NANO TECHNOLOGY FOR SCIENCE EDUCATION (NTSE) TEACHERS' REPORT

Conclusions synthesized from curriculum analyses made in the first part of the project

The first questionnaire conducted by Doga Schools aimed to raise students', prospective teachers' and teachers' reflection related to which are the most important topics to be taught or learned in Science lessons and which are the most suitable methods and tools to be used during those lessons. The total number of students involved with the questionnaire was 256. The evaluation of the Students' Questionnaires showed that the students are interested in learning science lessons connected to the new technologies and developments.

The most interesting topics for students are:

Life, death and human soul (%59,66)

Structure of DNA, genetic studies, heredity and how genes influence how we develop (% 56,39)

Technology in healthcare and medicine (% 51,10)

Robots and automated machines and their use in life (% 50,31)

Learning with ICT tools, interviews with scientists and academicians as "other ways" are good to learn science. (63%)

Students are interested in learning new aspects of science via ICT tools like computers and Internet.

Students also indicate that they would like to use platforms specially made for them to learn science, scientific blogs and related web pages.

A total number of 67 prospective teachers and 111 teachers were involved in filling in the questionnaires.

The evaluation of the questionnaires showed that most of the prospective teachers and teachers have some ideas about nanotechnology but do not have any further knowledge and do not know how to integrate basic nanotechnology topics with science lessons. Being in lack of resources about nano experiments integrated to science curriculums, they do not have the opportunity to implement and teach basic nano topics in their classrooms.

Teachers believe that topics about environmental issues and technological developments and inventions are interesting extracurricular topics for students. Teachers consider that interactive computer based tools are the most effective way to teach a particular scientific topic in a modern way. On the other hand, most of the prospective teachers absolutely agree that watching clips and documentaries are the most effective way to teach a scientific topic. Teachers believe that the purpose of using Nano-Tech experiments in the classroom by the use of ICT is to raise the students' motivation for learning nanotechnology. Prospective teachers believe that some

application areas of nanotechnology should be taught to high school students by using a virtual lab. Teachers and prospective teachers indicate that videos and procedures are important for an on line virtual lab. Teachers and prospective teachers consider collaboration using ICT for teaching Science/Nano-Tech topics as a method to make learning content more attractive (by using virtual environments and multimedia tools) Both teachers and prospective teachers find good examples of science/nanotech experiments for their lessons from the Internet. This process finding is used to identify the training needs and the educational contents for the NTSE Virtual Lab.

Need Analysis and Curriculum Match

The educational basis of the project was initiated with the planning of need analysis studies to define the pedagogical features required for ICT-based science teaching on nanotech, for different target groups as students between the ages 13-18, teachers and prospective teachers. This study also comprises the basis of educational tool in the virtual laboratory.

Before applying the questionnaires on the target groups “National Curriculum for Science Education” for the students between the ages 13-18 of the Partner Countries were examined. This description highlighted, in what extent the Nano Project team have to add some extra information on existing system and guide to the science teachers on Nanotechnology.

The curriculum of physics, chemistry, biology subjects in high schools and science curriculum in secondary schools were analysed in each country according to the content of the topics in each subject in order to find out the nano related topics. In the curriculum match table, the nano related topics, the content (background) of these topics, matching Nano Experiments of the Virtual Lab and the related grades of the schools in partner countries are defined. The most common matched Nano activities in partner countries are “Making Origami Buckyball” and “Carbon Nanotubes”. These activities are both related with physics and chemistry topics in TR, RO, GR and IT. “Making Origami Buckyball” and “Carbon Nanotubes” experiments are matched with “Atomic Structure, Chemical Bonding, Compounds, Periodic Table” topics. These topics are current in TR in 8th, 10th grades chemistry and 11th grade physics; in GR 11th grade chemistry and 12th grade physics; in RO in 9th grade chemistry and in IT in 12th grade chemistry. “LEDs” experiment is another common activity in partner countries matched with “Photoelectric and Compton effect” in physics and “Structure of Atom” in chemistry. In GR and RO, the activity is related to the physics topic in 12th grades and in IT in 13th grades. In TR, the activity is matched with 11th grade physics and 10th grade chemistry. “Iron Nanoparticles and Ferrofluid” experiment is also common in TR, GR and RO while IT has no matching topic. It is matched with “Magnetism” in physics and “Atomic Structure, Chemical Bonding and Electrochemistry” in chemistry. In TR and GR the activity is

related with 11th grades and in RO it is related with 12th grades in physics. Only in TR, the activity is matched with 10th and 11th grade chemistry topics. “Understanding Nanoscale” experiment is mainly matched with physics topic “The nature of Physics” in partner countries. The activity is related with physics topics in GR in 8th and 10th grades, in IT 12th grades, in TR 9th grades and in 8th grade chemistry.“Nanocrystal Fabrication” experiment is a common activity for chemistry topics “States of Matter and Mixtures” in all partner countries. It is related with chemistry topics in GR 8th and 10th grades, in RO 9th grades, in TR 10th grades and in IT 12th grades.“Waves and Dancing Ferrofluid” experiment is matched with physics topic “Magnetism”. The topic is current in TR and GR in 11th grades and in RO in 12th grades. On the other hand, there is matching with this activity in IT.“Lotus Effect” activity is matched with the topic “Properties of matter” in 10th grade physics in TR and in 8th grade chemistry in GR.“Waveguide Fabrication by Sol-Gel” activity is matched with 9th grade physics topic “Waves” only in TR. There is no other matching topic in partner countries.

After the survey of the state of art of the partner countries the curriculum, match the nano related topics, the content (background) of these topics, matching Nano Experiments of the Virtual Lab and the related grades of the schools in partner countries are defined. Curriculum matches between basic science and technical skills and nano related issues represent powerful tools aimed to involve school classes and their teachers from different countries in educational experiences under the guidance of experts both in didactics and in nano sciences. The curriculum matching analysis emerged that there is a widespread core of common scientific subjects characterizing the educational background in science for the students of the high schools of each partner country.

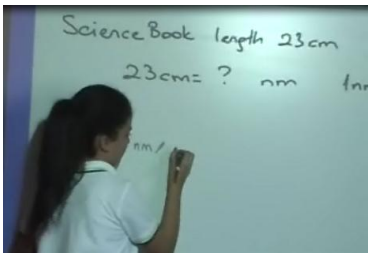
The curriculum matches and mainly the results arising from the questionnaires provided to different samples of the beneficiaries of the project, as well as some considerations arising from the comparison of the school curricula in science in the countries of the partner organizations paved the way of writing the concept paper that draws the strategies in order to define method in experiments and identify the components of the virtual laboratory.

As underlined in the concept paper, according to the statistics of the questionnaires for the students, teachers and prospective teachers the best way to make easier the learning of science is an experimental approach like performing real experiments, having direct contacts with nature or, secondarily, enjoying simulated experiments on virtual labs and the like. During the process of setting up the Virtual Lab, the components and educational materials drew the guidance for the target groups as Inquiry Based Scientific Education (IBSE) approach.

The number of teachers & schools took part in the test-implementation

38 implementations were made; 28 teachers implemented Nanotech topics in 24 different schools of Doğa Schools and 3 state schools as an outside body in their classrooms.

At least 12 more implementations are planned to be done.

An implementation in 30 Ağustos Girls Vocational High School was made and a visit to Yakacık Nanobiotech Lab was made by Hacı Rahime Ulusoy Martime Technical & Vocational High School students as outside bodies.


The first implementation stage, including 5 experiments, continued till March 2013. After some implementations developed in each country, based on the feedback of the in-service and prospective teachers involved in the 1st implementation stage, the partnership decided to improve the materials and making them more inquiry based learning encouraging learners to think about processes and phenomena by posing questions connected to real life, to find solutions and exchange information through specific channels (blog, videoconference).

The first implementation period of the lesson plans developed within the project. The results are based on the students questionnaires conducted after the lessons. The questionnaires were conducted in two phases according to the implementation stages, completion of virtual laboratories and redesign of the lesson plans with inquiry-based learning. The following data reflect ideas and thoughts of 195 students with an age range of 13-17, from

15 different schools of elementary and high school level related to the components of virtual laboratory and our educational materials (guidelines, simulations, videos etc.) in the 1st Implementation Phase. Most of the boys enjoyed the lesson, interactive animation and activities helped them to better understand the topic and they learned new things; the girls' questionnaires it can be inferred that they had the same problems with boys. They had some difficulties to follow video experiments and the tests, tasks in the lesson. Additionally, only half of the girls found the "Reading before the experiment" part easy to understand. The second implementation phase covers the finalization of NTSE virtual laboratory, revision of the 9 experiments with all supportive educational tools according to inquiry based method, reinforcement of virtual experiments with Nano – kits and simplification and tailoring the guidelines for the lower grades between 10-13 ages. The questionnaires were conducted for 71 (52 girls, 19 boys) students studying at 9 different high schools between the age of 15-18. From the boys' questionnaires it can be inferred that even though most of the boys found "Reading before experiment" part difficult to understand, they still thought that it is useful. As found out in the first implementation phase, following video experiment was still hard for students in the second implementation phase yet, they were able to better understand videos after using interactive animation and doing activities.

Girls' ideas and thoughts about the lesson plans and experiments do not show a big difference from boys in the second implementation phase. However, most of the girls chose assignments as the best way to better understand the subject matter instead of videos or interactive animation.

The questionnaires were conducted for 42 elementary school students (20 boys, 22 girls) studying. The age range of the students is between 10-15 years old. The questionnaires reflect the views of the students after simplification of the guidelines in our experiments room.

The positive effects of changes made in the second implementation process are more visible when we look at the elementary school students' questionnaires. Compared to boys studying at high school, more boys found "Reading before experiment part" easy to understand and useful. It is obviously become easier to follow the video experiments and more of the students thought that tasks and tests in the lesson were easy. The positive effects of changes made in the second implementation process are more visible when we look at the elementary school students' questionnaires. It is observable that the changes made in the lesson plans and experiments also reflected in the girls understanding of the lessons. Compared to the girls studying at high school, more girls found "Reading before

experiment part" easy to understand and useful. It is obviously become easier to follow the video experiments and more of the students thought that tasks and tests in the lesson were easy. As an added value, **the Nano Kit** produced by Turkish experts comprises of nine experiments similar to those ones included in the NTSE Virtual Laboratory that serves for hands-on activities related to Nanoscience and Nanotechnology and Science teaching. With the help of the materials provided in the NTSE Nano Kit, activities concerning Nanoscale, Buckyball, Lotus Effect, Nanocrystals, Ferrofluids and Leds can be taught to students. Thousands of young students (from NTSE project partner countries, but not only!) will benefit of NTSE Nano Kit, during the scholar activities, in the following years. The NTSE Nano Kit can be easier implemented in the Science curricula and offers sufficient strong points to be adopted by the Science teachers for practicing and developing Nano experiments in the classrooms.

Having a big exploitation potential, the Nano Kit which comprises of nine experiments similar to those ones included in the NTSE Virtual Laboratory that serves for hands-on activities related to Nanoscience and Nanotechnology and Science teaching and the related 9 experiments provided by the NTSE Virtual Laboratory will be included in next years' Science curriculum, in Doğa Schools, starting from 5th grades-the lower secondary education level and expanding to other levels, gradually. With this belief, the experts chose 3 lessons as Understanding Nanoscale, Lotus Effect and Iron Nanoparticles and Ferrofluids that can be adaptable for the students aged 10 apart from the target group and they revised the plans and the content of Nano Kit. It is estimated that during the 2014-2015 school year, the NTSE Nano Kit and the NTSE Virtual Laboratory will be used by 4000 students from lower secondary and 3700 students from upper secondary schools.

Videos of the experiments were highly voted educational tools in our Virtual Laboratory. Hands on activities and use of Nano kits are another enjoyable parts of teachers' implementations. Simulations are defined as the third enjoyable tools in their classroom implementations. The teachers believe that these educational tools are both applicable and enjoyable in their teaching since they reinforce students' learning and raise their motivation while implementing in their classrooms.

CASE STUDY:

The case studies on our project were prepared after at least three weeks classroom implementations. The teachers selected at least 3 lesson plans from our virtual laboratory to observe the impact on their students' motivation, academic achievement and attitude towards science education. By the way they tried to define the effect of use of ICT in

science education. The pre and post questionnaires, students' grids and reflections were used as the tools to gather the data from the students. During the implementations, the teachers tried to balance the number of the girls and boys. The results of the case studies showed that, the students have prejudice to learn the science education and they believe that it is challenging to learn the science at schools. After classroom implementations, it is quite clear that the perception towards science education has changed. It is observed that they like the science education when it was connected with the real life, supported with the hands on activities, videos and simulations. Even though the term and topics of Nanotechnology were very new and innovative for the students, they were open to learn and had positive attitudes since they can easily connect with the real life experiences.

During the project it was not easy to design the products addressing for the different target groups who are students from the general and vocational schools aged 13 to 18; teachers in science subject; and college & university students attending science education courses. The Virtual Lab is the milestone of the project that serves as a platform for science lessons, as a database of teaching materials, and as a hub for science learning-related experiments on Nanotechnology. Our project experts have been using the content of Virtual Lab and hands-on activities with nano kits for students at workshops. To be able to share the outputs and make more teachers and students be aware of the project number of dissemination activities were organized both in Turkey and in the partner countries. One and most important of those activities was the two-day long International Nano Technology Science Education Congress. During the congress the project was presented and key note speakers gave speeches on nanoscience, nanotechnology and workshops dedicated to different themes and topics in nanoscience were held.

Besides, webinar sessions http://www.ntse-nanotech.eu/webinar.asp were held to provide basic information on how to effectively use the virtual lab in the classroom to reach more and more users to include the Nano-Science Center, presenting to learners and their in-service or future teachers the miracles of the nanotechnologies. A program for a week Science Camp training including hands-on experiments and demonstrations will be developed and delivered through the Virtual Lab, this is a good step as an approbation of the contents and functionalities of the virtual lab. We should increase the numbers of webinar sections in order to reach more teachers; via webinars through given tasks; teachers learn how to use ICTs more effectively when they see the technologies not as generic and decontextualized tools but as tools for teaching, that is, for motivating,

managing, facilitating, enhancing, and evaluating learning. When teachers perceive ICT as a tool to meet curricular goals they are more likely to integrate ICT in their lessons.

The NTSE project aimed to support the acquisition of key competencies through making all levels of education and training more attractive and efficient in line with the strategic objectives of the Education and Training 2020" (ET 2020). The project deliverables aspired to support mostly basic competences in science and technology through providing adequate equipment and educational software and encouraging the teachers for the best use of teaching and learning techniques based on ICT. The NTSE project by prioritizing these goals focused on the young students as well as their teachers and has been searching to diversify teaching equipment and ICT tools to help people to gain science and digital competence.

Three case studies were prepared.

1 case study : Gender issues in science education

2 case studies: Motivation of the students at Vocational school

- Local experts of the Project acted as an implementer teacher and as a guide for the implementer teachers in using Virtual Lab and its contents such as Experiment guidelines, videos, simulations and other documents which are present in the Experiments Room
- Local experts' roles are to prepare educational material, implementation in the classroom, conducting video sessions and design workshops for students and teachers.

International Nano-Tech Science Education Congress (INT-NTSE)

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1. **Test-implementation which produced new lesson plans**
    - Preparations before the implementations were made by the implementer teachers with the guidance of local experts via mail or phone calls

- Three Video conferences between two schools in BG and TR were designed for selected activities from the current experiments -conf.dogakoleji.com/euprojects.
- One video conference between Italy and Turkey was made (June 2013)
- In December 2012 video conference about LEDs and in May 2012 video conference about Nanocrystals were conducted.
- In June 2013 video conference between BG and TR was made.
- In June 2013 video conference between TR and IT was made.
- The number of video conferences is yet not enough.
- During the implementation process no major difficulties were seen. The only difficulty was the absence of pre-knowledge about Nanotechnology.
- According to the implementer teachers' and students' feedback after the experiment implementation the awareness and the curiosity about nanotechnology is increased.

2. Thematic Overview

Thematic Analysis of the Teachers' Reflections on Implemented Lesson Plans

7 high school teachers and 4 elementary school teachers provided reflections on their classroom implementations. Their reflections were analyzed using the thematic analysis through defining the main and sub themes in their reflections. The data was analyzed by a content analysis approach. The content analysis is used in four stages to process the qualitative research data received from the documents: (1) coding the data, (2) identifying the themes, (3) arranging of codes and themes, and (4) identifying and interpreting the findings. Inductive coding is made in order to reveal the concepts, and the relationship between these concepts that underlay the data and themes are determined accordingly. The themes are placed under four topics during the analysis process: applicability, difficulty, enjoyment, curriculum match. In order to filter the data under four areas, uncertain expressions and repeats are eliminated. Each table is interpreted in accordance with the themes determined and an attempt is to define the impact of our educational tools on the students and teachers. The results were listed according to their frequency. Some of the teachers gave more than one answers to same questions.

MAIN THEMES	SUB THEMES	FREQ	QUOTES FROM THE TEACHERS
APPLICABLE PARTS	Videos of the experiments	**6**	*"The videos are very short and easy." to follow."* *"My students especially like sugar cubes activities."*
	Hands on activities	**4**	
	Simulations	**2**	
	Conversion of units	**3**	
	Links with the real life implementations	**1**	
DIFFICULT PARTS	Conversion of units in traditional way	**4**	*"It takes longer than I expected to plan and prepare the activities with the students. I spent at least 90 minutes for each lesson. "* *"Our students had difficulty to convert the units in traditional way since it requires good mathematical skills."* *"Some of my students had difficulty to understand and follow the simulations in English. The language barrier hinders their learning."*
	Language barriers while watching videos&simulations	**3**	
	Time constraints in planning and implementing hands on activities	**2**	
	Transitions of the activities from videos to simulations	**1**	
	New terms and topics about Nanotechnology	**1**	
ENJOYABLE PARTS	Videos of the experiments	**7**	*"Students were mostly impressed by videos of the experiments."* *"I observed that the students enjoyed to measure desks and chairs with with a nanoscale ruler. "*
	Hands on activities and use of Nano Kit	**6**	
	Simulations	**4**	

TOPICS MATCHED WITH THE CURRICULUM	Nano Crystal Fabrication, Iron Nano Particles and Ferrofluid match with Atomic structure	**6**	*"Lesson materials were matched with chemistry Curriculum. The lessons will especially help students to learn atomic structure more easily."* *"Topics of conversion of unit, nanotechnology and state of matter are directly linked to lesson plans."* *"The Nano Crystal Fabrication Lesson Plan is in relation to the topics of atomic structure, scale and conversion of unit."*
	States of matter	**6**	
	Understanding Nanoscale matches with the topic The nature of physics:Scales	**3**	
	Conversion of Unit	**1**	

Thematic analysis of the teachers' reflections on Implemented Lesson Plans in classroom.

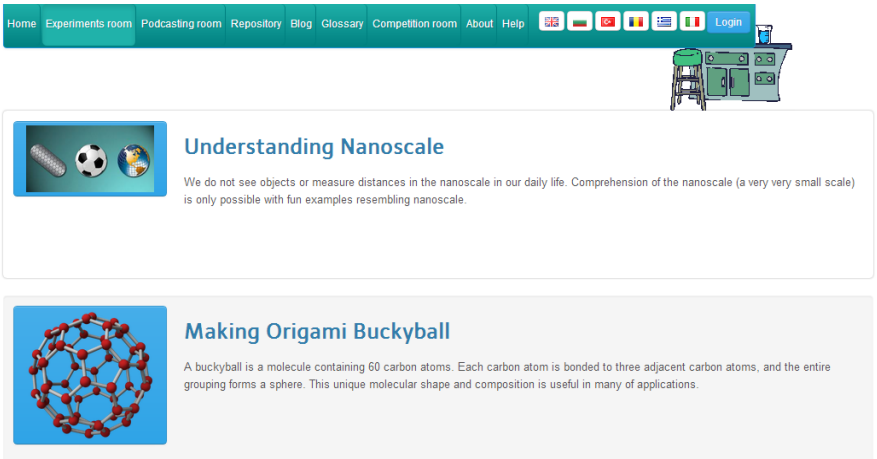
According to the thematic analysis of the Teachers' Reflection Questions; the videos, simulations (ICT tools) and hands-on activities are helping students to understand science better and relate it with real life. It is obvious that the experiments are well integrated with the science curriculum, so that the students can learn the topics more easily as well as raising their awareness in nanotechnology. The experiments with hands on activities, simulations, and videos are the most applicable tools and parts of the educational tools of the Virtual Laboratory for teachers.

On the contrary, traditional teaching in science education such as conversion of units is the most difficult part while implementing Nano Scale Lesson Plan. Apart from this, the language barrier in understanding videos and simulations are other obstacles in our Virtual laboratory. Time constraints in planning and implementing the lesson and mostly the hands on activities are other problems explained by teachers. It is observed that the obstacles are mostly about the logistic supports. Only one of them is about the content of the topic. But it totally proved that traditional teaching makes students learning more challenging and monotonous. This problem can be easily eliminated through revising the lesson plans in our Virtual Laboratory. Apart from this, it is useful to insert the notes for the teachers to let them modify the lesson plans according to the levels of their learners. Another problem about the language barriers can be sorted out with the translations. The time constraint in teaching is a big challenge for the teachers. Pre- planning the hands on activities and giving clear instructions before hands on activities can be the practical solutions to prevent this obstacle.

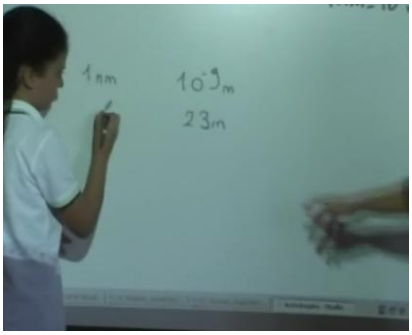
Videos of the experiments were highly voted educational tools in our Virtual Laboratory. Hands on activities and use of Nano kits are another enjoyable parts of teachers' implementations. Simulations are defined as the third enjoyable tools in their classroom implementations. The teachers believe that these educational tools are both applicable and enjoyable in their teaching since they reinforce students' learning and raise their motivation while implementing in their classrooms.

The last question shows that the topics of Atomic structure and States of Matter in Chemistry and Physics Education are the mostly matched with the Nano topics. These topics are Nano Crystal Fabrication, Nano Particles and Ferrofluid. Apart from this, the topic of Nature of Physics in Physics Curriculum is the second topic matched with the Nano scale topic. Conversion of Units is the last topic that can be matched with the Nano Scale topic. According to the results, all teachers found the matched the Nano Technology topics with their science education. So it is quite clear that the students' background knowledge in these topics supports their learning and makes the topics easier and meaningful since they can find the connection with their previous learning.

Also during the first implementations, most popular lesson plans are «Understanding Nanoscale» and «Making Origami Buckyball».



Understanding Nanoscale is an experiment which can be implemented both in secondary schools and high schools and easy to understand the main basics of nanoscale and nanotechnology.



Buckyball is another popular nano topic for students. It is highly related to the curriculum and for the potential use of fullerens especially the Buckyball, this topic captures the interest of students.

- *Deviations from lesson plans;*

  In Doğa Schools teachers are frequently called to implement experiments from the Experiment Room in VL. When teachers select the experiment randomly students may find the topic difficult to understand.

  It is important that the implementations of the lesson plans should be in the order as in the Experiments Room and should be implemented according to the guidance of the simulated Guided Tour.

  The lesson plans are designed in a regular harmony

  The current five lesson plans are revised according to the methodology of the Project which is inquiry based learning method. The new inquiry based guidelines empower learners in highly diverse settings to become digitally competent and scientifically literate.

  All assessment grids are reconstructed in order to find out the internalization of what is learnt and what is adapted to real life.

- *Matching with the curriculum;*

  Nanoscale is the first experiment to be implemented. Although it is extra curriculum it is easy to understand and captures the interest of students. It is highly related with some topics in the curriculum like measurement units, chemical and physical properties of matter.

  Buckyball and Nanocrystal Fabrication experiments are also related with the curriculum topics.

  The activities and experiments make it easy for the students to realize the real life examples of nanotechnology are somehow related to their curriculum topics.

3. Teachers' Feedback on the teaching materials according to the general pedagogical criteria

- Information,
- Structure,
- Presentation & Design,
- Accuracy.

4. Teachers' Feedback on the Virtual Laboratory

Feedbacks are positive about VL:

- Implementer teachers believe VL serves as criteria for selecting the experiments and the resources in platform for teaching Nanotechnology. Because experiments and simulations simplify the nano topics for students.
- Teachers' and students' guidelines contain enough informative activities for users.

According to the implementer teachers;

- Structure of the Virtual Lab is specially designed for teachers and students as a guide to Nanotechnology.
- The existing guidelines are being revised according to the inquiry based method and teachers and students find the new guidelines easier to understand

Structure;

- Podcasting Room contains videos but new, interesting videos from each partner should be uploaded
- Repository gives extra reading and videos to the users which is very useful. But not every experiment has links to the repository and this avoids the use of repository.
- Blog is not updated. Teachers find it boring with only three articles and do not use it. New articles should be uploaded.

Presentation & Design;

- Teachers find the VL presentation well-constructed, step by step and from easy to hard.
- On the other hand they find the design of the VL very plane and not appealing enough.

Accuracy;

- Teachers find the topics in the experiments room accurate to scientific facts and integrated with real life.

5. Future Plans & Conclusion

- Collaboration with Living Schools Lab project run by European Schoolnet is on the way as question and answer, quiz show and Nano Activity implementations.
- Nano-Science Camp training, with hands-on experiments and demonstrations, was realized on 30 June – 7 July 2013. The camp participants were selected through the Nano-Technology poster competition 24-28 April 2013 in Antalya." and Nano-Science Camp will be held annually.
- A remarkable project result, with a huge potential of exploitation on a large scale, is offered by the realization and production of the NTSE Nano Kit, designed by DOĞA experts. The NTSE Nano Kit comprises of nine experiments similar to those ones included in the NTSE Virtual Laboratory that serves for hands-on activities related to Nanoscience and Nanotechnology and Science teaching. With the help of the materials provided in the NTSE Nano Kit, acvitivities concerning Nanoscale, Buckyball, Lotus Effect, Nanocrystals, Ferrofluids and Leds can be taught to students. Thousands of young students (from NTSE project partner countries, but not only!) will benefit of NTSE Nano Kit, during the scholar activities, in the following years. The NTSE Nano Kit can be easier implemented in the Science curricula and offers sufficient strong points to be adopted by the Science teachers for practicing and developing Nano experiments in the classrooms. Apart from the target group; the plans and the content of Nano Kit were revised for the students aged 10 It is estimated that during the 2014-2015 school year, the NTSE Nano Kit and the NTSE Virtual Laboratory will be used by 4000 students from lower secondary and 3700 students from upper secondary schools.
- Besides, webinar sessions http://www.ntse-nanotech.eu/webinar.asp were held on 9th & 16th December, 2013 to provide basic information on how to effectively use the virtual lab in the classroom to reach more and more users to include the Nano-Science Center, presenting to learners and their in-service or future teachers the miracles of the nanotechnologies. A program for a week Science Camp training including hands-on experiments and demonstrations will be developed and delivered through the Virtual Lab, this is a good step as an approbation of the contents and functionalities of the virtual lab. We should increase the numbers of webinar sections in order to reach more teachers; via webinars through given tasks; teachers learn how to use ICTs more effectively when they see the technologies not as generic and decontextualized tools but as tools for teaching, that is, for motivating, managing, facilitating, enhancing, and evaluating learning. When

teachers perceive ICT as a tool to meet curricular goals they are more likely to integrate ICT in their lessons.