Work package 8 Scientific literacies, motivation and learning

Table with Conceptual Structure for WP8

Here's the table with a conceptual structure for WP8 which Jens explained in Trondheim.

Objectives: To integrate scientific literacy into teacher education in order to provide teachers with specific competencies required to teach for sc.lit. in all its aspects.

	Policy level	Action level (teaching)	Teacher professional development level
Gathering	The role of sc.lit. in national curriculum documents and educational politics	Examples of good practice	The role og sc.lit. in teacher training in different countries. Different contexts for teacher training.
Production	Recommendations for the role and importance of sc.lit. in teaching and in teacher training	Maps of sc.lit. in different countries Video clips of teaching sequences in different subjects and cross disciplinary. Design of teacher training courses.	Designing teacher training modules using the video clips
Distribution	Policy papers Shareholder conferences		Implementing pilot teacher training courses

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WP8 Deliverables

	WP8: Scientific literacies, motivation and learning					
	Task	**Travels / events (dates, if applicable)**	**Partner**	**Person months**	**Start date**	**End date**
	WP leader		**UCPH**	**18**	**01-05-2009**	**30-04-2012**
	8.1 Overview report on scientific literacy policy. (12)		**UCPH**	**4**	**01-07-2009**	**30-04-2010**
	8a Training package on competence development through scientific literacy. (Product 8.2) (18)		**UCPH**	**6**	**03-05-2010**	**31-10-2010**
	8b Training package for science teachers on maximising student interest in biology. (Product 8.3) (18)		**IIT**	**3**	**01/05/2009** working part time on this project	**31-10-2010**
	8c Training package for science teachers on the use of drama in scientific literacy. (Product 8.4) (18)		**IIT (NTNU)**	**3**	**01/05/2009** working part time on this project	**31-10-2010**
	8d Training package on combining arts and science - the Water project (Product 8.5) (30)		**NTNU**	**3**	**01-08-2011**	**31-10-2011**
	IIT	**2**	**01-09-2011**	**31-10-2011**		
	8e Training package for new science teachers on media and the nature of science. (Product 8.6) (24)		**HUT**	**6**	**01-11-2010**	**30-04-2011**
	8f Report on dimensions of scientific literacy. (Product 8.7) (24)		**CNRS**	**6**	**01-11-2010**	**30-04-2011**
	Sum PM WP8			**51**		

Country Definitions of Scientific Literacy

Denmark

Danish Scientific Literacy

Purpose
Students should, through the teaching of the basic course realize the importance of knowing and understanding scientific thinking, and they must be able to relate to the strengths and limitations of scientific knowledge. Students should achieve knowledge of some key scientific issues and their social, ethical or historical perspectives, so they can express a knowledge-based view on issues and problems from a scientific perspective. Finally, students' curiosity towards and engagement in the scientific field should be supported and promoted.
Students should be able to:

- Carry out practical investigations and observations, both in the laboratory and in nature, including creating and assessing simple hypotheses.

- Use models that qualitatively and quantitatively describe simple relationships in nature and see the possibilities and limitations of such models.
- Communicate a scientific topic with a correct use of professional concepts.
- Put into perspective the contributions of scientific subjects to technological and societal development through examples.

Lessons must be organized so that:

- Students are stimulated to work actively with scientific issues, including taking part in dialogues using correct professional concepts.
- Students will work with various forms of written work which is designed with a clear progression in the requirements toward a final written product.
- In relation to written assignments and processing measured data, students should use Information Communications Technology (ICT) tools.

- Data processing should be included in the context of practical inquiry, and students should be presented with examples of computer modeling.

France

In the official text on the lower secondary school (college)- Assessement: A final exam called "Brevet des colleges" is organized at the end of this schooling. However it is not compulsory to pass this exam to enter the upper grade (Tenth grade at upper secondary school, "lycée"). After the ninth grade (3ème), students can choose between two orientations).
Title of the text: The common base (decret of the 11-07- 2006)
Under title : All what is absolutely necessary to master at the end of the obligatory school
Chapter 3: The essential elements in mathematics and the scientific and technologic literacy
Section A: The essential elements in mathematics
Section B: Scientific and technologic literacy (full translation of the text)
Experimental sciences and technologies object is to describe the real world: its natural aspect and its modifications by the humans and their activities. Their study contributes to student's understanding of the distinction between the facts, the verifiable hypothesis, and the belief or opinions. In order to reach these targets, observing, questioning, manipulating, experimenting must be trained already at the primary level of school in the same state of mind that the "main à la pâte" project (http://www.lamap.fr/) which give the taste for sciences and techniques in the student's early age. Complex notions (DNA, genes, plate tectonics) which are heard about in the current life by the students should be presented with adaptation. The presentation of the concepts elaboration history by using pluridisciplinary resources constitutes an efficient mean to picture this complexity: the historical perspective contributes to give an insight in the coherence of sciences and techniques as well as of their synergic development.
The students must understand that sciences and techniques contribute to the well-being and the progress of the society.
Knowledge:
At the end of the obligatory school all the students should have a coherent representation of the world based on knowledge. Everybody should thus :
Know That universe is structured:
• At the microscopic level (atoms, molecules living cells)
• At the macroscopic level (planets, stars, galaxies)
Know That the earth planet
• Is part of the solar system governs by the gravity
• Has a structure and internal and external dynamics phenomena
Know That matter has multiple forms
• Susceptible to react and be transformed
• Organized from the elementary to the complex and from the mineral to the living
Know What are the characteristic of the living
• The organized units (cells), and the biodiversity
• The reproduction modes, from the development to the functions of the living organisms
• The basic unit of the living (DNA) and the evolution of the species.
Know That the universe the matter and the living organism are emerged in a multitude of interactions and signals, as light that act at distances.
Know That energy and perceptible motions can occur under different aspects and be transformed from one into the other. Knowing what is electric energy and its importance, and the fossils energy as well as the renewable energies.
That the progressive mastering by human being of the matter and the energies allowed him to produce a large diversity of technical objects which should be understood at the level of :
• Using conditions
• Impacts on the environment
• How it works and should be use for security.
Master knowledge on human:
• Uniqueness and diversity of the individual comprising the human species (genetics, reproduction)
• Organization and function of the human body
• The human body and its abilities
• The human influences on the ecosystem (resources management)
Be familiar with current techniques, electronic and numerical treatments of the information, and the automatic process involved in the objects used in the everyday life
Abilities:
Experimental sciences should develop inductive and deductive abilities of the intelligence under their different aspects. The student must be able:

- to put in practice a scientific approach:
  Knowing how to observe, to interrogate, to express hypothesis and to validate it, to argue, to elaborate elementary model
  Understanding the link between the natural phenomenon and the mathematical language that apply to those and help to describe them.
  -to do hand on experiments in order to experience the handling and experimental realities.
  Participating to the design of an experimental protocol and operate the protocol using the appropriate tools (meaning also based on electronic)
  Developing manual skills and feelings of familiarity with technical behaviors and gestures.
  Perceiving the difference between reality and simulation.
  -to understand that an effect might have several causes acting simultaneously, and to perceive that it might exist unapparent or unknown causes;
  -to express and to use appropriately the results of measurements or of any research thus for that purpose:
  Using the scientific language as much written than orally
  Mastering the main units of measurements and knowing to which dimension it correspond
  Understanding that any measurement is associated with a level of uncertainty
  Understanding the nature and the validity of a statistical result
  -to perceive the link between sciences and techniques.
  -to mobilize knowledge in situation as for example understanding the functioning of its own body and the incidence of nutrition as well as how to act on it by doing sportive activities or any exercises, as well also how to take care of potential risks for natural, professional or everyday accidents.
- to use techniques and technology to overcome obstacles.
  Attitudes:
  The rational apprehension of things develops the following attitudes (note: in this text the word "attitude" is taken as it is understood in every day life not in its rigorous sense and thus for the authors it is expected that attitude = behavior which of course not the general case; the meaning here is a disposition of mind promoting systematically the behaviors corresponding to what is enumerated)
  -the observation sense
  -the curiosity toward discovering the natural phenomenon causes, the reasoned imagination, the open mindedness.
  -the critical sense: the distinction between the proved, the probable or the uncertain, the prediction and the prevision, to situate a result or an information in its context;
  -the manifestation of an interest toward scientific and techniques progresses
- the consciousness of ethical implication of such changes
- the observance of elementary rules of security in the domains of biology, chemistry and electricity
  -the responsibility in front of the environment, the living world, at the health.

Hungary

Israel

Scientific Literacy - a combination of basic science knowledge, skills required for the future citizen, and attitudes towards science and technology.

Acquisition of scientific literacy may contribute to the future citizen's ability to evaluate scientific initiatives, understand the principles by which the natural world operates, think critically and independently, make informed decisions when choosing between alternatives, and cope with problems which include facts and interpretation, numbers and patterns, logical arguments and uncertainty.

Norway

United Kingdom

How science works

Data, evidence, theories and explanations

Pupils should be taught:

a how scientific data can be collected and analysed

b how interpretation of data, using creative thought, provides evidence to

test ideas and develop theories

c how explanations of many phenomena can be developed using scientific

theories, models and ideas

d that there are some questions that science cannot currently answer, and

some that science cannot address.

Practical and enquiry skills

Pupils should be taught to:

a plan to test a scientific idea, answer a scientific question, or solve a

scientific problem

b collect data from primary or secondary sources, including using ICT

sources and tools

c work accurately and safely, individually and with others, when collecting

first-hand data

d evaluate methods of collection of data and consider their validity and

reliability as evidence.

Communication skills

Pupils should be taught to:

a recall, analyse, interpret, apply and question scientific information or ideas

b use both qualitative and quantitative approaches

c present information, develop an argument and draw a conclusion, using

scientific, technical and mathematical language, conventions and symbols

and ICT tools.

Scotland

How does the science curriculum support development of the skills and attributes of scientifically literate citizens?

Children and young people develop as scientifically literate citizens with a lifelong interest in science by:

• developing scientific values and respect for living things and the environment

• assessing risk and benefit of science applications

• making informed personal decisions and choices

• expressing opinions and showing respect for others' views

• developing informed social, moral and ethical views of scientific, economic and environmental issues

• developing self-awareness through reflecting on the impact, significance and cultural importance of science and its applications to society

• demonstrating honesty in collecting and presenting scientific information/data and showing respect for evidence

• being able to read and understand essential points from sources of information including media reports

• discussing and debating scientific ideas and issues

• reflecting critically on information included or omitted from sources/reports including consideration of limitations of data.

Source:

Curriculum for Excellence, Science: Principles and Practice. Avaialbe at http://www.ltscotland.org.uk/Images/sciences_principles_practice_tcm4-540396.pdf

Turkey

A compilation of expressions related to scientific literacy in the Turkish secondary school science programs (physics, chemistry, biology) (2007)

Source: MEB (Turkish Ministry of National Education) (2009). *Biology, Chemistry and Physics Curricula*, Retrieved 15 August, 2009, from http://ttkb.meb.gov.tr/ogretmen/

The following list is a compilation of objectives (which also include objectives related to process skills and attitudes) related to scientific literacy in the Turkish secondary school science programs (grades 9 through 11). These programs have been recently renewed (in 2007). One concern about this compilation is that these three programs have been prepared by different people who put different amount of emphasis on different aspects of scientific literacy. Therefore, this compilation provides average information in terms of how much scientific literacy is emphasized in each program but does not provide an exact picture for each program. Since this is a compilation, the list is not necessarily in pedagogical order.

According to these programs, physics, chemistry, biology, astronomy, and geology form the "physical sciences" and they use mathematics as a tool of thinking and language. Science is seen as a dynamic way of understanding which provides the most accurate explanations of the universe and life based on observations and experiments with a capability of changing these explanations based on developing observations and experiments. These programs state that students should be able to:

1. Understand and accepts the nature of science,
2. Comprehend the importance of observation and experimentation for understanding the universe,
3. Develop skills for conducting experiments and evaluates experimental data to reach generalizations,
4. State the results of observations, experiments and research orally and verbally,
5. Use theory and models to describe and predict physical events,

6. Express experiment results with tables and graphics, interprets tables and graphics,

7. Becomes aware of the importance of scientific approach and critical thinking to interpret the world,

8. Becomes sensitive toward environmental problems,

9. Define science and understand that science help us understand the events in the universe,

10. Understand that science has a structure that is based on evidence and it allows questioning and falsification,

11. Realize that increase in knowledge in science accelerates.

12. Realize that scientific knowledge is not always absolute truth, but valid under certain limits,

13. Explain the role of evidences, theories and/or paradigms on how scientific knowledge changes,

14. Realize that the knowledge change in science is usually incremental, however, sometimes change occurs as a paradigm shift,

15. Realize that when new evidence appears, current scientific knowledge is tested, limited, corrected or renewed,

16. Understand key scientific concepts (in physics, chemistry and biology),

17. Investigate the relationship between science and philosophy,

18. Define technology and realizes technological change,

19. Understand that technological design is a process and it consists of several phases (specifying design features, pre-design, collaboration, use models and simulations, trial production and product evaluation),

20. Realize that technology is not good or bad in itself, but decisions on the use of technological products and systems may result in wanted or unwanted consequences and gives examples for these situations,

21. Understand that no technological design is perfect in terms of usability, security, cost, esthetics and environmental effects. Features of materials used and natural laws limit technological products,

22. Realize that many men and women from different cultures contribute to science and technology,

23. Evaluate the role of continuous testing, reviewing, and criticizing in the development of science and technology,

24. Investigate the historical interaction between science and technology,

25. Explain, with examples, how a technological innovation contributes to development of knowledge in science,

26. Explains with examples how knowledge in science contributes to development of technology,

27. Understands the importance of relationship between science and technology in solving problems that we face in daily life,

28. Makes a technological design and explains the scientific knowledge used during the process,

29. Establish the link among different science fields in terms of scientific and technological applications,

30. Give examples of scientists who are well known around the world and give examples of their contributions to science,

31. Explain how individuals, society and environment influence science and technology,

32. Investigates the positive and negative influence of science and technology on individuals, society and environment (in social, cultural, economic, political, ethical and other areas),

33. Understands that it is possible to adopt measures against negative effects of technology through developments in science and technology and these effects could be reduced or eliminated,

34. Explain how to use technological products and systems to preserve natural resources, living beings and habitats and explain how to reduce hazardous waste stems from the use of products and systems,

35. Understand reasons and influence of local, national and global environmental problems,

36. Perceive that waste management is a social problem and become aware of the necessity of recycling or demolishing the damage that they would give to environment,

37. Join contemporary discussions about science and technology that may influence the future of individuals, society or environment,

38. Evaluate the economic, social and environmental costs of technological benefits,

39. Investigate the relationship between applications of science and ethical values,

40. Realize that there may be different opinions in the society about the adoption of ideas and applications in science,

41. Observe how society uses science and technology when making decisions about environmental problems,

42. Notice the importance and conditions of providing resources for the research projects in science and technology,

43. Make connections between science subjects and jobs that are based on science and technology,

44. Offer solutions by using science and technology for the social problems that are related to providing better life with individual, social and environmental needs in mind,

45. Give examples to the cases when today's knowledge in science and technology is insufficient for solving problems related to individuals, society and environment,

46. Explain the importance of sharing scientific and technological results through appropriate communication contexts (conferences, meetings, seminars, internet, television, radio, etc.),

47. Explain how an important milestone in science and technology changes the scientific community and society in general,

48. Realize that societies are in competition on science and technology developments,

49. Discuss possible solutions for local, national and global environmental problems,

50. Comprehend and discuss conservation methods for environment, wild life and natural resources,

51. Understand the responsibilities of individuals and societies for conservation of environment, wild life and natural resources,

52. Give examples for how men and society affect environment,

53. Become aware that one of the driving force for development in science and technology is the individual, societal and environmental needs,

54. Understand the necessity that when developing and using technology, individuals need to be responsible for themselves, society and environment,

55. Understand duties of national and international quality check/control agencies and their symbols which are used on products,

56. Evaluate benefits, quality and cost-price of assets that are used in daily life.

Expressions related to scientific literacy in the Turkish secondary school biology program (2007)

Stated vision of the biology program:

The vision of the biology class program is to teach for biological literacy. A biologically literate person:

- Understands and accepts the nature of science in general and nature of biology in specific,
- Understands the necessity of learning biology to understand self and the events in the environment,
- Has a meaningful cognitive structure formed around key concepts of biology,
- Analyzes the interaction among science-technology-society-environment in relation to past, present and future,
- Has tendency to solve problems using scientific methods,
- Develop the technological and psycho-motor skills necessary to work in biology related fields.

Stated purposes of the biology program include:

Students in this program, with a vision to achieve biological literacy for all individuals,

- Understands the nature of science,
- Improves their knowledge about how science contributes to culture by learning the fields of study in science and in biology,
- Own the knowledge, skills, attitudes and values necessitated by the era we live in that are related to biology and use them to better understand the natural world,
- Understands and accept scientific values which are important to society and environment as responsible individuals,
- Uses biology knowledge to solve problems faces in daily life,
- Uses scientific methods to solve problems,
- Establishes the necessary cognitive and affective foundation necessary to biology related jobs,
- Joins activities for promoting and protecting the biological richness as a responsible individual.

Stated Science - Technology - Society - Environment (STSE) objectives for the classroom

1.* *Understand the role of science while serving/meeting individuals and social needs.

2.* *Understand the testability, falsifiability and evidence based structure of science.

3.* *Become aware of that scientific knowledge increases.

4.* *Explain the role of evidence, theories and/or paradigms in the change of scientific knowledge

5.* *Become aware of that scientific knowledge usually continuously changes, but sometimes paradigms shifts cause that change.

6.* *When a new finding comes out, current scientific knowledge is examined, tested, corrected or replaced.

7.* *Become aware of that biology helps to understand life

8.* *Understand socio-economical and cultural contexts affect the development of biology.

9.* *Evaluate applications of biology on individual, society and environment.

10. Become aware of that biology has boundaries/limitations.

11. Make connections between biology sub-domains and the real-life applications of them.

12. Understand the relationships between biology and other area of science.

13. Understand the relationships between science-technology-society-environment.

14. Become aware of the importance and conditions of providing financial support for science and technological research projects.

15. Know the importance of models in construction and presentation of scientific knowledge.

16. Know technological concepts, principle and processes.

17. Realize limitations and resources of technological development process and possible effect of technological applications.

18. Make connections between biological topics and careers related to biology.

19. Explain contributions of societies with different historical and cultural background to the development of scientific thought and development of biology as a science domain.

20. Compare the effect of different attitudes and values on biological concepts.

21. Give examples of scientists who have well known around the world and give examples of their contributions to science.

22. Give examples that scientific development contributes technological development and it pioneers new technological innovations and applications.

23. Perceive that waste management is a social problem and become aware of the necessity of recycling or demolishing the damage that they would give to environment.

24. Explain how to use technological products and systems to preserve natural resources, living beings and habitats and explain how to reduce hazardous waste stems from the use of products and systems.

25. Understand reasons and influence of local, national and global environmental problems.

26. Discuss possible solutions for local, national and global environmental problems.

27. Comprehend and discuss conservation methods for environment, wild life and natural resources.

28. Know responsibility of individual and societies for conservation of environment, wild life and natural resources.

29. Give examples for how men and society affect environment.

30. Become aware of that one of the driving force for development of science and technology is the individual, societal and environmental needs.

31. Understand necessity that when developing and using technology, individuals need to be responsible for themselves, society and environment.

32. Know duties of national and international quality check/control agencies and their symbols which are used on products.

33. Develop benefits, quality and cost-price of assets that are used in his/her daily life.

Expressions related to scientific literacy in the Turkish secondary school chemistry program (2007)

Stated purposes of the chemistry program include:

1.* *Provide an understanding of basic concepts related to matter and interactions among matter, and also the historical development of these concepts, their influence on the personal, social, economic and technological world and their relationship with the environment.

2. *Provide skills that allow a student* to come up with concepts and models based on data and information related to a specific subject; to use chemistry terminology to explain these concepts and models; to solve problems with simple skills such as observation, experimentation and data collection; to communicate high level of thinking with others.

3. *Develop an attitude of* wonder for investigating matter and relationships among matter; respect for self, environment, society and others' views; habit for questioning different views within various fields of chemistry.

Stated vision of the chemistry program:

This program accepts that chemistry, together with, physics, biology, astronomy, and geology forms the "physical sciences" and it uses mathematics as a tool of thinking and language. The main inputs of this program are, structure of matter, interactions among matter, matter-energy relationship, structure and function of chemical products that the society uses, the influence of chemical technologies on environment and human life and also the nature of scientific thinking and its superiority over other ways of thinking, positive attitudes and values in the personal and social levels towards science.

Secondary level chemistry program sees science as a dynamic way of understanding which provides the most accurate explanations of the universe and life based on observations and experiments with a capability of changing these explanations based on developing observations and experiments. Studying science, and chemistry as one of its components, is not limited to people with very special skills; therefore anyone can learn and contribute to this pleasant and useful field. Understanding of scientific method, nature of science, and science-technology-society relationships develops over time. As chemistry subjects are taught and students learn and develop skills, they should develop an understanding of scientific method and use it and also in this process they should develop evaluation skills, attitudes and values compatible with peoples of science.

Chemistry is a field with its own principles, concepts, and coding system (symbols and formulas). It uses mathematics to combine its principles and concepts to convert them to higher level teaching objectives. This program focuses on the trio of chemistry specific principles, concepts, and coding system and sees mathematics as a tool. Using mathematics when necessary is considered enough for utilizing mathematics in life and using chemical concepts and principles as a tool to create mathematics problems is avoided.

Stated objectives for science process skills in the program include:

1.* *Comprehends the importance of observation and experimentation for understanding the universe,

2.* *Develops skills for conducting experiments and evaluates experimental data to reach generalizations,

3.* *States the results of observations, experiments and research orally and verbally,

4.* *Use theory and models to describe and predict physical events,

5.* *Express experiment results with tables and graphics, interprets tables and graphics,

6.* *Establish chemically based cause-effect relations when interpreting natural events.

Stated objectives related to Chemistry-Technology-Society-Environment:

1.* *Uses knowledge learned in chemistry classes to solve problems faced in daily life,

2.* *Becomes aware of the social, economic and technological influence of chemistry,

3.* *Gives examples of negative influence of scientific and technological developments on humans and nature,

4.* *Questions the importance of conducting research about science and technology,

5.* *Examines the applicability of chemistry in social and economic fields,

6.* *Becomes aware of chemical applications in social life,

7.* *Interprets the influence of chemical developments on economic, social, political, and moral values,

8.* *Becomes aware of the importance of scientific approach and critical thinking to interpret the world,

9.* *Examines the social cost of scientific developments,

10.* *Applies the knowledge that was learned for explaining physical events to solve chemistry related problems.

Stated objectives related to Attitudes and Values

1.* *Accepts the guidance of science to understand the universe and life,

2.* *Becomes sensitive toward environmental problems,

3.* *Becomes interested in science and chemistry as one of its fields.

Expressions related to scientific literacy in the Turkish secondary school physics program (2007)

Stated vision of the physics program:

Educating individuals to help them become people who accepts physics as life itself, who solves the problems that he/she faces by using the scientific method, who can analyze the interaction among physics - technology - society - and environment, who develops positive attitudes for self and others, who is technologically literate, who can state his/her views effectively and unbiased, and who are productive.

Stated Physics - Technology - Society - Environment (STSE) objectives for the classroom

These objectives include skills such as understanding, interpreting, and developing the relationship among physics, society, technology and environment. (The objectives for students are organized under three titles.)

1. Understands the nature of physics and technology

a. Defines physics and understands that physics is one of the main sciences that help us understand the events in the universe.

b. Understands that physics has a structure that is based on evidence and it allows questioning and falsification.

c. Realizes that increase in knowledge in physics accelerates.

d. Realizes that scientific knowledge in physics is not always absolute truth, but valid under certain limits.

e. Explains the role of evidences, theories and/or paradigms roles on how scientific knowledge changes in physics.

f. Realizes that the knowledge change in physics is usually incremental, however, sometimes change occurs as a paradigm shift.

g. Realizes that when new evidence appears, current scientific knowledge is tested, limited, corrected or renewed.

h. Understands key physical concepts (change, interaction, force, field, conservation, measurement, probability, certainty, scale, equilibrium, matter-energy relationship, time-space structure, resonance, entropy, etc.).

i. Investigates the relationship between physics and philosophy.

j. Defines technology and realizes technological change.

k. Understands that technological design is a process and it consists of several phases (specifying design features, pre-design, collaboration, use models and simulations, trial production and product evaluation).

l. Realizes that technology is not good or bad in itself, but decisions on the use of products and systems may result in wanted or unwanted consequences and gives examples.

m. Understands that no technological design is perfect in terms of usability, security, cost, esthetics and environmental effects. Features of materials used and natural laws limit technological products.

n. Realizes that many men and women from different cultures contribute to physics and technology.

o. Evaluates the role of continuous testing, reviewing, and criticizing in the development of physics and technology.

p. Establishes the link between physics and other science fields in terms of scientific and technological applications.

2. Analyzes how technology and physics influence each other

a. Investigates the historical interaction between physics and technology.

b. Explains with examples how a technological innovation contributes to development of knowledge in physics.

c. Explains with examples how knowledge in physics contributes to development of technology.

d. Understands the importance of relationship between physics and technology in solving problems that we face in daily life.

e. Makes a technological design and explains the scientific knowledge used during the process.

3. Analyzes the interaction of physics and technology with individuals, society and environment

a. Explains how individuals, society and environment influence physics and technology.

b. Investigates the positive and negative influence of physics and technology on individuals, society and environment (in social, cultural, economic, political, ethical and other areas).

c. Understands that it is possible to adopt measures against negative effects of technology through developments in physics and technology and these effects could be reduced or eliminated.

d. Joins contemporary discussions about physics and technology that may influence the future of individuals, society or environment.

e. Evaluates the economic, social and environmental costs of technological benefits.

f. Investigates the relationship between applications of physics and ethical values.

g. Realizes that there may be different opinions in the society about the adoption of ideas and applications in physics.

h. Observes how society uses physics and technology when making decisions about environmental problems.

i. Notices the importance and conditions of providing resources for the research projects in physics and technology.

j. Makes connections between physics subjects and jobs that are based on physics and technology.

k. Offers solutions by using physics and technology for the social problems that are related to providing better life with individual, social and environmental needs in mind.

l. Gives examples to the cases when today's knowledge in physics and technology is insufficient for solving problems related to individuals, society and environment.

m. Explains the importance of sharing scientific and technological results through appropriate communication contexts (conferences, meetings, seminars, internet, television, radio, etc.).

n. Explains how an important milestone in physics and technology changes the scientific community and society.

o. Realizes that societies are in competition on physics and technology developments.

WP3 Mind The Gap Scientific Literacy Site

Here is a link to the new WP3 Mind The Gap scientific literacy site which uses concept maps and videos to create a learning environment about scientific literacy taught with Inquiry Based Science Methods. The site will be posted here after during the Lyon conference so you everyone can look it over. It is obviously under construction and comments about what might be useful in teacher education and what could be made more useful will be appreciated.

http://www1.ind.ku.dk/mtg/wp3/scientificliteracy/maps

WP8 group with e-mail Addresses

Here is our WP8 group with e-mail addresses to communicate with one another. When you add or change something of significance to us, let all or some of know via an e-mail reminder (so we don't all have to check this Wiki each day).

Jens Dolin	
Robert Evans	
Pascale Montpied	
Florence le Hebel	
Gultekin Cakmakci	
Yalcin Yalaki	
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