Report on the Results gathered from the Evaluation Questionnaire for Science Teachers (IT)

Number of questioned Science teachers: 8 from secondary or high schools science teachers.
Questionnaires data processed by Luigi Cerri, Fondazione Idis-Città della Scienza, Naples, Italy

Question no. 1:

- Which kind of topics in Science education would you consider to be more appealing for students?

Traditional and curricular subjects	2
Daily life related subjects	2
Environment	1
Astronomy	1
Earth sciences	1
Subject related to human life and health	2
Innovation and new technologies	2
Natural phenomena that can be directly perceived	1
Nutrition	1

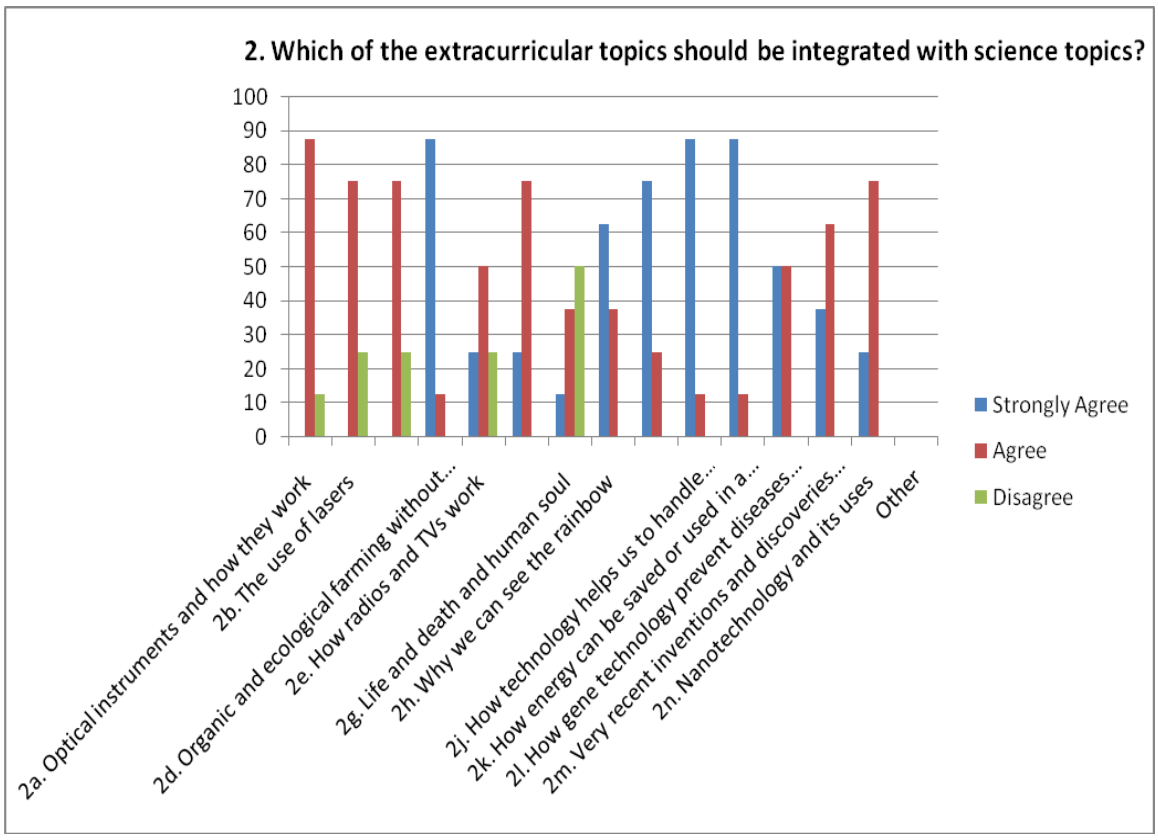
Having the interviewees to opportunity to answer in a free way, we gathered a very heterogeneous range of answers as showed in the table above. Anyway there are four subjects recurring more times: traditional and curricular subjects; daily life related subjects; subjects related to human life and health; innovation and new technologies

Question no. 2:

- Which of the extracurricular topics should be integrated with Science topics?

2. Which of the extracurricular topics should be integrated with science topics? What kind of extracurricular subjects would you consider to be important and/or innovative?	% Strongly Agree	% Agree	% Disagree
2a. Optical instruments and how they work	0	87,5	12,5
2b. The use of lasers	0	75	25
2c. How CDs and DVDs store and play sound and image	0	75	25
2d. Organic and ecological farming without use …	87,5	12,5	0
2e. How radios and TVs work	25	50	25
2f. How mobile phones can send and receive messages	25	75	0
2g. Life and death and human soul	12,5	37,5	50
2h. Why we can see the rainbow	62,5	37,5	0
2i. The ozone layer and how it may be affected by humans	75	25	0
2j. How technology helps us to handle waste, garbage and sewage	87,5	12,5	0
2k. How energy can be saved or used in a more effective way	87,5	12,5	0
2l. How gene technology prevent diseases	50	50	0
2m. Very recent inventions and discoveries …	37,5	62,5	0
2n. Nanotechnology and its uses	25	75	0
Other	0	0	0

Results diagram is presented below:



Relevant issues from question N.2

- In three cases (answers 2d. Organic and ecological farming without use …, 2j. How technology helps us to handle waste, garbage and sewage; 2k. How energy can be saved or used in a more effective way) the 87,5% of interviewees strongly agrees with the related topics, while the remaining 12,5% just agrees;
- The 75% of interviewees consider strongly agrees with the subject of answer 2i (the ozone layer and how it may be affected by humans) while the remaining 25% just agrees.

Question no. 3a:

- Do you have any knowledge about Nanotechnology?

Just the 12,5% (one interviewees) affirms he have any knowledge about nanotechnology. The remaining 87,5% answered they haven't even if one them however answered the following related question.

Question no. 3b:

- If yes, which of the curriculum topics are related with Nanotechnology?

The table below resumes the answers of these two interviewees:

If yes, which of the curriculum topics are related with nanotechnology?	yes	not	not sure
3a. Chemicals, their properties and how they react	1		1
3b. Parts of human body and how the systems work	2		
3c. Structure of DNA, genetic studies, heredity and how genes influence how we develop reproduction in humans	1		1
3d. How plants and animals grow and reproduce		1	1
3e. How people, animals, plants and the environment depend on each other	2		
3f. Atom, molecules and chemical bonding	2		
3g. Light and its nature		1	1
3h. Radioactivity and its effects		1	1
3i. The nature of sound and its properties		1	1
3j. Velocity and the relationship between velocity, time and road		1	1
3k. The structure of cell, mitosis and meiosis	2		
3l. Simple machines and how they ease our lives		2	
3m. Electricity and its properties	2		
3n. Optics and how they are used in our daily lives	1	1	
3o. Structure of Earth and how earthquakes happen		2	
3p. Clouds, rain and the weather		2	
3r. Sustainable energy and its sources		2	
3s. Heat and temperature	2		
3t. Technology and its interaction with science	2		

Even if the results from a such low sample of people are little significant, we can pick out that in seven cases (answers 3b, 3e, 3f, 3k, 3m, 3s and 3t) both the interviewees strongly agreed about the subject.

Question no. 4:

- Which Science topics do you think that should be supported with experiments for a meaningful and permanent learning?

Everything	3
Light and optics	2
Forces	1
Chemistry	2
Water	1
Heat and temperature	1
Mechanics	1
Kinematics	1
Physics	1

Having the interviewees to opportunity to answer in a free way, we gathered a very heterogeneous range of answers as showed in the table above. Anyway the most rated answer is “everything” and also topics in physics are represented more times .

Question no. 5:

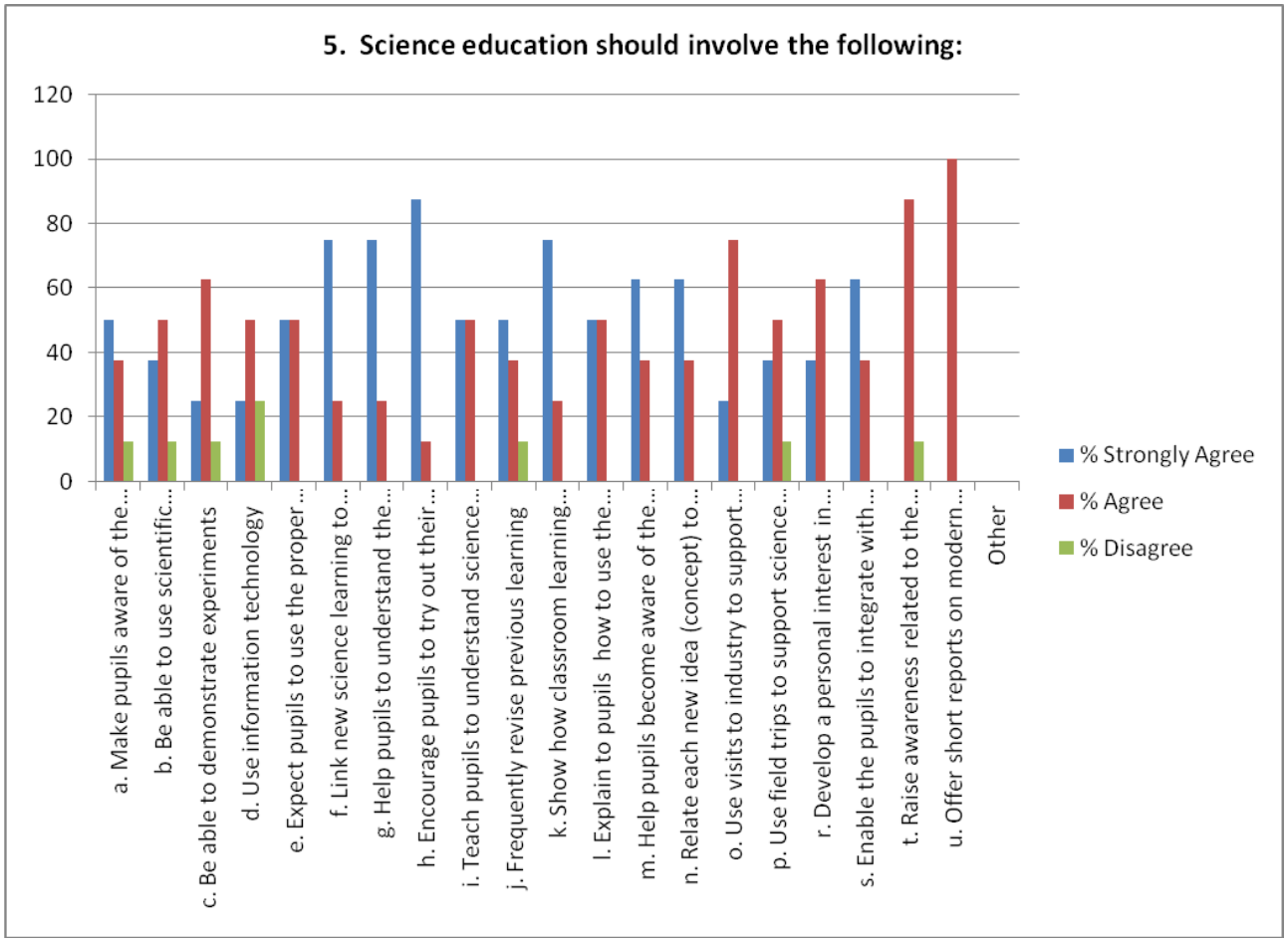
- Science education should involve the following…

The table below resumes the results:

5. Science education should involve the following:	% Strongly Agree	% Agree	% Disagree
a. Make pupils aware of the unlimited aspects of science	50	37,5	12,5
b. Be able to use scientific equipment skillfully	37,5	50	12,5
c. Be able to demonstrate experiments	25	62,5	12,5
d. Use information technology	25	50	25
e. Expect pupils to use the proper terminology correctly	50	50	0
f. Link new science learning to everyday experiences	75	25	0
g. Help pupils to understand the importance of science in modern business applications	75	25	0
h. Encourage pupils to try out their own ideas in experiments	87,5	12,5	0
i. Teach pupils to understand science concepts	50	50	0
j. Frequently revise previous learning	50	37,5	12,5
k. Show how classroom learning relates to phenomena in outside world and everyday life	75	25	0
l. Explain to pupils how to use the scientific knowledge and why their science activity is important,	50	50	0
m. Help pupils become aware of the benefits and misuses of science	62,5	37,5	0
n. Relate each new idea (concept) to ones the pupils have already learnt	62,5	37,5	0
o. Use visits to industry to support science learning	25	75	0
p. Use field trips to support science learning	37,5	50	12,5
r. Develop a personal interest in science (e.g. find new and exciting scientific topics to enrich their understanding of new horizons)	37,5	62,5	0
s. Enable the pupils to integrate with everyday lives and problems of global importance, scientific/technological achievements	62,5	37,5	0
t. Raise awareness related to the nanotechnology by introducing short talks at the last 10 minutes of learning unit	0	87,5	12,5

u. Offer short reports on modern achievements in science at the micro- and nano-level to be added to every learning unit	0	100	0
Other	0	0	0

Results diagram is presented below:



- 87.50 % of science teachers strongly agree that Science Education should *Encourage pupils to try out their own ideas in experiments*;
- 75,00% of science teachers strongly agree that Science Education should *link new science learning to everyday experiences* and *help pupils to understand the importance of science in modern business applications*;
- 62.5% of science teachers strongly agree that Science education should *Help pupils become aware of the benefits and misuses of science*, *Relate each new idea (concept) to ones the pupils have already learnt* and *Enable the pupils to integrate with everyday lives and problems of global importance, scientific/technological achievements*.

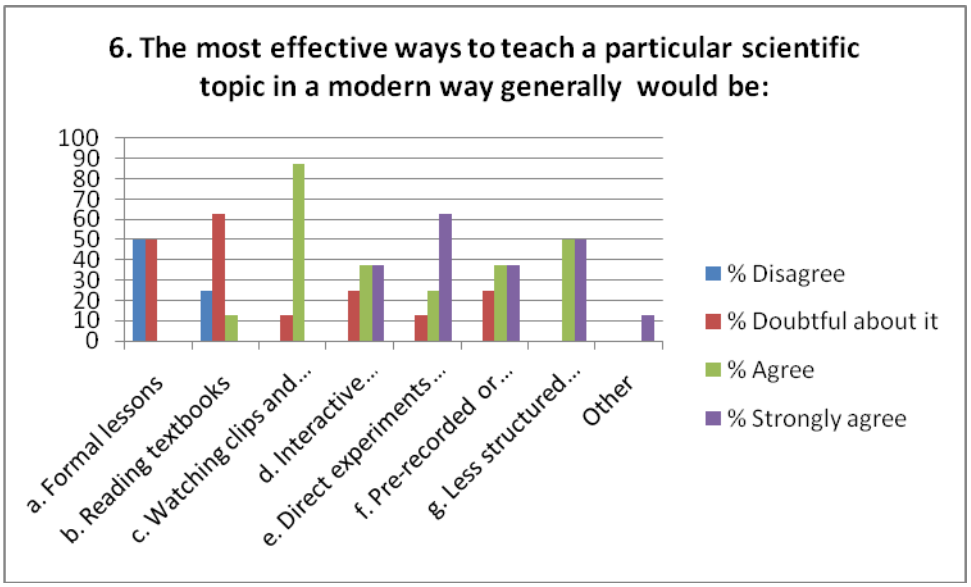
Question no. 6:

- The most effective ways to teach a particular scientific topic in a modern way generally would be…

The table below resumes the results:

6. The most effective ways to teach a particular scientific topic in a modern way generally would be:	% Disagree	% Doubtful about it	% Agree	% Strongly agree
a. Formal lessons	50	50	0	0
b. Reading textbooks	25	62,5	12,5	0
c. Watching clips and documentaries	0	12,5	87,5	0
d. Interactive computer based tools	0	25	37,5	37,5
e. Direct experiments using measuring equipment	0	12,5	25	62,5
f. Pre-recorded or filmed experiments with explanations	0	25	37,5	37,5
g. Less structured experiments	0	0	50	50
Other	0	0	0	12,5

Results diagram is presented below:



- 62.50% of Science teachers strongly agree that *direct experiments using measuring equipment* represent a most effective way to teach a particular scientific topic;
- While 50,00% of Science teachers strongly agree about the effectiveness of *less structured experiments* represent a most effective way to teach a particular scientific topic;
- 37.50% of Science teachers strongly agree that both *interactive computer based tools* and *pre-recorded or filmed experiments with explanations* represent a most effective way to teach a particular scientific topic;
- The 87,50% of science teachers just agree that *watching clips and documentaries represent* an effective way to teach a particular scientific topic

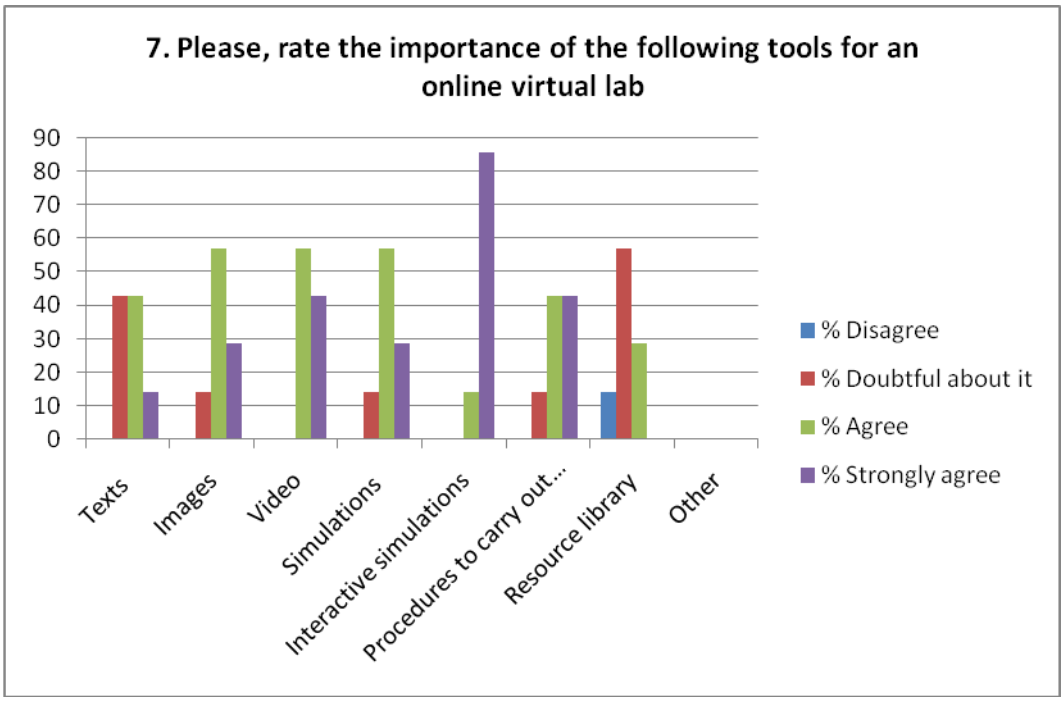
Question no. 7:

- Do you think the following tools are important for an on-line Virtual Lab?

The table below resumes the results:

7. Please, rate the importance of the following tools for an online virtual lab:	% Disagree	% Doubtful about it	% Agree	% Strongly agree
Texts	0	42,86	42,86	14,29
Images	0	14,29	57,14	28,57
Video	0	0,00	57,14	42,86
Simulations	0	14,29	57,14	28,57
Interactive simulations	0	0,00	14,29	85,71
Procedures to carry out experiments with the students	0	14,29	42,86	42,86
Resource library	14,29	57,14	28,57	0,00
Other	0	0	0	0

Results diagram is presented below:



- 85,71% of Science teachers strongly agree that interactive simulations are important for an on-line Virtual Lab;
- 42.86% of Science teachers strongly agree and 57,14% of them just agree that videos are important for an on-line Virtual Lab;
- 42.86% of Science teachers strongly agree and 42,86% of them just agree that Procedures to carry out experiments with the students are important for an on-line Virtual Lab.

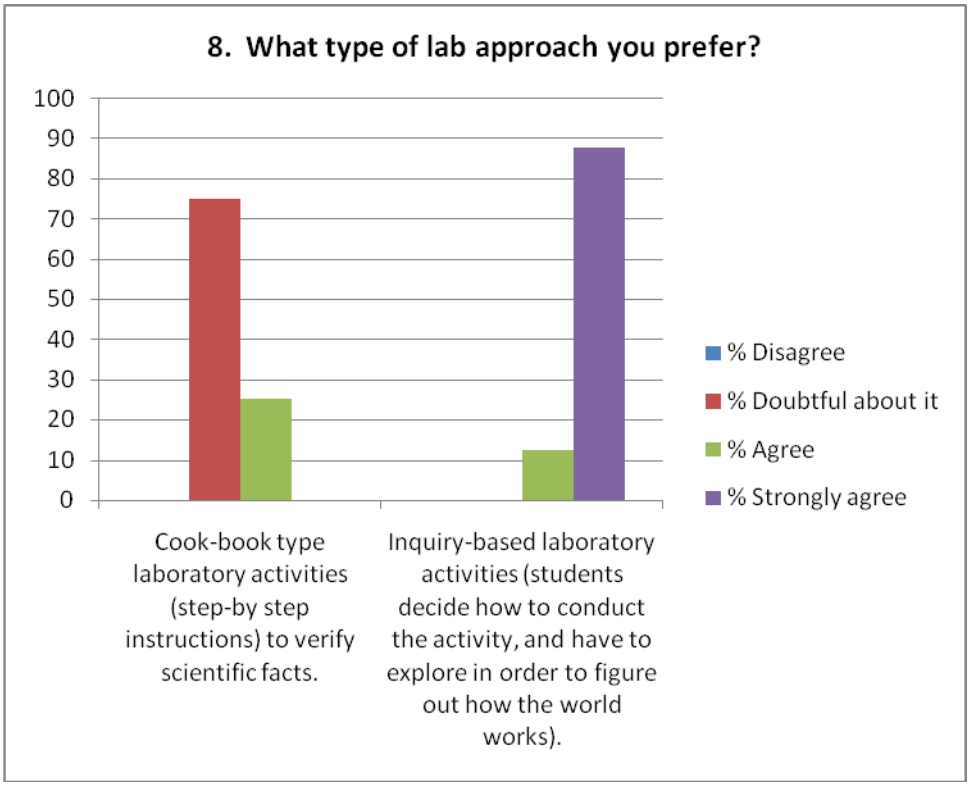
Question no. 8:

- Which type of Lab approach do you think is better?

The table below resumes the results:

8. What type of lab approach you prefer?	% Disagree	% Doubtful about it	% Agree	% Strongly agree
Cook-book type laboratory activities (step-by step instructions) to verify scientific facts.	0	75	25	0
Inquiry-based laboratory activities (students decide how to conduct the activity, and have to explore in order to figure out how the world works).	0	0	12,5	87,5

Results diagram is presented below:



- 87, 50% of Science teachers strongly agree that inquiry-based laboratory activities (where students decide how to conduct the activity, and have to explore in order to figure out how the world works) are the best approach for an on-line Virtual Lab;
- while 75.00% of Science teachers is doubtful about the fact that *cook-book type laboratory activities (step-by step instructions) to verify scientific facts* represent an effective educational approach for an on-line Virtual Lab.

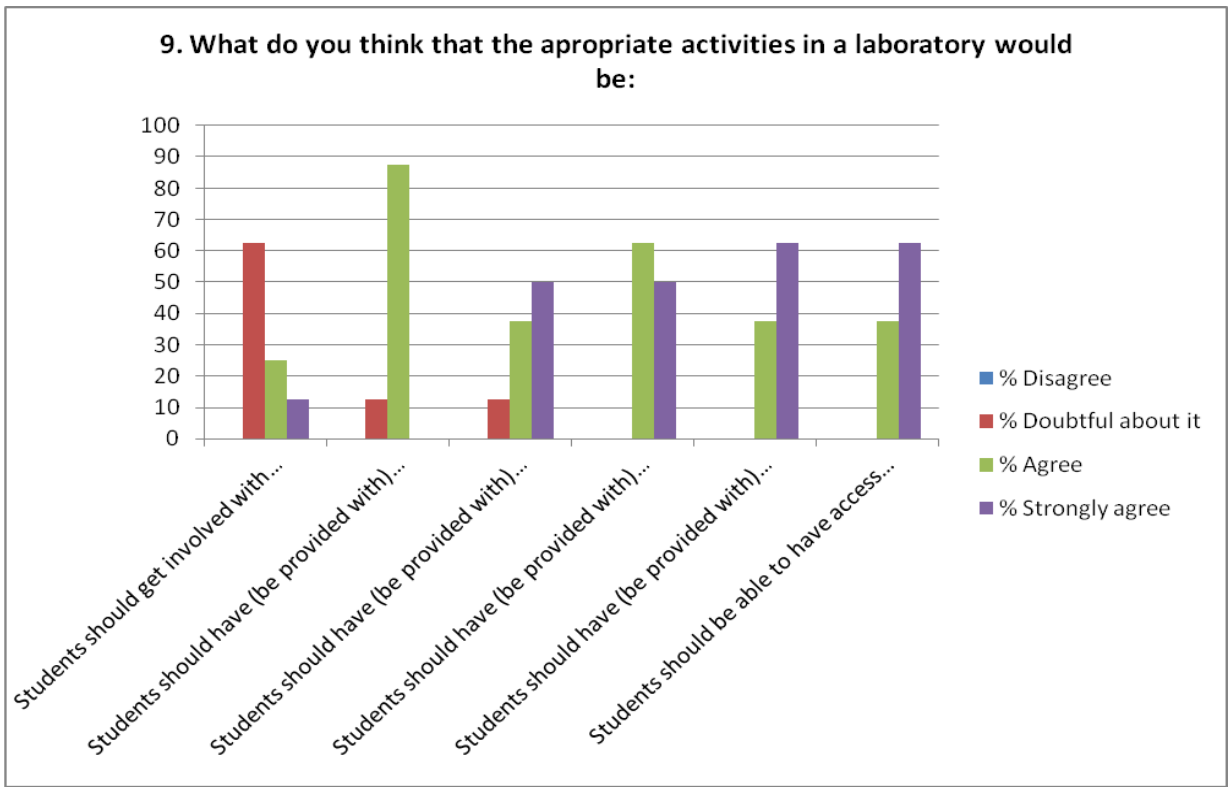
Question no. 9:

- The appropriate activities in a laboratory would be…

The table below resumes the results:

9. What do you think that the apropriate activities in a laboratory would be:	% Disagree	% Doubtful about it	% Agree	% Strongly agree
Students should get involved with scientifically oriented questions.	0	62,5	25	12,5
Students should have (be provided with) the ability to determine what data allows them to develop and evaluate scientific explanations.	0	12,5	87,5	0
Students should have (be provided with) the ability to formulate their own explanations from the evidence they have obtained.	0	12,5	37,5	50
Students should have (be provided with) the ability to expand upon their findings and relate those findings to similar situations.	0	0	50	50
Students should have (be provided with) the ability to communicate their experimental findings to others in class via written laboratory reports.	0	0	37,5	62,5
Students should be able to have access to experiments on-line which cannot be done in a laboratory	0	0	37,5	62,5

Results diagram is presented below:



- 62,50% of Science teachers strongly agree and the remaining 37,50% just agree that *students should have (be provided with) the ability to communicate their experimental findings to others in class via written laboratory reports* as well as that *students should be able to have access to experiments on-line which cannot be done in a laboratory*;
- Also 87,50 % of Science teachers just agree that *students should have (be provided with) the ability to determine what data allows them to develop and evaluate scientific explanations.*

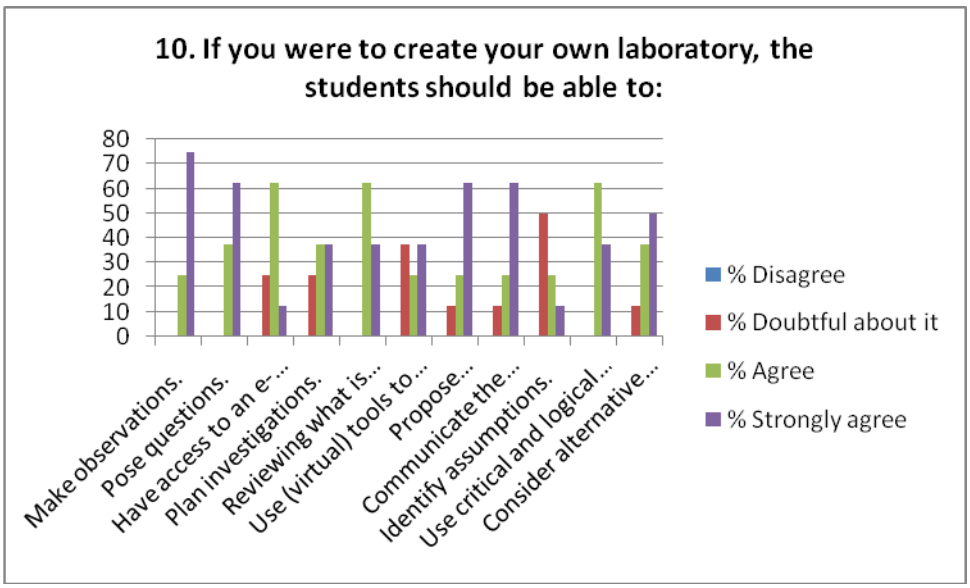
Question no. 10:

- If you were to create your own laboratory, the students should be able to…

The table below resumes the results:

10. If you were to create your own laboratory, the students should be able to:	% Disagree	% Doubtful about it	% Agree	% Strongly agree
Make observations.	0	0	25	75
Pose questions.	0	0	37,5	62,5
Have access to an e-Library (other sources of information).	0	25	62,5	12,5
Plan investigations.	0	25	37,5	37,5
Reviewing what is already known in light of experimental evidence.	0	0	62,5	37,5
Use (virtual) tools to gather, analyze and interpret data.	0	37,5	25	37,5
Propose answers, explanations, and predictions.	0	12,5	25	62,5
Communicate the results.	0	12,5	25	62,5
Identify assumptions.	0	50	25	12,5
Use critical and logical thinking.	0	0	62,5	37,5
Consider alternative explanations.	0	12,5	37,5	50

Results diagram is presented below:



- 62,50% of Science teachers strongly agree and the remaining 37,50% just agree that students should be able to pose question;
- 62,50% of Science teachers strongly agree while the 25,00% just agree that students should *propose answers, explanations*, *and predictions* and *communicate the results*.

Question no. 11:

- How well are you able to manage with using ICT tools for teaching Science topics?

11. How well are you able to manage with using ICT tools for teaching Science topics?	% poor	% average	% good	% excellent
	0	12,5	75	12,5

- 75,00% of science teachers affirm their skills in the use of ITC for teaching science topics are good, while 12,50% affirm their skills are excellent and the remaining 12,50% their skills are average.

Question no. 12:

- To what extent do you implement ready-made ICT tools for teaching Science topics?

12. To what extent do you implement ready-made ICT tools for teaching Science topics?	% never	% sometimes	% often	% always
	0	25	37,5	37,5

- 37,50% of science teacher affirm the they always use to implement ready-made ICT tools for teaching Science topics and 37,50% of them affirm they often do it.

Question no. 13:

- What is the purpose of using Nano-Tech experiments in your classroom by the use of ICT?

We remember that the interviewees could choose more than one answer to this question. Finally them were gathered 13 answers on eight interviewees.

13. What is the purpose of using Nano-Tech experiments in your classroom by the use of ICT?	
To let students understand the core aspects of the nano-technology	4
To provide students with nano-tech examples	3
To verify hypothesis, theories or models from nano-technology area	2
To raise the students' motivation for learning nano-technology	4

To most recurring answers are *to let students understand the core aspects of the nano-technology* (30,77%) and *to raise the students' motivation for learning nano-technology* (30,77%).

Question no. 14:

- What kind(s) of ICT tools do you use for presenting Science/Nano-Tech experiments in your lessons?

We remember that the interviewees could choose more than one answer to this question. Finally them were gathered 17 answers on eight interviewees.

14. What kind(s) of ICT tools do you use for presenting Science/Nano-Tech experiments in your lessons?	
PowerPoint Presentations	5
Digital Images	3
Video clips	4
Virtual Experiments	5
Other	0

To most recurring answers are *Power Point presentations* (29,41%) and *virtual experiments* (29,41%) followed by *video clips* (23,53%).

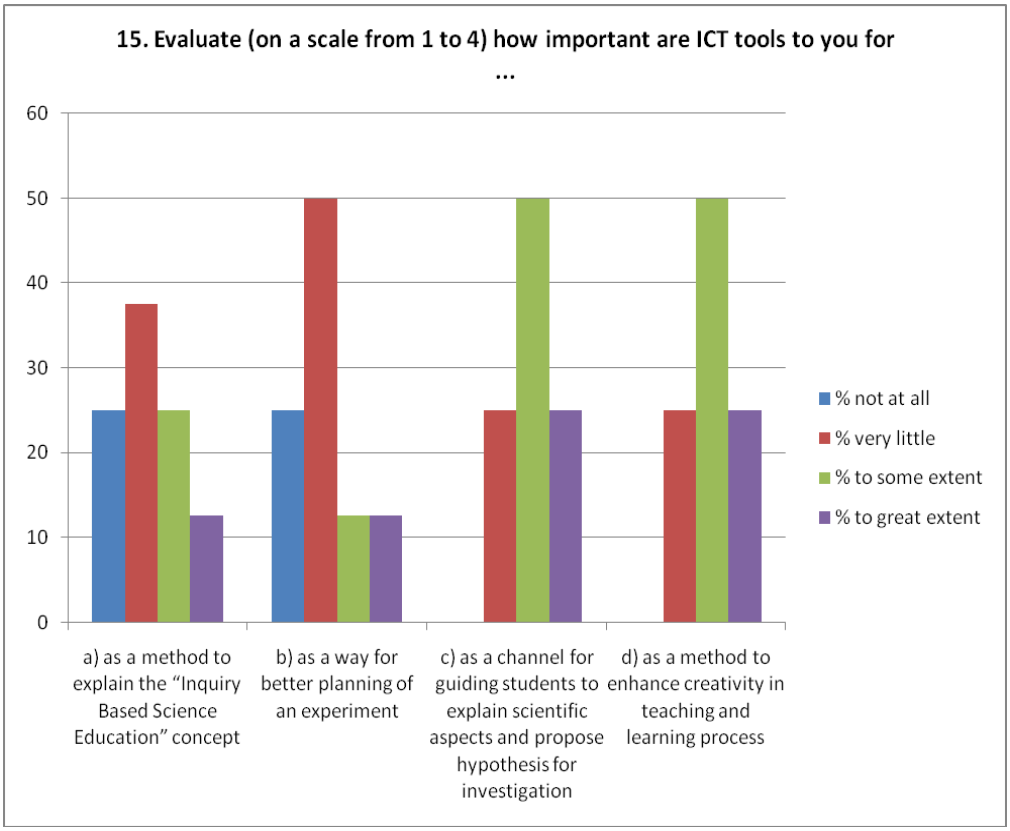
Question no. 15:

- Evaluate (on a scale from 1 to 4) how important are ICT tools for you related to the promoting of inquiry based/creative learning about Science/Nano-Tech topics.

The table below resumes the results:

15. Evaluate (on a scale from 1 to 4) how important are ICT tools to you for the purpose of promoting an inquiry based/creative learning environment in Science teaching?	**% not at all**	**% very little**	**% to some extent**	**% to great extent**
a) as a method to explain the "Inquiry Based Science Education" concept	25	37,5	25	12,5
b) as a way for better planning of an experiment	25	50	12,5	12,5
c) as a channel for guiding students to explain scientific aspects and propose hypothesis for investigation	0	25	50	25
d) as a method to enhance creativity in teaching and learning process	0	25	50	25

Results diagram is presented below:



- Just minorities of the interviewees express his maximum agreement about all the statements listed (respectively 12,5% for statement a; 12,5% for b; 25% for c and 25% for d;

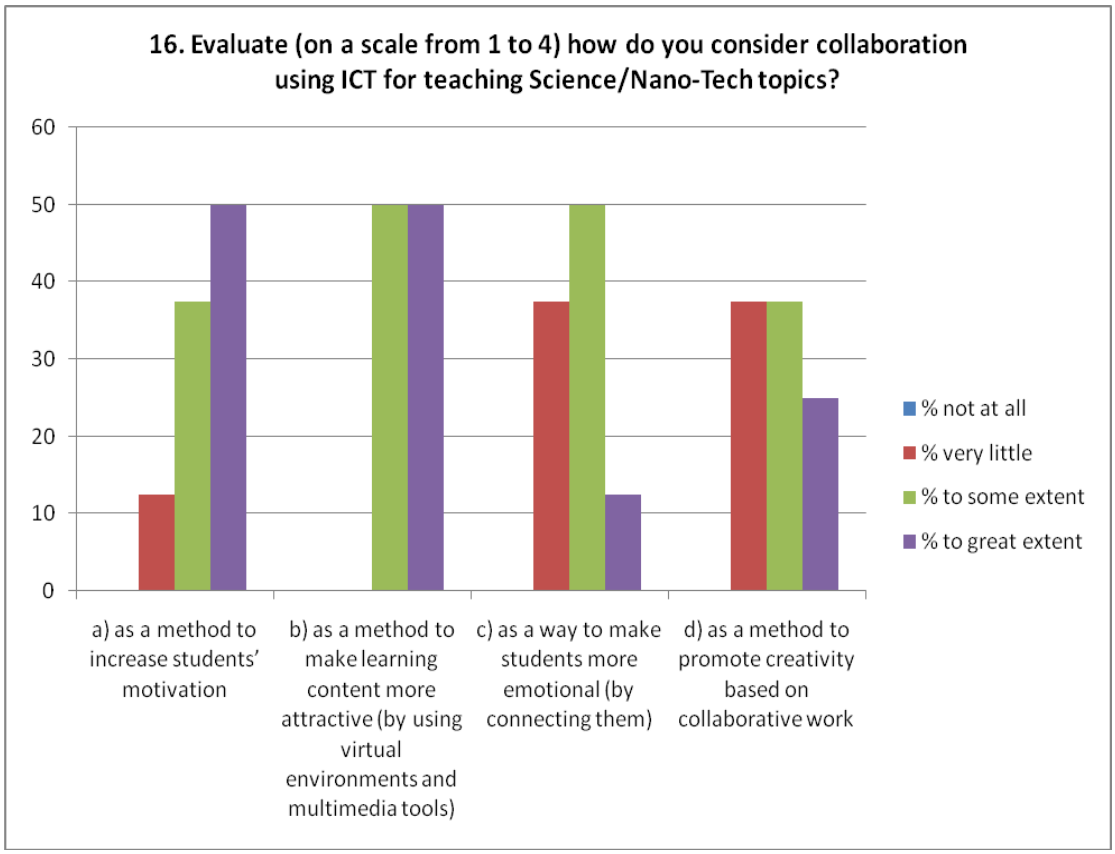
- however, both the statements c (*as a channel for guiding students to explain scientific aspects and propose hypothesis for investigation*) and d (*as a method to enhance creativity in teaching and learning process*) show for the 50.00% of interviewees a quiet appreciation (to some extent).

Question no. 16:

- Evaluate (on a scale from 1 to 4) how you consider collaboration using ICT for teaching Science/Nano-Tech topics.

16. Evaluate (on a scale from 1 to 4) how do you consider collaboration using ICT for teaching Science/Nano-Tech topics?	% not at all	% very little	% to some extent	% to great extent
a) as a method to increase students' motivation	0	12,5	37,5	50
b) as a method to make learning content more attractive (by using virtual environments and multimedia tools)	0	0	50	50
c) as a way to make students more emotional (by connecting them)	0	37,5	50	12,5
d) as a method to promote creativity based on collaborative work	0	37,5	37,5	25

Results diagram is presented below:



- 50,00% of science teachers appreciate (in a great extent) that ICT tools represent a method to increase students' motivation as well as the same percent appreciate that ICT method to make learning content more attractive (by using virtual environments and multimedia tools), considering the role of ICT tools for teaching Science/Nano-Tech topics.

Question no. 17:

- Where do you find good examples of Science experiments, appropriate to be presented in the classroom?

We remember that the interviewees could choose more than one answer to this question. Finally them were gathered 16 answers on eight interviewees.

17. Where do you find good examples of Science experiments, appropriate to be presented in the classroom?	
From real life	7
From Internet (WWW Space), please specify some sources:	4
From educational CDs/DVDs, please name some titles:	2
They are produced by myself, please provide further details:	3

To most recurring answer is *From real life* (43,75%) followed by *From internet* (25,00%) and *They are produced by myself* (18,75%).