in which students are asked to evaluate items on a 4-point scale (totally disagree - totally agree), for items 1-22, and on a 3-point scale (no, cannot make up my mind, yes), for items 25-28. Furthermore, two background knowledge questions about the topic of the scenario and careers (items 23 and 24) are included, to be answered using a 3-point scale (nothing, a little, a lot).

Items 1-6, 23 and 24 focus on knowledge-triggered interest, while items 7-17 focus on value-triggered interest (Hidi and Baird, 1986). The value-triggered interest category of statements were divided into the subcategories 'impact level', 'connectedness with a future career and studies' and 'science for everyone.' (Kotkas, Holbrook & Rannikmäe, 2016).

Additionally, statements 18-22 measure how scenario attributes impact on students' perceptions about the scenarios. This is included noting that the scientific literature indicates the way information is presented affects the reaction to information (e.g. Bergin, 1999).

The open-ended questions to the questionnaire are included to gain understanding of the reasons why students consider scenarios as interesting, relevant, motivating or likeable. This allows researchers the possibility to understand how students think about the topic under investigation (Johnson & Christensen, 2000).

The Instrument was piloted with 143 students. The internal reliability was calculated over all items, resulting in Cronbach  $\alpha = 0.88$ . To explore, whether the questionnaire followed item distribution among categories, principal axis factoring with Varimax rotation was undertaken. This analysis described 51% of the variance and an identified 6 factor solution (Appendix 1, Table 2):

- 1) knowledge value (factor loadings 0.702-0.386, items 1, 2, 3, 7, 8, 10, 26);
- 2) practical value (factor loadings 0.779-0.544, items 12, 13, 14, 15, 16, 28);
- 3) scenario attributes (factor loadings 0.817 -0.570, items 19, 20, 21, 22);
- 4) career awareness (factor loadings 0.809-0.342, items 4, 5, 6);
- 5) social value (factor loadings 0.518-0.429, items 9, 11, 17, 18);
- 6) like - interest (factor loadings 0.81-0.588; items 25, 27).

To ensure that principal axis factoring was applicable, a Kaiser-Meyer-Olkin measure of Sampling Adequacy (0,801) and Bartlett's Test of Sphericity were conducted (sig. 0,000).

A thorough overview of the scenario evaluation instrument is not discussed further but to be published separately as a scientific article.



## References

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## Scenario Evaluation Process

Altogether 30 scenarios were developed, although depending on the country, different numbers of scenarios were evaluated. It was agreed among partners that 20 scenarios would be evaluated by students in each country. Nonetheless, not all partner schools were able to contribute as much lesson time as initially planned. Thus there were differences in the number of students evaluating the scenarios and also the total number of scenarios evaluated within each country. Table 1 indicates the number of students (St N) and scenarios evaluated per country.

<b>Table 1. Scenarios Evaluated per Country</b>							
Number	Scenario	Partner	St N UBO	St N UEF	St N UCL	St N UT	St N UCY
1	Alternatives to sugar	UBO	2	6	18	4	8
2	Apple	UBO	4	9	30	3	1
3	Crime scene	UBO	-	7	23	3	1
4	Dental Lab.	UBO	2	12	-	4	1
5	Earthquake	UCL	3	2	21	4	6
6	Eco scientist	UCL	8	-	21	4	-
7	Energy	UCL	6	6	-	-	-
8	GEMs	UCL	2	-	23	4	-
9	Nutritionist	UCL	3	11	11	5	-
10	Sustainable	UCL	8	6	-	4	3
11	Transport (Keith)	UCL	5	7	-	4	-
12	Transport (Roundabout)	UCL	-	-	-	-	-
13	Nuclear decisions	UCY	-	-	-	-	24
14	Recent heatwave	UCY	-	-	-	-	1
15	Recycling	UCY	3	2	25	5	1
16	Solar panels	UCY	4	-	25	4	7
17	Animal geologist	UEF	6	-	-	3	1
18	Dangerous substance	UEF	-	-	-	4	-
19	Interior police	UEF	-	6	-	3	-
20	Marketing chief	UEF	-	7	-	-	-
21	Mysterious animal	UEF	8	2	-	2	1
22	Sport physician	UEF	4	7	-	4	1
23	Thermal expansion	UEF	4	8	-	4	1
24	Water purification	UEF	8	6	10	3	-
25	Energy	UT	2	8	15	6	11
26	Food industry (cucumber)	UT	8	7	17	6	1
27	Food industry (wasp)	UT	2	-	-	4	12
28	Pharmacology	UT	4	-	25	4	1
TOTAL number of responses			96	119	264	91	82
Total number of scenarios evaluated			21	18	13	23	18

Based on this table, it is decided that nine scenarios are to be taken for overall comparative evaluation to maintain the research validity. The analysis of other scenarios are to be undertaken by each country and after additional data collection are to be processed in a similar manner.



### **Undertaking the scenario evaluation process.**

Students either looked at the scenarios independently, or in small groups of 2-3 students. For scenarios which were videos, or animated Powerpoint presentations, computers, or tablets were used. All scenarios were translated into the students' native language. The technical problem of translating videos was solved by supplying the translations on paper. Nonetheless, students did provide feedback indicating that it was not as easy to follow the scenario in a video format, with written translations on paper, compared to having voice-over translations, or subtitles. After looking at, or reading the scenario, students evaluated these independently by completing the "scenario evaluation questionnaire." The scenario evaluation took place during one or two school lessons (45 min). For UBO, additional scenario evaluations took place in the after-school program. The scenario evaluations were carried out among 7<sup>th</sup> grade students.

### **Data analysis**

Cross-country comparative analysis was carried out on scenarios, which were evaluative by at least 4 countries. In this way, altogether 9 scenarios were evaluated. As seen from table 1, a number of scenarios were evaluated by only 3 countries and therefore additional data collection was needed for increasing the evaluated sample. Furthermore, additional data was needed in cases where less than 6 students evaluated a scenario per country. It was planned that full data analysis would be carried out in February-March 2017.

The comparative data analysis was carried out at two level – by items and by categories.

#### *(a) Analysis at the item level (tables 1 to 5 in the appendix 2)*

In order to determine which scenarios were valued highly by students and the reason for this, means and standard deviations were calculated for each items in the questionnaire. For partners UBO and UT, this was undertaken by calculating the means based on the 4 point scale (giving a mean score above 2.5 for a positively valued scenario and a mean below 2.5 for a scenario valued negatively). The other partners collapsed Likert scale scores of 1 and 2 to form a mean of 1 and the scale of 3 and 4 to form a mean of 2 (giving a mean score above 1.5 as a positively valued scenario and a mean below 1.5 as valued negatively).

#### *(b) Analysis at the category level*

Based on the categorisations of the instrument items, means for all categories were calculated. This enabled the creation of a list of the scenarios in each country (tables 2-5 and 7). In the case of items 25-28, the scale was (-1, 0 1), indicating positive values above a mean of 0 and negative means for negative category levels.

#### *Analysis of open-ended questions*

In order to analyse responses given to open ended questions, inductive codes were developed and categorised. Category descriptions were developed, based on the students' responses. The categories were validated by three international experts. The agreement between the experts was greater than 90%.

Students' responses were categorised by two survey evaluators and the categorisations compared seeking consensus by discussion, where mismatching occurred. The open-ended question response categories with descriptions and sample responses are presented in Appendix 3.



## Data analysis results

### 1. From the German Partner (UBO)

**Table 2. German results of scenario evaluations**

Scenarios	Categories											
	Knowledge value		Practical value		Scenario attributes		Career awareness		Social value		Like and interest	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1. Apple (UBO)	2,29	0,62	2,04	0,50	3,44	0,45	3,00	0,59	2,81	0,57	1,00	0,00
2. Water (UEF)	1,81	0,67	1,33	0,63	2,67	1,18	3,00	1,41	2,17	0,82	0,17	0,88
3. Energy (UT)	1,71	0,00	1,92	0,08	2,25	0,00	4,00	0,00	2,50	0,00	0,25	0,25
4. Food (UT)*	1,39	0,52	1,44	0,61	2,35	0,67	1,71	0,53	1,75	0,67	-0,06	0,73
5. Recycling (UCY)	1,90	0,74	1,72	0,77	2,17	0,44	2,33	0,57	2,71	0,45	-0,50	0,47
6. Earthquake (UCY)	2,71	0,00	2,11	0,08	3,50	0,00	3,67	0,00	3,50	0,00	1,00	0,00
7. Sugar (UBO)*	1,67	0,70	2,00	1,09	2,92	0,79	2,00	0,59	2,00	0,61	0,17	0,88
8. Nutritionist (UCL)*	1,81	0,67	1,33	0,63	2,67	1,18	3,00	1,41	2,17	0,82	0,17	0,88
9. Solar power (UCY)*	1,89	0,88	1,17	0,56	1,63	0,57	1,75	0,55	2,21	0,45	-0,67	0,47

Green indicates a favourable mean, while red indicates an unfavourable mean

\*Scenarios created by students

Data analysis showed that students' don't recognise the knowledge value (e.g. new knowledge about the scenario topic, usefulness of knowledge in the future) in evaluated scenarios, except in the case of the 'Earthquake' scenario (created by UCY). Students felt a lack of practical value (e.g. future career related with the topic covered in the scenario, skills described in the scenario needed in my future career) in all evaluated scenarios. In the scenario attributes category (e.g. easy to follow and understand, format, scenario is enjoyable), students felt that those more easy to follow and understand were 'Apple', 'Water', 'Earthquake', and two created by students 'Sugar' and 'Nutritionist'. In the category career awareness (e.g. new knowledge about possible careers, responsibilities related to career, skills necessary in this profession), students evaluated more highly the scenarios: 'Apple', 'Water', 'Energy', 'Earthquake' and one created by students, 'Nutritionist'. Students felt a lack of career awareness in the other scenarios. In the social value category (e.g. scenario topic important for local community, whole world, socially relevant problem presented in the scenario, it was easy to relate with the situation described), students agreed that this aspect was presented in the scenarios: 'Apple', 'Energy', 'Recycling' and 'Earthquake'. Based on this data, students liked and found interesting 6 of the 9 scenarios evaluated. These scenarios were: 'Apple', 'Water', 'Energy', 'Earthquake', created by educationalists and 'Sugar' and 'Nutritionist' created by students.

Altogether, 21 scenarios were evaluated by 96 German students. The number of students, who evaluated one scenario, varied from 2-8.

The analysis of students' responses indicated that the majority of students did recognize the possibility to gain new knowledge about the scenario topics, the careers connected with the scenarios and



also the responsibilities related to the careers covered. Additionally, the majority of students considered the scenarios as socially relevant for the whole world and they felt it was easy to relate to the scenarios. The German students considered the scenarios easy to follow and the majority liked the format of the scenarios.

Nonetheless, the majority of students did not see the value of gained knowledge for their future, they could not see the practical value, did not see the personal value of the scenario topics, nor even for learning school subjects. Although students altogether evaluated 21 scenarios, the majority of students did not see their future studies and career connected to the scenario topics. German students did not find themselves as part of the science community and did not consider the scenarios as enjoyable.

It is appropriate to point out that a large proportion of the German students did find the scenarios interesting (Item 25; 43 out of 96). Nonetheless, the majority did not want to study the scenario topics further; this indicated a lack of motivation (item 28).





## 2. From the UK partner (UCL)

**Table 3. Evaluation of scenarios by grade 7 students in the UK**

Scenarios	Categories											
	Knowledge value		Practical value		Scenario attributes		Career awareness		Social value		Like and interest	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1. Apple (UBO)	1,39	0,39	1,05	0,52	1,80	0,38	1,75	0,38	1,76	0,38	0,25	0,76
2. Water (UEF)	1,19	0,48	1,17	0,57	1,68	0,49	1,60	0,52	1,60	0,51	-0,25	0,66
3. Energy (UT)	1,21	0,45	1,02	0,47	1,65	0,49	1,62	0,50	1,59	0,51	0,20	0,71
4. Food (UT)*	1,00	0,46	0,88	0,42	1,54	0,48	1,36	0,49	1,20	0,39	-0,41	0,80
5. Recycling (UCY)	1,43	0,53	1,13	0,54	1,77	0,41	1,57	0,50	1,66	0,48	0,00	0,77
6. Earthquake (UCY)	1,25	0,52	1,02	0,48	1,61	0,46	1,71	0,46	1,56	0,47	-0,17	0,64
7. Sugar (UBO)*	1,42	0,50	1,07	0,45	1,69	0,47	1,35	0,46	1,60	0,48	0,47	0,67
8. Nutritionist (UCL)*	1,22	0,50	0,92	0,47	1,72	0,44	1,75	0,43	1,75	0,44	-0,27	0,72
9. Solar power (UCY)*	1,20	0,49	1,10	0,53	1,63	0,49	1,60	0,50	1,57	0,51	-0,13	0,83

Green indicates a favourable mean, while red indicates an unfavourable mean

\*Created by students

Data analysis showed that students did not appreciate the knowledge value (e.g. new knowledge about the scenario topic, usefulness of the knowledge in the future) and the practical value (e.g. future career related with the topic covered in the scenario, skills described in the scenario needed in my future career). However, in all scenarios, students from UK evaluated more highly scenario attributes (e.g. easy to follow and understand). In the category, career awareness (e.g. new knowledge about possible careers, responsibilities related to career, skills necessary in this profession), students evaluated all scenarios highly, except the scenario on 'Food' (created by Estonian students) and 'Sugar' (created by Germany students). Similar tendencies were also seen for social value category (e.g. scenario topic important for local community, whole world, socially relevant problem presented in the scenario, it was easy to relate with the situation described). In this category, the only scenarios where students, in general, disagreed with those statements, was in the case of the scenario about 'Food'. Based on this data, students liked and found interesting the scenarios related to 'Apple', 'Energy' and 'Sugar'. In case of Recycling, there was a balance of mixed responses.

### a) Favourite scenario

The favourite scenario for the majority of the girls was (UBO 'Alternatives for Sugar'). Reasons given were:

- it was factual;
- people can relate to it;
- easy to understand, was presentable;
- people talking to each other – conversational format.



The second favourite scenario was (UCY 'Earthquake') This was seen as “straight to the point,” although too factual and a bit boring.

In contrast, the scenario used for the intervention (UBO 'Crime Scene') was considered to be boring, because:

- one photo explained everything;
- it had extensive information to process;
- and students (at least in one school) prefer a narrative style.

### **Comments on other scenarios**

- The scenario (UT 'Food industry') had good visuals, but students questioned “how does it relates to science?”
- The scenario (UT 'Energy') was the favourite for just one girl, who had a particular interest on the topic of alternative energy. However, the majority of students considered the topic to be relevant, as it addressed alternatives to fossil fuel, but was considered to be too long and complex.
- The scenario (UCY 'Eco-scientist') was a favourite for just one girl, who liked drawing and comics. Generally, students liked the comic format. However, it was considered too long and too descriptive, with the pictures hard to follow.



### 3. From the Cyprus partner (UCY)

**Table 4. Cyprus results of scenario evaluations**

Scenarios	Categories											
	Knowledge value		Practical value		Scenario attributes		Career awareness		Social value		Like and interest	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
3. Energy (UT)	1,65	0,23	1,51	0,31	1,57	0,25	1,70	0,23	1,81	0,21	0,82	0,66
6. Earthquake (UCY)	1,33	0,18	1,37	0,82	1,63	0,26	1,72	0,39	1,80	0,37	0,01	0,53
7. Sugar (UBO)*	1,57	0,21	1,33	0,32	1,83	0,18	1,52	0,24	1,78	0,23	0,56	0,96
9. Solar power (UCY)*	1,64	0,20	1,54	0,19	1,64	0,19	1,33	0,33	1,86	0,19	0,30	0,60

Green indicates a favourable mean, while red indicates an unfavourable mean

\*Created by students

Item analyses shows that the students agree with most statements and recognise the knowledge value and practical value in the scenarios. They liked the scenario attributes, except attribute relate to enjoyability (Appendix 2, table 3), which was scored somewhat lower and noting the spread of scores indicated by the SD indicates some negative responses.

Items related to the value (26) and willingness to learn about the topic (28) were towards a negative agreement in case of the scenarios created by educators and slightly towards a positive agreement in case of the scenarios created by the students. Nevertheless, students evaluated the social value all scenarios, in all categories, positively. And there was no difference between scenarios created by educationalists and students. Noting the relatively high SD in the like and interest category, this suggested that, in some cases students evaluated all scenarios negatively.

It appeared that some scenarios were more interesting to students in contrast to others.

- The scenario ‘Energy’ seemed interesting to students. The majority of students reported that the topic of the scenario was generally appealing, but they did not think that they would use such information in the future.
- Students’ opinion on the scenario ‘Which alternatives are there for sugar?’ (created by students) was not so clear. Half the students found the topic interesting, because they thought that it was important for their health. Others indicated that they found the scenario boring, because they did not want to lose weight.
- Students claimed that the ‘Switch to solar power’ scenario (created by students) was not interesting. Nevertheless, they realized that the information retrieved was important, because they could use this knowledge to ‘change’ the world.
- With regard to the ‘Food industry (wasp)’ scenario, the majority of students agreed that it was boring and that they didn’t like it. Also, some students characterized this scenario as childish. There was a consensus that they would not follow a similar future career.



4. A similar opinion was given for the 'Earthquakes red alert' scenario. Most students didn't find the scenario topic interesting, feeling they would not want to study this area in the future. Also, two students mentioned that there were problems with the scenario. Specifically, they pointed out that there were difficult words and insufficient information was given.



#### 4. From the Finnish partner (UEF)

**Table 5. Finnish results of scenario evaluations**

Scenarios	Categories											
	Knowledge value		Practical value		Scenario attributes		Career awareness		Social value		Like and interest	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1. Apple (UBO)	1,17	0,22	0,83	0,14	1,81	0,26	1,69	0,32	1,56	0,30	0,31	0,53
2. Water (UEF)	1,46	0,25	1,34	0,39	1,90	0,22	1,94	0,14	1,42	0,26	0,70	0,44
3. Energy (UT)	1,36	0,31	1,12	0,38	1,53	0,41	1,75	0,24	1,80	0,18	0,06	0,62
4. Food (UT)*	1,24	0,21	1,11	0,42	1,93	0,12	1,76	0,42	1,35	0,39	0,50	0,50
5. Recycling (UCY)	1,45	0,17	0,82	0,02	1,75	0,35	1,67	0,47	1,63	0,18	0,75	0,35
6. Earthquake (UCY)	1,21	0,51	1,08	0,35	1,88	0,18	1,83	0,24	1,50	0,00	0,25	0,35
7. Sugar (UBO)*	1,25	0,23	0,93	0,23	1,95	0,11	1,61	0,39	1,29	0,19	0,20	0,45
8. Nutritionist (UCL)*	1,41	0,31	1,19	0,44	1,80	0,27	1,61	0,39	1,56	0,37	0,05	0,79

Green indicates a favourable mean, while red indicates an unfavourable mean.

\*Created by students

In total 18 scenarios were evaluated by 133 students in lower secondary schools in Finland. As a group, two to three students evaluated scenarios together and overall 118 evaluation sheets were returned.

Data analysis showed that the scenarios tended to lack practical value for Finnish students and students had difficulties in perceiving the knowledge gained from the scenario topics as valuable. All the compared scenarios were highly evaluated in the scenario attributes category, which showed that the scenarios were perceived as having high technical quality. All scenarios were seen as enabling a raised awareness about scenario related careers. Finnish students also evaluated the social value of many scenarios highly, the highest being the ‘Energy’ scenario. This scenario is about solar panels and renewable energy sources. Finnish students considered all but 1 scenario as interesting, the exception being the ‘Nutrition’ scenario (created by students).

**Re-knowledge value.** UEF ‘Water Purification’ was mostly favoured by students, followed by UEF ‘Sports Physician’ and UCL ‘Sustainable’. Students commented that *‘information was given properly’* and was *‘good for further studies’*.

**Re-practical value.** UEF ‘Water Purification’ was the most favoured by students, followed by UEF ‘Marketing Chief’ and UEF ‘Mysterious Animal’. Students commented *‘it was good information if I needed to face that situation’*, *‘I undertook sport a lot’* and *‘it showed the responsibility of the company’*.

**Re-scenario attributes.** UBO ‘Alternatives to Sugar’ (created by students) was most favoured by students, followed by UT ‘Food Industry’ (created by students) and UCL ‘Energy’. Students commented that the scenarios *‘were nice and fun to read’*, *‘had a nice layout’* and *‘I liked the colours used in the scenario’*.



**Re-career awareness.** UEF ‘Thermal Expansion’ was most favoured by students, followed by UEF ‘Marketing Chief’ and UEF ‘Water Purification’. Students commented that *‘I may need it for my future career’* and *‘it is an interesting profession’*.

**Re-social value.** UT ‘Energy’ was most favoured by students, followed by UCY ‘Recycling Scenario’ and UEF ‘Marketing Chief’. Students commented that *‘you can sort waste better and understand the issue’* and *‘it is about nature’*.

**Re-like & interest.** UCY ‘Recycling Scenario’ was most favoured by students, followed by UEF ‘Water Purification’ and UEF ‘Marketing Chief’. Students commented that *‘I like it because of it’s length and clarity’* and *‘it covers much knowledge’*.

UEF provided an overall ranking of the scenarios as given below in table 6

**Table 6 Ranking of Evaluated Scenarios by Value Category**

RANK	KNOWLEDGE VALUE	PRACTICAL VALUE	SCENARIO ATTRIBUTES	CAREER AWARENESS	SOCIAL VALUE	LIKE & INTEREST
1	UEF Water Purification	UEF Water Purification	UBO Alternatives to Sugar	UEF Thermal Expansion	UT Energy	UCY Recycling Scenario
2	UEF Sports Physician	UEF Marketing Chief	UT Food Industry	UEF Marketing Chief	UCY Recycling Scenario	UEF Water Purification
3	UCL Sustainable	UEF Mysterious Animal	UCL Energy	UEF Water Purification	UEF Marketing Chief	UEF Marketing Chief
4	UCY Recycling Scenario	UCL Nutritionist	UEF Water Purification	UBO Dental Lab	UCL Sustainable	UT Food industry
5	UCL Nutritionist	UT Energy	UEF Marketing chief	UBO Crime Scene	UCL Energy	UBO Dental Lab
6	UEF Marketing Chief	UT Food Industry	UEF Mysterious Animal	UCY Earthquake Scenario	UCL Nutritionist	UEF Sports physician
7	UT Energy	UCL Transport	UCY Earthquake Scenario	UCL Transport	UBO Apple Diversity	UBO Apple Diversity
8	UBO Crime Scene	UCY Earthquake Scenario	UEF Sports Physician	UEF Sports physician	UEF Sports physician	UCY Earthquake Scenario
9	UEF Thermal Expansion	UEF Sports Physician	UBO Apple Diversity	UT Food industry	UEF Mysterious animal	UBO Alternatives to Sugar
10	UT Food Industry	UCL Energy	UCL Nutritionist	UT Energy	UBO Dental Lab	UCL Energy



## 5. From the Estonian partner (UT)

**Table 7. Evaluation of scenarios by grade 7 students in Estonia**

Scenarios	Categories											
	Knowledge value		Practical value		Scenario attributes		Career awareness		Social value		Like and interest	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1. Apple (UBO)	1,96	0,54	2,00	0,48	2,83	0,58	2,89	0,91	2,58	0,82	0,33	0,58
2. Water (UEF)	2,11	0,49	1,63	0,82	2,44	0,75	2,92	0,17	3,00	0,65	0,13	1,06
3. Energy (UT)	2,35	0,80	2,00	0,88	3,37	0,68	3,28	1,31	3,17	0,80	0,33	0,82
4. Food (UT)*	1,52	0,61	1,73	1,10	1,46	1,10	2,44	0,43	2,17	0,70	0,33	0,67
5. Recycling (UCY)	2,44	0,58	1,27	0,53	3,15	0,57	2,40	0,60	3,5	0,37	0,40	0,55
6. Earthquake (UCY)	2,28	0,82	1,29	0,69	3,25	0,66	3,08	0,63	3,13	0,84	0,50	0,50
7. Sugar (UBO)*	2,08	0,57	1,96	0,69	3,19	0,58	2,17	0,74	2,81	0,77	0,50	1,00
8. Nutritionist (UCL)*	2,33	0,47	1,50	0,70	1,72	0,48	3,00	0,47	3,05	0,56	0,90	0,23
9. Solar power (UCY)*	2,11	0,49	1,63	0,82	2,44	0,75	2,92	0,17	3,00	0,65	0,13	1,06

Green indicates a favourable mean, while red indicates an unfavourable mean.

\*Created by students

Data analysis among categories showed that the scenarios were seen as lacking practical value for Estonian students and the students had difficulties in perceiving the knowledge gain in scenario topics as valuable. Scenario attributes were highly valued by students for the scenarios ‘Apple diversity’, ‘Energy’, ‘Recycling’, ‘Earthquake’ and ‘Sugar’ (created by German students). Nonetheless, students did not value technical attributes highly for four scenarios. In the general opinion of Estonian students, aspects about raising students’ career awareness were highly evaluated within the scenarios: ‘Apple diversity’ (UBO), ‘Energy’ (UT), ‘Water’ (UEF), ‘Earthquake’ (UCY), ‘Nutritionist’ (created by UK students) and ‘Solar power’ (created by Cypriot students). The Estonian students evaluated social value of most scenarios highly, except the ‘Food’ scenario (created by Estonian students), which was about the process of industrial cucumber pickling. The Estonian students considered all scenarios as interesting, with two exceptions - the ‘Solar power’ (created by students) and ‘Water’ (UEF).

The favourite scenario for the majority of the students was (UT ‘Energy’). The reasons put forward were:

- it was factual;
- people can relate to it;
- easy to understand, was well presented;
- it was video recorded;

The second favourite scenario was (UCL ‘Nutritionist’ created by students). Students commented that it was an important topic, easy to follow and logical, although too factual and boring.



In contrast, the scenario used for the intervention (UEF ‘Mysterious animal’) was considered to be boring, because:

- it wasn’t understandable;
- scenario didn’t attract students;
- the scenario was too boring;
- it didn’t interest students.





## Overall Feedback from all Partners

### The overall feedback from students:

- Students did not have enough time to evaluate more than two scenarios
- Some scenarios were very boring and hard to understand
- The translation sheets were important
- It was hard to evaluate some questions (for example, career related questions, students don't know who they want to be in their future).

### The overall feedback from teachers:

- Some students didn't look through their scenarios
- Students did not have enough time
- Teachers and students had problems with Google Drive (uploading process to Google Drive site was too long almost 24 hours/ problems with students e-mail addresses, e.g. didn't remember their passwords)
- Two teachers were needed, because students had so many questions and they needed teachers help with the computer programs.
- Some scenarios were too hard to understand for seventh graders.

The comparison between scenario evaluation outcomes showed that students from all countries recognised that in all scenarios there was lack of knowledge and practical value. The only expectations in knowledge value were the 'Earthquake' scenario (recognised by Germany students) and 'Energy', 'Sugar' and 'Solar power' scenarios (recognised by Cyprus students). In the practical value category, only students from Cyprus felt that this was exhibited within two scenarios 'Energy' and 'Solar power'.

Table 8 shows the overall tendencies by scenario for each of the 6 category areas evaluated.

**Table 8. Overall tendencies related to scenarios across countries** (positive tendencies in green, negative tendencies in red, no overall tendency in white)

Categ- ories	Part- ner	Apple (UBO)	Water (UEF)	En- ergy (UT)	Food* (UT)	Recy- cling (UCY)	Earth- quake (UCY)	Sugar* (UBO)	Nutrition- ist* (UCL)	Solar power* (UCY)
Knowledge	UBO									
	UCL									
	UCY	-	-		-	-			-	-
	UEF									-
	UT									
Practical	UBO									
	UCL									
	UCY	-	-		-	-			-	
	UEF									-
	UT									
Sce- nario	UBO									
	UCL									
	UCY		-		-	-			-	



	UEF									-
	UT									
Career	UBO									
	UCL									
	UCY	-	-		-	-			-	
	UEF									-
	UT									
	UBO									
Social value	UCL									
	UCY	-	-		-	-			-	
	UEF									-
	UT									
	UBO									
Like/Interest	UCL									
	UCY	-			-	-			-	
	UEF									-
	UT									
	UBO									

In the latter 4 categories, students were more positive towards scenarios. In scenario attributes category (e.g. easy to follow and understand, format, scenario is enjoyable), students from Finland, UK and Cyprus felt positive towards all scenarios their students evaluated. Students from Germany and Estonia didn't agree that they liked scenario attributes in 'Food' and 'Solar power' scenarios. Additionally, Estonian students didn't like scenario attributes in the 'Water' and 'Nutritionist' scenarios while German students didn't like 'Energy' and 'Recycling' scenarios attributes.

In the career awareness category, students from Finland felt that career awareness was presented in all scenarios they evaluated. German, UK and Estonian students felt the lack of career awareness in 'Food' and 'Sugar' scenarios (both scenarios created by students). German and Estonian students also felt the lack of career awareness in the 'Recycling' scenario and German and Cypriot students felt this also in the 'Solar power' scenario.

In the social value category, evaluation outcomes showed that students from countries felt a lack of social value in the 'Food' scenario. In other scenarios, students from Estonia, UK and Cyprus recognised the social value. German and Finnish students felt a lack of social value also in the 'Water' and 'Sugar' scenarios. Students from Germany were also more critical towards 'Energy', 'Nutritionist' and 'Solar power' scenarios in terms of social value presented in those scenarios.

In the like and interest category, students from Cyprus liked and found interesting all scenarios they evaluated. Students from all countries also liked and found interesting Apple, Energy and Sugar scenarios. Most critical in this category were students towards the 'Solar power' scenario (except students from Cyprus). Students from Estonia and UK felt the lack of like and interest in 'Water' and Solar power scenarios (also students from Germany). Students from Finland didn't like the 'Nutritionist' scenario and for German students, 'Food' and 'Recycling' scenario was not interesting and they didn't like those scenarios.



**Appendix 1**      **Table 1. Distribution of Scenario Evaluation Instrument Items, based on theory.**

Category	Sub-category	Item no.	Item
<b>1. Knowledge-triggered interest</b>		1	This scenario enables me to gain new knowledge about the scenarios' topic.
		4	From this scenario, I am able to gain new knowledge about possible career(s).
		5	This scenario enables me to understand the responsibilities of the persons in the career position indicated
		6	This scenario enables me to understand the skills that are necessary in this profession.
		23	I know (...?) about the <b>career</b> described.
		24	I know (...?) about the topic in the scenario.
		28	The scenario makes me want to learn more about the topic.
<b>2. Value-triggered interest</b>	Usefulness	2	The knowledge I gain from the scenario may be useful in the future.
		3	I can put knowledge gained from the scenario into practice, to solve problems.
		12	I feel my future career may be connected with the topic covered <u>in the scenario.</u>
		13	I think my future studies at the gymnasium or university level may be connected to the topic covered <u>in the scenario.</u>
		14	I predict I will need to perform skills, described in the scenario, in my future career.
		15	I predict I need to perform science-related skills, described in the scenario, in my future career.
		26	I find the information gained from the scenario important to me.
	Impact level	7	I find this scenario topic important for me personally.
		8	I find this scenario topic important to my family.
		9	I find this scenario topic important for appreciating the work of our local community (town, country).
		10	I find this scenario topic important for learning school subjects.
		11	I find this scenario topic important for the whole world.
	Related-ness	16	The scenario describes the science community, to which I relate.
		17	The scenario presents a scientific problem, which is socially relevant.
		18	The scenario makes it easy for me to relate with the situation described.
<b>3. Scenario presentation</b>		19	The scenario is easy to follow.
		20	The scenario is easy to understand.
		21	The find this scenario enjoyable.
		22	I like the format of the scenario.
<b>4. Affective reaction</b>		25	I find this scenario interesting to me.
		27	I liked the scenario.

**Table 2. Distribution of Scenario Evaluation Items by post-analysis Factor Analysis**

Category	Item		Category description
<b>1. Learning value</b>	1	This scenario enables me to gain new knowledge about the scenarios' topic.	This category includes items, which refer to learning: gaining knowledge about the topic, the applicability of the gained knowledge and the value for the students' life either now or in the future: including school and close relationships. <i>Individual dimension present future line in a model by Stuckey et al, 2013</i>
	2	The knowledge I gain from the scenario may be useful in the future.	
	3	I can put knowledge gained from the scenario into practice, to solve problems.	
	7	I find this scenario topic important for me personally.	
	8	I find this scenario topic important to my family.	
	10	I find this scenario topic important for learning school subjects.	
	26	I find the information in this scenario valuable to me.	
	23	I know (...) about the <b>career</b> described.	Background in formation
	24	I know (...) about the topic in the scenario.	
<b>2. Vocational value</b>	12	I feel my future career may be connected with the topic covered <u>in the scenario</u> .	This category includes items, which imply to future career, students' present opinions of relatedness to the community of possible future career, and what skills are necessary to be performed for the possible careers. Additionally whether student is already willing to make an effort to learn for the future in mind ( <i>Stuckey et al, 2013, vocational dimension</i> ).
	13	I think my future studies at the gymnasium or university level may be connected to the topic covered <u>in the scenario</u> .	
	14	I predict I will need to perform skills, described in the scenario, in my future career.	
	15	I predict I need to perform science-related skills, described in the scenario, in my future career.	
	16	The scenario describes the science community, to which I relate.	
	28	This scenario makes me want to learn more about the topic.	
<b>3. Scenario attributes</b>	19	The scenario is easy to follow.	This category contains items about the technical aspects that can impact students' opinion about the scenario, like the format of the scenario, how well students understand the scenario, the wording difficulties etc. Also the overall opinion of the scenario is included here.
	20	The scenario is easy to understand.	
	21	The find this scenario enjoyable.	
	22	I like the format of the scenario.	
<b>4. Career awareness</b>	4	From this scenario, I am able to gain new knowledge about possible career(s).	This category includes items covering <u>career awareness</u> : <u>getting to know</u> about different careers, the responsibilities of a career, and skills necessary for different careers.
	5	This scenario enables me to understand the responsibilities of the persons in the career position indicated	
	6	This scenario enables me to understand the skills that are necessary in this profession.	
<b>5. Social value</b>	9	I find this scenario topic important for appreciating the work of our local community (town, country).	This category describes the items, which indicate to the societal value, either on a local, or a global level. The situation may or may not be relatable to the student ( <i>Stuckey, et al. societal dimension</i> )
	11	I find this scenario topic important for the whole world.	
	17	The scenario presents a scientific problem, which is socially relevant.	
	18	The scenario makes it easy for me to relate with the situation described.	
<b>6. Like and interest</b>	25	I find this scenario interesting to me.	This category includes items about interest and like toward the scenario.
	27	I liked the scenario.	



**Appendix 2 Table 1. German (UBO) Scenario Evaluation Data Analysis per item**

Items	1. Apple		2. Water		3. Energy		4. Food		5. Recycling		6. Earthquake		7. Sugar		8. Nutritionist		9. Solar power	
	UBO (N=4)		UEF (N=8)		UT (N=2)		UT (N=8)		UCY (N=3)		UCY (N=3)		UBO (N=3)		UCL (N=3)		UCY (N=4)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1	3,75	0,43	3,38	0,48	3,00	0,00	2,75	0,43	2,00	0,82	4,00	0,00	1,67	0,94	3,00	0,00	1,75	0,83
2	3,25	0,43	2,88	0,60	2,00	0,00	1,50	0,50	2,00	1,00	3,00	0,00	2,67	0,47	2,33	0,94	2,00	0,71
3	2,00	0,71	2,13	0,60	2,00	0,00	1,50	0,50	3,00	1,00	2,00	0,00	2,33	0,94	1,67	0,47	1,50	0,87
4	3,25	0,83	3,25	0,43	4,00	0,00	1,50	0,50	2,33	0,47	3,00	0,00	2,00	0,82	3,00	1,41	1,75	0,43
5	3,50	0,50	3,38	0,70	4,00	0,00	2,13	0,60	2,67	1,25	4,00	0,00	2,67	0,47	3,00	1,41	1,50	0,50
6	2,25	0,43	3,63	0,48	4,00	0,00	1,50	0,50	2,00	0,00	4,00	0,00	1,33	0,47	3,00	1,41	2,00	0,71
7	2,00	1,00	2,63	0,86	3,00	0,00	1,38	0,48	2,33	0,94	3,00	0,00	2,00	0,82	2,33	0,94	2,50	1,12
8	2,50	0,50	2,29	0,70	2,00	0,00	1,63	0,48	2,33	0,47	3,00	0,00	1,67	0,47	1,33	0,47	2,75	0,83
9	1,50	0,50	2,38	0,70	2,00	0,00	1,63	0,48	2,50	0,50	2,00	0,00	1,00	0,00	1,00	0,00	2,00	0,00
10	2,25	0,43	3,13	0,60	1,00	0,00	1,50	0,71	2,33	0,47	3,00	0,00	1,33	0,47	2,33	0,94	2,75	0,83
11	3,75	0,43	2,75	0,83	3,00	0,00	1,63	0,48	3,00	0,00	4,00	0,00	2,00	0,82	2,33	0,94	3,25	0,43
12	1,50	0,50	2,00	1,00	2,00	0,00	1,38	0,48	3,00	0,82	2,00	0,00	5,00	2,94	1,67	0,94	1,25	0,43
13	2,25	0,43	2,75	0,66	2,00	0,00	2,25	0,66	2,33	1,25	2,00	0,00	2,33	1,25	2,33	0,94	2,00	0,71
14	2,50	0,50	2,25	0,97	2,00	0,00	1,75	0,66	2,00	0,82	2,00	0,00	1,67	0,94	1,67	0,47	1,25	0,43
15	2,00	0,71	2,00	1,12	3,00	0,00	1,63	0,48	1,67	0,47	2,00	0,00	1,67	0,47	1,67	0,47	1,50	0,50
16	3,25	0,43	2,88	0,60	3,00	0,00	2,00	0,50	2,00	0,82	3,67	0,47	2,33	0,94	1,00	0,00	1,25	0,43
17	3,50	0,50	2,88	0,60	3,00	0,00	1,88	0,78	2,33	0,47	4,00	0,00	3,00	0,82	2,33	0,94	2,33	0,94
18	2,50	0,87	3,25	0,66	2,00	0,00	1,88	0,93	3,00	0,82	4,00	0,00	2,00	0,82	3,00	1,41	1,25	0,43
19	3,25	0,43	3,00	0,50	3,00	0,00	2,38	0,86	2,67	0,94	4,00	0,00	3,33	0,47	3,00	1,41	1,25	0,43
20	3,25	0,43	3,13	0,33	2,00	0,00	2,57	0,73	1,00	0,00	4,00	0,00	3,33	0,47	3,00	1,41	1,50	0,50
21	3,75	0,43	2,13	1,05	2,00	0,00	1,75	0,66	2,00	0,82	3,00	0,00	2,00	1,41	2,33	0,94	1,50	0,50
22	3,50	0,50	3,13	0,93	2,00	0,00	2,71	0,45	3,00	0,00	3,00	0,00	3,00	0,82	2,33	0,94	2,25	0,83
23	0,25	0,43	1,00	0,50	1,00	0,00	0,75	0,83	1,33	0,47	2,00	0,00	1,00	0,82	0,67	0,47	0,50	0,50
24	1,00	0,00	1,29	0,45	1,00	0,00	0,88	0,78	0,33	0,47	2,00	0,00	1,67	0,47	1,00	0,82	1,25	0,43
25	1,00	0,00	0,13	0,93	0,50	0,50	-0,13	0,60	-0,67	0,47	1,00	0,00	0,33	0,94	0,00	0,82	-0,33	0,94
26	0,25	0,83	0,00	0,93	-1,00	0,00	-0,50	0,50	-0,67	0,47	1,00	0,00	0,00	0,82	-0,33	0,94	0,00	1,00
27	1,00	0,00	-0,13	0,93	0,00	0,00	0,00	0,87	-0,33	0,47	1,00	0,00	0,00	0,82	0,33	0,94	-1,00	0,00
28	0,75	0,43	-0,29	0,88	-0,50	0,50	-0,38	0,86	-0,67	0,47	1,00	0,00	-1,00	0,00	-0,33	0,94	-0,25	0,83



**Table 2. UK (UCL) Scenario Evaluation Data Analysis, per item**

Items	1. Apple		2. Water		3. Energy		4. Food		5. Recycling		6. Earthquake		7. Sugar		8. Nutritionist		9. Solar power	
	UBO (N=30)		UEF (N=10)		UT (N=15)		UT (N=17)		UCY (N=25)		UCY (N=21)		UBO (N=18)		UCL (N=11)		UCY (N=25)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1	2,00	0,00	1,90	0,32	1,67	0,49	1,41	0,51	1,88	0,33	1,81	0,40	1,83	0,38	1,64	0,51	1,72	0,46
2	2,00	0,00	1,30	0,48	1,53	0,52	1,24	0,44	1,72	0,46	1,57	0,51	1,83	0,38	1,55	0,52	1,64	0,49
3	1,57	0,50	1,50	0,53	1,60	0,51	1,27	0,46	1,68	0,48	1,52	0,51	1,44	0,51	1,80	0,42	1,60	0,50
4	1,83	0,38	1,60	0,52	1,73	0,46	1,41	0,51	1,60	0,50	1,71	0,46	1,18	0,39	1,70	0,48	1,56	0,51
5	1,93	0,25	1,60	0,52	1,60	0,51	1,29	0,47	1,58	0,50	1,67	0,48	1,53	0,51	1,91	0,30	1,56	0,51
6	1,50	0,51	1,60	0,52	1,53	0,52	1,38	0,50	1,52	0,51	1,75	0,44	1,33	0,49	1,64	0,51	1,68	0,48
7	1,28	0,46	1,20	0,42	1,00	0,00	1,24	0,44	1,67	0,48	1,40	0,50	1,59	0,51	1,30	0,48	1,28	0,46
8	1,23	0,43	1,20	0,42	1,40	0,51	1,18	0,39	1,48	0,51	1,24	0,44	1,72	0,46	1,45	0,52	1,13	0,34
9	1,68	0,48	1,60	0,52	1,53	0,52	1,35	0,49	1,72	0,46	1,29	0,46	1,33	0,49	1,73	0,47	1,52	0,51
10	1,55	0,51	1,70	0,48	1,53	0,52	1,35	0,49	1,48	0,51	1,40	0,50	1,41	0,51	1,36	0,51	1,40	0,50
11	1,97	0,18	1,70	0,48	1,67	0,49	1,13	0,34	1,72	0,46	1,76	0,44	1,71	0,47	1,91	0,30	1,58	0,50
12	1,25	0,44	1,40	0,52	1,20	0,41	1,25	0,45	1,36	0,49	1,25	0,44	1,12	0,33	1,27	0,47	1,36	0,49
13	1,25	0,44	1,40	0,52	1,20	0,41	1,18	0,39	1,36	0,49	1,19	0,40	1,22	0,43	1,18	0,41	1,32	0,48
14	1,21	0,42	1,40	0,52	1,13	0,35	1,18	0,39	1,40	0,50	1,10	0,30	1,17	0,38	1,18	0,41	1,40	0,50
15	1,33	0,48	1,40	0,52	1,40	0,51	1,06	0,24	1,40	0,50	1,29	0,46	1,24	0,44	1,18	0,41	1,42	0,50
16	1,39	0,50	1,60	0,52	1,33	0,49	1,06	0,24	1,64	0,49	1,43	0,51	1,50	0,51	1,18	0,41	1,62	0,50
17	1,86	0,35	1,60	0,52	1,50	0,52	1,13	0,34	1,56	0,51	1,71	0,46	1,78	0,43	1,73	0,47	1,54	0,51
18	1,54	0,51	1,50	0,53	1,67	0,49	1,18	0,39	1,64	0,49	1,48	0,51	1,56	0,51	1,64	0,51	1,62	0,50
19	1,90	0,30	1,70	0,48	1,73	0,46	1,69	0,48	1,92	0,28	1,76	0,44	1,67	0,49	1,80	0,42	1,75	0,44
20	1,93	0,25	1,80	0,42	1,67	0,49	1,69	0,48	1,84	0,37	1,81	0,40	1,78	0,43	1,90	0,32	1,67	0,48
21	1,68	0,48	1,60	0,52	1,60	0,51	1,24	0,44	1,64	0,49	1,33	0,48	1,59	0,51	1,55	0,52	1,54	0,51
22	1,71	0,46	1,60	0,52	1,60	0,51	1,53	0,51	1,67	0,48	1,52	0,51	1,72	0,46	1,64	0,51	1,54	0,51
23	0,97	0,32	0,80	0,63	0,93	0,46	0,29	0,47	1,20	0,58	0,81	0,60	0,94	0,75	0,82	0,60	0,92	0,50
24	1,38	0,56	1,00	0,47	1,14	0,54	0,57	0,65	1,40	0,58	1,24	0,54	1,13	0,62	1,00	0,82	1,13	0,68
25	0,23	0,77	-0,20	0,63	0,07	0,70	-0,41	0,80	-0,04	0,79	-0,15	0,67	0,44	0,71	-0,27	0,65	-0,17	0,82
26	0,10	0,80	-0,50	0,71	-0,27	0,59	-0,71	0,47	0,08	0,91	-0,19	0,75	0,11	0,76	-0,55	0,52	-0,37	0,71
27	0,27	0,74	-0,30	0,68	0,33	0,72	-0,41	0,80	0,04	0,74	-0,19	0,60	0,50	0,62	-0,27	0,79	-0,08	0,83
28	-0,13	0,86	-0,20	0,79	-0,13	0,64	-0,47	0,80	-0,36	0,76	-0,14	0,79	0,17	0,62	-0,45	0,69	-0,50	0,72



**Table 3. Cyprus (UCY) Scenario Evaluation Data Analysis, per item**

Items	3. Energy		6. Earthquake		7. Sugar		9. Solar power	
	UT		UCY		UBO		UCY	
	M	SD	M	SD	M	SD	M	SD
1	1,91	0,30	2,00	0,00	1,67	0,50	2,00	0,00
2	1,91	0,30	1,17	0,41	2,00	0,00	2,00	0,00
3	1,64	0,50	1,17	0,41	1,67	0,50	2,00	0,00
4	1,82	0,40	1,67	0,52	1,33	0,50	1,43	0,53
5	1,45	0,52	1,83	0,41	1,89	0,33	1,14	0,38
6	1,82	0,40	1,67	0,52	1,33	0,50	1,43	0,53
7	1,45	0,52	1,00	0,00	1,44	0,53	1,29	0,49
8	1,40	0,52	1,00	0,00	1,44	0,53	1,43	0,53
9	1,78	0,44	1,83	0,41	1,67	0,50	1,86	0,38
10	1,40	0,52	1,67	0,52	1,22	0,44	1,14	0,38
11	1,73	0,47	1,83	0,41	1,89	0,33	1,86	0,38
12	1,45	0,52	1,00	0,00	1,22	0,44	1,29	0,49
13	1,36	0,50	1,00	0,00	1,33	0,50	1,29	0,49
14	1,27	0,47	1,83	0,41	1,33	0,50	1,14	0,38
15	1,73	0,47	2,00	0,00	1,56	0,53	2,00	0,00
16	1,73	0,40	1,00	0,00	1,22	0,44	2,00	0,00
17	0,54	0,66	1,83	0,41	1,67	0,50	2,00	0,00
18	1,55	0,52	1,80	0,45	1,89	0,33	1,71	0,49
19	1,73	0,47	1,67	0,52	2,00	0,00	1,86	0,38
20	1,55	0,52	1,83	0,41	2,00	0,00	1,71	0,49
21	1,27	0,47	1,17	0,41	1,78	0,44	1,29	0,49
22	1,73	0,47	1,83	0,41	1,56	0,53	1,71	0,49
23	1,09	0,70	0,67	0,52	1,11	0,60	0,86	0,38
24	1,18	0,60	1,00	0,63	1,22	0,44	1,14	0,69
25	1,27	0,65	0,67	0,52	1,00	1,00	0,43	0,79
26	-0,18	0,87	-1,00	0,00	0,00	1,00	0,17	0,41
27	0,36	0,67	-0,50	0,55	0,11	0,93	0,17	0,41
28	-0,27	0,65	-0,83	0,41	0,00	1,00	0,17	0,98



**Table 4. Finland (UEF) Scenario Evaluation Data Analysis, per item**

Items	1. Apple		2. Water		3. Energy		4. Food		5. Recycling		6. Earthquake		7. Sugar		8. Nutritionist	
	UBO (N=9)		UEF (N=6)		UT (N=8)		UT (N=7)		UCY (N=2)		UCY (N=2)		UBO (N=6)		UCL (N=11)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1	1,89	0,33	2,00	0,00	1,75	0,46	2,00	0,0	2,00	0,00	2,00	0,00	2,00	0,00	1,73	0,47
2	1,68	0,50	1,83	0,41	1,75	0,46	1,57	0,53	2,00	0,00	1,50	0,71	1,67	0,52	1,91	0,30
3	1,11	0,33	1,67	0,52	1,50	0,53	1,71	0,49	2,00	0,00	1,50	0,71	1,67	0,52	1,91	0,30
4	1,78	0,44	2,00	0,00	1,88	0,35	1,71	0,49	1,60	0,71	1,50	0,71	1,67	0,52	1,55	0,52
5	1,63	0,52	1,80	0,45	1,50	0,53	1,71	0,49	2,00	0,00	2,00	0,00	1,50	0,55	1,55	0,52
6	1,67	0,50	2,00	0,00	1,88	0,35	1,86	0,38	1,50	0,71	2,00	0,00	1,67	0,52	1,73	0,47
7	1,13	0,35	1,40	0,55	1,38	0,52	1,00	0,00	1,00	0,00	1,00	0,00	1,17	0,41	1,27	0,47
8	1,00	0,00	1,17	0,41	1,57	0,53	1,00	0,00	1,50	0,71	1,00	0,00	1,00	0,00	1,55	0,52
9	1,67	0,50	1,50	0,55	1,75	0,46	1,33	0,52	1,50	0,71	1,00	0,00	1,33	0,52	1,70	0,48
10	1,22	0,44	1,83	0,41	1,50	0,53	1,29	0,49	1,00	0,00	1,50	0,71	1,17	0,41	1,40	0,52
11	1,78	0,44	1,80	0,45	2,00	0,0	1,29	0,49	2,00	0,00	2,00	0,00	1,33	0,52	1,60	0,52
12	1,00	0,00	1,40	0,55	1,14	0,38	1,14	0,38	1,00	0,00	1,50	0,71	1,17	0,41	1,45	0,52
13	1,00	0,00	1,67	0,52	1,25	0,46	1,33	0,52	1,00	0,00	1,50	0,71	1,17	0,41	1,45	0,52
14	1,00	0,00	1,67	0,52	1,50	0,53	1,50	0,50	1,00	0,00	1,00	0,00	1,00	0,00	1,55	0,52
15	1,11	0,33	1,50	0,55	1,38	0,52	1,43	0,53	1,50	0,71	1,50	0,71	1,17	0,41	1,36	0,50
16	1,00	0,00	1,20	0,45	1,63	0,52	1,29	0,49	1,00	0,00	1,00	0,00	1,20	0,45	1,30	0,48
17	1,63	0,52	1,40	0,55	2,00	0,00	1,43	0,53	2,00	0,00	2,00	0,00	1,40	0,55	1,50	0,53
18	1,00	0,00	1,20	0,45	1,50	0,53	1,29	0,49	1,00	0,00	1,00	0,00	1,20	0,45	1,50	0,53
19	1,86	0,35	2,00	0,00	1,38	0,52	2,00	0,00	1,50	0,71	2,00	0,00	2,00	0,00	1,80	0,42
20	1,71	0,49	2,00	0,00	1,50	0,53	2,00	0,00	1,50	0,71	2,00	0,00	2,00	0,00	1,90	0,32
21	1,86	0,38	1,80	0,45	1,50	0,53	1,67	0,52	2,00	0,00	1,50	0,71	2,00	0,00	1,70	0,48
22	1,88	0,35	1,80	0,45	1,75	0,46	2,00	0,00	2,00	0,00	2,00	0,00	1,80	0,45	1,82	0,40
23	0,50	0,53	1,00	0,00	1,13	0,35	0,86	0,38	0,50	0,71	0,00	0,00	0,80	0,45	1,18	0,40
24	0,38	0,52	1,60	0,55	1,00	0,53	0,67	0,52	0,50	0,71	0,50	0,71	1,40	0,55	1,27	0,79
25	0,13	0,64	0,80	0,45	0,00	0,76	0,43	0,53	0,50	0,71	0,50	0,71	-0,20	0,45	0,00	1,00
26	0,00	0,53	0,00	0,71	0,13	0,64	0,14	0,69	1,00	0,00	0,00	1,41	0,00	0,71	0,09	0,70
27	0,50	0,53	0,60	0,55	0,13	0,61	0,57	0,53	1,00	0,00	0,00	0,00	0,60	0,55	-0,09	0,70
28	-0,25	0,71	0,20	0,45	-0,25	0,71	0,14	0,69	-0,50	0,71	0,00	0,00	-0,40	0,55	0,09	0,83





**Table 5. Estonian (UT) Scenario Evaluation Data Analysis, per item**

Items	1. Apple		2. Water		3. Energy		4. Food (Cucumber)		6. Recycling		7. Earthquake		9. Sugar		10. Nutritionist		11. Solar power	
	UBO (N=3)		UEF (N=3)		UT (N=4)		UT (N=6)		UCY (N=5)		UCY (N=4)		UBO (N=4)		UCL (N=5)		UCY (N=4)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1	3,33	0,58	3,50	0,58	3,33	0,82	2,83	0,41	3,60	0,55	3,50	0,58	3,75	0,50	3,40	0,55	3,50	0,58
2	3,00	1,00	3,00	0,00	3,33	0,82	2,33	0,52	3,20	0,45	3,50	0,58	2,75	0,50	3,20	0,45	3,00	0,00
3	2,00	0,00	2,75	0,50	3,33	0,82	1,50	0,55	3,40	0,55	2,75	0,96	2,75	0,50	2,80	0,45	2,75	0,50
4	3,00	1,00	2,75	0,50	3,33	0,82	1,83	0,75	1,60	0,55	2,75	0,50	2,00	0,82	3,00	0,0	2,75	0,50
5	3,33	1,15	3,00	0,00	3,00	1,55	3,00	0,00	3,00	0,71	3,50	0,58	2,50	0,58	3,00	0,71	3,00	0,00
6	2,33	0,58	3,00	0,00	3,50	0,55	2,50	0,55	2,60	0,55	3,00	0,82	2,00	0,82	3,00	0,71	3,00	0,00
7	2,00	0,00	2,50	0,58	3,17	0,98	1,83	0,41	2,80	0,84	3,00	1,41	2,50	0,58	2,80	0,45	2,50	0,58
8	1,67	0,58	2,50	0,58	2,83	0,98	1,83	0,98	3,20	0,84	2,25	0,96	2,50	0,58	3,20	0,45	2,50	0,58
9	2,33	0,58	3,00	0,82	3,17	0,75	2,17	0,41	3,40	0,55	2,75	1,26	2,75	0,50	3,20	0,45	3,00	0,82
10	1,67	0,58	2,00	0,82	2,50	0,84	2,00	0,89	1,80	0,45	2,75	0,96	2,75	0,50	2,40	0,55	2,00	0,82
11	2,33	0,58	2,75	1,26	3,33	0,82	2,33	0,52	3,80	0,48	3,75	0,50	2,75	0,50	3,20	0,45	4,00	0,00
12	3,33	0,58	2,00	0,82	2,33	0,82	2,00	1,33	1,60	0,55	1,75	0,96	2,50	0,58	1,80	0,84	2,00	0,82
13	2,67	0,58	2,00	0,82	2,50	1,05	2,17	1,17	1,80	0,45	1,50	0,58	2,50	0,58	1,80	0,84	2,00	0,82
14	2,33	0,58	2,00	1,15	2,50	1,05	1,67	1,21	1,60	0,55	1,75	0,50	2,00	0,82	1,80	0,84	2,00	1,15
15	2,00	0,00	2,00	0,82	2,50	1,05	2,17	0,98	1,60	0,55	1,50	0,58	2,00	0,82	1,80	0,84	2,00	0,82
16	2,33	0,58	1,75	0,50	2,17	0,41	1,67	1,03	1,60	0,55	1,75	0,50	1,75	0,50	2,00	0,00	1,75	0,50
17	3,33	0,58	2,75	1,26	3,17	0,75	2,17	0,98	3,80	0,45	3,50	0,58	3,00	0,82	3,20	0,45	2,75	1,26
18	2,33	1,53	2,25	0,50	3,00	0,89	2,00	0,89	3,00	0,00	2,50	1,00	2,75	1,26	2,60	0,89	2,25	0,50
19	3,33	0,58	2,25	0,50	3,33	0,82	2,67	0,82	3,40	0,55	3,50	0,58	3,25	0,50	1,80	0,55	2,25	0,50
20	3,33	0,58	2,75	0,50	3,33	0,82	3,17	0,41	3,40	0,55	3,50	0,58	3,25	0,50	1,90	0,45	2,75	0,50
21	2,33	0,58	2,75	0,58	3,33	0,52	2,83	0,75	2,80	0,45	3,25	0,50	3,25	0,50	1,55	0,45	2,75	0,58
22	2,33	0,58	2,00	1,41	3,50	0,55	3,00	0,00	3,00	0,71	2,75	0,96	3,00	0,82	1,64	0,45	2,00	1,41
23	3,33	0,58	1,00	0,82	0,83	0,41	0,67	0,52	0,80	0,45	0,75	0,96	0,75	0,50	0,80	0,45	1,00	0,82
24	0,67	0,58	1,00	0,00	1,17	0,75	1,17	0,41	1,60	0,55	1,25	0,50	0,75	0,50	1,40	0,89	1,00	0,00
25	0,33	0,58	0,00	1,15	0,33	0,82	0,33	0,67	0,44	0,55	0,75	0,50	0,50	1,00	0,80	0,45	0,00	1,15
26	0,00	1,00	0,75	0,50	0,67	0,82	-0,50	0,84	0,60	0,55	0,75	0,50	0,25	0,96	1,00	0,00	0,75	0,50
27	0,33	0,58	-0,25	0,96	0,33	0,82	0,33	0,82	0,40	0,55	0,25	0,50	0,50	1,00	1,00	0,00	-0,25	0,96
28	<b>-0,67</b>	0,58	0,00	0,82	0,00	0,89	<b>-0,50</b>	0,84	<b>-0,60</b>	0,55	<b>-0,50</b>	1,00	0,00	0,82	<b>-0,20</b>	0,84	0,00	0,82

### Appendix 3. Categories and Category Descriptions, with examples of student responses

#### 1. Categories for relevance reasoning

Category	Sub-category	Description	Example response
<b>1. (Without answer)</b>	-	No answer written	
<b>2. (Without explanation)</b>	-	Answer lacks explanation	
<b>3. Value</b>	3.1 “Practical value”	Students’ response contains the implications to practical use or value either now, in near, or far, future.	Examples of students responses under this category: <i>“When I grow up...”, “In the future”, “I presume I need...”, “In my future profession...”, “I could use” etc.</i>
	3.2 “Intrinsic value”	Student indicates value to him/herself or to his/her family (close relationships).	Examples of students responses under this category: <i>“... not connected with myself personally”, “I don’t know my families’ budget...”, “valuable to me...”, “Our families’ ...”, “I have solar panels on our ...”</i>
	3.3 “Knowledge value”	Student reasons relevance with knowledge gain and importance of knowledge.	Examples of students responses under this category: <i>“Everyone should know about...”, “the information is valuable to raise mine and others knowledge...”, “gave information, “I can get to know...”, “I know now”</i>
	3.4 “Global value”	Student reasons relevance from global standpoint.	Examples of students responses under this category: <i>“Nature protection is important”; “it is important for the world”, “it is important for our environment”, “we all wish to save”</i>
<b>4. Interest</b>	4.1 “Topic interest”	Student reasons relevance/lack of relevance through topic interest.	Examples of student responses under this category: <i>“I am not interested in these topics”, “it was interesting”, “it does not interest me much”, “it was boring”.</i>
<b>5. Multiple reasons in one answer</b>	-	Students’ responses combine several previous categories.	For example: there is a combination of different categories.



## 2. Categories for Motivation reasoning

Category	Subcategory	Description and samples	
1. (Without answer)		No answer written	
2. (Without explanation)		Answer lacks explanation	
3. Value	3.1 “Practical value”	Students’ response contains the implications to practical use or value either now, in near or far future.	Examples of students’ responses under this category: <i>“I believe I need this in the future”; “I would like to make a solar panel by myself”; “I will not use it for my future profession”; “My family could use...”</i>
	3.2 “Knowledge/information value”	Student reasons motivation/lack of motivation with knowledge/ information appreciation.	Examples of students’ responses under this category: <i>“I have made some research on the topic by myself and it makes me want to learn more”; “I do not know about the topic...”; “It gave new information about..., and it could be useful” “I would like to gather some more information”</i>
4. Interest	4.1 “Topic interest”	Student reasons motivation/lack of motivation through topic interest.	Examples of students’ responses under this category: <i>“I am not interested in these topics”, “I have been interested in this topic since...”; “not my topic”; “this topic does not excite me”; “I wish not to learn this topic”;</i>
	4.2 “Motivation reasoned with just interest/lack of interest”	Student reasons motivation/lack of motivation with the following wording in his/her reason: “It was boring”, “It was/wasn’t interesting”, “Not interested”	
5. “Scenario related reasoning”		Student reasons motivation/lack of motivation with scenario characteristics.	Examples of students’ responses under this category: <i>“Scenario was easy to understand and made topic more interesting”; “I didn’t like the scenario, and professions were not made interesting enough”; “It was different”</i>
6. “Multiple reasons in one answer”		Students’ response combines several previous categories.	For example: there is a combination of cat. 5 and 4.2.
7. Other	7.1 “Rebellion/ignorance”	Student reasons their answer with: <i>“I’m not that easy to get influenced by one story”; “If the following videos are the same, then not”; “Maybe I’ll look at it in the future”; “I’m too lazy to study further”; I don’t really want to”</i>	
	7.2 “Difficulty/lack of skills”	Student reasons their answer with: <i>“It does not fit with my skills”</i>	



### 3. Categorization of Like reasoning

Category	Subcategory	Description and samples
1. (Without answer)	-	No answer written
2. (Without explanation)	-	Answer lacks explanation
3. Value	3.1 “Knowledge value”	Student reasons like with knowledge gain and importance of knowledge. Student uses following wording in his/her reason: <i>“Because I got new knowledge”</i> ; <i>“It gave new information about...”</i> ; <i>“It was very informative”</i> ; <i>“It is important to talk about career opportunities to students”</i>
	3.2 “Practical value”	Students’ response contains the implications to practical use or value, either now, in near or far future. Examples of students’ responses under this category: <i>“It might be useful in the future, when I’m buying a house”</i>
4. “Interest”	4.1 “Like reasoned with just interest/lack of interest”	Student indicates like to him/herself by using following wording in his/her reason: <i>“It was boring at times”</i> ; <i>“It was interesting”</i> ;
	4.2 “Topic interest”	Student reasons like/lack of like through <b>topic</b> interest. Student uses following wording in his/her reason: <i>“I am not interested in this topic at the moment”</i> , <i>“I’m not really interested in electricity topic”</i> ; <i>“It covered interesting topic”</i>
5. “Scenario related reason”	-	Student reasons like/dislike with <b>scenario characteristics</b> . Examples of students’ responses under this category: <i>“It was developed interestingly and made me think”</i> ; <i>“It was easily understandable”</i> ; <i>“easy to watch”</i> ; <i>“Explained /discussed difficult problem/topic in an easy way”</i> ;
6. “Multiple reasons in one answer”	-	Students’ response combines several previous categories.
7. “Emotional response”	-	Student indicates like to him/herself by using following wording in his/her reason: <i>“Because it was cool”</i> ; <i>“It was nice”</i>



#### 4. Categorization of Interest Reasoning

Category	Subcategory	Description and samples
1. (Without answer)	-	No answer written
2. (Without explanation)	-	Answer lacks explanation; or says that wasn't paying attention (why missing)
3. Value	3.1 "Knowledge value"	Student reasons interest with knowledge gain and importance of knowledge. Student uses following wording in his/her reason: <i>"It gave new knowledge about the field", "I got to know about the professions"</i> .
	3.2 "Global value"	Student reasons interest from global relevance standpoint. Examples of students' responses under this category: <i>"Because in reality we are running out of unrecoverable resources and we need to get energy from somewhere" (World related); "Because getting energy from the sun is very beneficial and it would solve a lot of problems in the world";</i>
	3.3 "Intrinsic value"	Student indicates interest to him/herself or to his/her family (close relationships). Examples of students responses under this category: <i>"My dad is planning to insert solar panels to our home" (Family related)</i>
4. "Topic interest"		Student reasons interest/lack of interest due to the topic. Student uses following wording in his/her reason: <i>"I'm still too young and I'm not interested in these topics"; "I'm just not interested in this topic";</i>
5. "Scenario related reason"	-	Student reasons interest/lack of interest with scenario characteristics. Examples of students' responses under this category: <i>"It was interesting, because I did not have to read and it had voiceover"; "... contained a problem, that I don't think about in everyday life (novelty aspect); "It was presented through life-related examples and it made it easier to understand"</i>
6. Multiple reasons in one answer	-	Students' response combines several previous categories.

