



543223-LLP-1-2013-1-LV-KA4- KA4MP

## Virtual Meeting

### Presentation of the Comments on Teachers' Experiences

Meeting held 27 November 2014, 15:00 – 17:00 CET

The video of the meeting is available on this Internet address:

<http://flashmeeting.e2bn.net/fm/0884ed-18234>

### Participants

#### Partners

Sonsóles Jimenez González (Alqueria), Alberto Domínguez Galdon (Alqueria), Lorenzo Martellini (Pixel), Giovanni Caruso (Pixel), Romans Vitkovskis (Riga State Technical School), Grzegorz Grodek (36,6 Competence Centre), Anna Ziemecka-Poteraj (36,6 Competence Centre), Dragos Zamosteanu (EuroEd), Juraj Dubrava (TRANSFER Slovensko), Vlasta Dubravova (TRANSFER Slovensko).

#### Teachers and Experts

Ignacio Pachés Giner (Spain), Laura Capella (Italy), Sandro Gomboli (Italy), Gabriella Faggioni (Italy), Uldis Heidingers (Latvia), Anita Krišamane (Latvia), Kamila Pawenta (Poland), Elza Gheorghiu (Romania), Jozef Strakoš (Slovakia), Katarína Javorová (Slovakia).

#### Minutes

As an introduction Lorenzo Martellini presented the agenda of the meeting.

### Presentation of the transnational discussion on the project portal related to the teachers' experiences (RSTS)

Romans Vitkovskis did the first speech of the virtual meeting. He presented the transnational discussion on the project portal related to the teachers' experiences. His speech was not focused on specific issue related to the materials available on the project portal, but it was centred on finding general aspects in common in order to use the material in a universal way.

All the resources uploaded on the portal can be divided into two groups: those that provide solutions for specific problems and those that supply with universal solutions. Both groups received however many positive comments by the portal users.

The concern about the first group of experiences lies on the difficulty to spread this particular solutions for a wide set of situations because of their strict connection to specific teaching contexts. The group of the universal solutions, of course, is not limited by these features and the experiences within this group are presented as applicable to every/many conditions.

Two main typologies of universal-solutions experiences can be identified: the change of perspective and the module method.

The former is a methodology very commonly used by teachers and consists in carrying out the same activity from different points of view (e.g. before as teacher and then in students' shoes). It is useful to better understand and potentially solve difficulties that would be hard to know if the subjects does not change his/her own perspective. One of the best facility is the usability of these experiences in addition to quite all the teaching activities. The latter is more focused on the students' activities and on the way how to organise these activities. The most usually proposed solutions concern students' workgroup activities, research initiatives and mutual evaluation practices. Within these proposals the students act directly and the teachers have a role as moderators. This method mainly allows to observe students' interaction and to evaluate the adoption of the solutions found by the students.



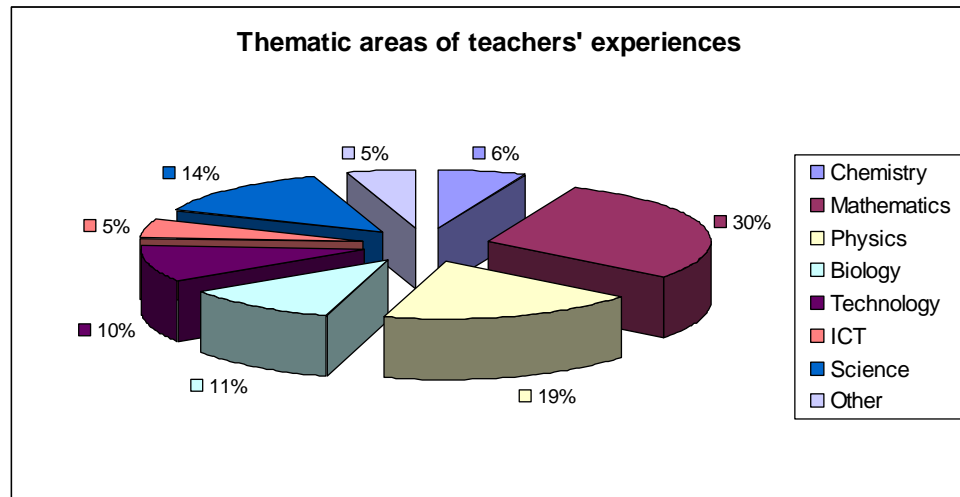


## Feedback of the Bulgarian teachers (ZinevArt)

Bulgarian teachers shared on the project portal 50 experiences related to science teaching. The shared experiences cover all thematic areas, some of them covering and being applicable also in more than one thematic area (for example science and physics or technology and physics).

As it can be seen from the chart the areas with the wider number of experiences are Mathematics and Physics. The thematic area that is less covered as experiences is the area of ICT. This is due to several reasons. On the one hand the teachers included in the project are not ICT teachers. On the other hand using ICT as a tool in the different subjects in Bulgarian schools (and in sciences subjects in particular) is not a popular and common practice.

As far as the teaching methodology is concerned, Bulgarian teachers' experiences



suggest activities can be implemented mainly in class (78%) and as extracurricular activities (16%), lab experiences are only 6%. The lack of online activities can be explained by the reasons mentioned above plus the fact that in Bulgarian schools ICT is usually a specific subject in the curricula and teachers from other sciences are not prone to pay attention to the use of ICT in their activities. It has also to be considered that many experiences require more than one type of teaching methodology. This analysis considers them separately.

The extracurricular activities (being 8 out of 50 teachers experience) cover the subjects of biology and chemistry. The laboratory experiences described (3 in total out of 50) are in the field of physics.

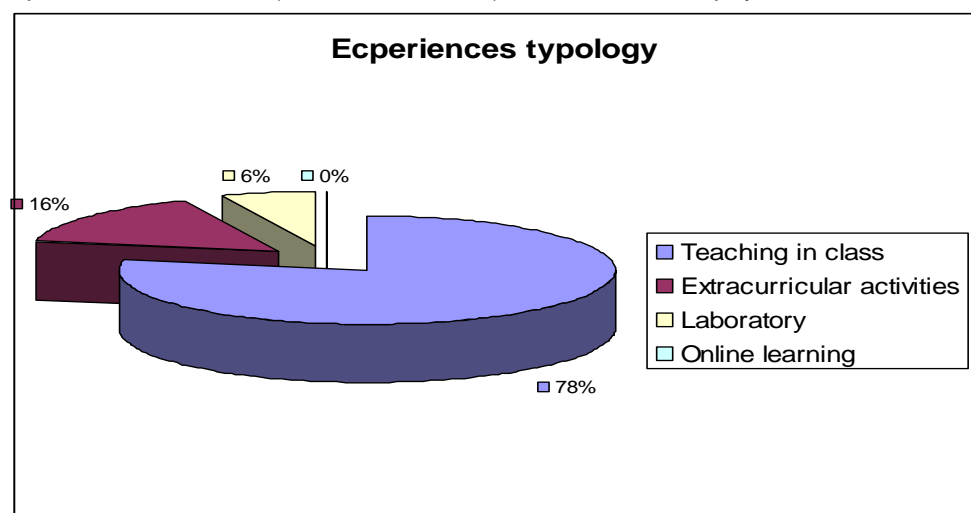
The analysis of the gathered teachers' and students' experiences allowed to define some main problems teachers and students face in the process of education in science in school.

As main trouble making factors Bulgarian science teachers pointed out the following:

lack of materials to illustrate problems for students;

lack of proper laboratories and laboratory equipment;

improper structure of the themes in the curriculum – in Bulgaria the process of development of school curricula is centralized and they are prepared by the Ministry of education and then given to schools to





follow. Teachers in science find the organization of themes in the curricula for the different science subjects and classes not very adequate, since often in lower grades they have to deal with themes, which in order to be explained to students require knowledge, which is supposed to be taught one or two years later in the process of education;

lack of attention from students in science subjects;

incomprehension of the processes and the texts.

In order to face and tackle the above mentioned problems teachers create various solutions, like:

producing visual materials - in order to overcome the lack of visual materials they often work with parents and students in order to produce illustrative materials like models, presentation boards, etc. themselves.

Though with these activities it is hard to cover all themes in the curriculum, they have proved to be very efficient in terms of comprehension. Students feel more actively involved in the process of education and are more interested to work on science topics; they allow themselves to be more creative and propose solutions for the visual materials in order the specific subject to be easier to understand for the other students;

work in groups – a lot of teachers use the team work and project-based learning in order to deal with the difficulties students have in the education process. They consider peer-learning and support in the group as effective method enough to help students understand science themes in a better way. The method allows science problems to be explained by peers in a language closer to the students model of comprehension;

practical work – teachers use practical work as a method to make students more actively involved in the process of education and learning. Practical work refers to a wide range of activities – making students create examples and experiments themselves; provide materials for the experiments; create models and structures for visualisation of specific themes.

presentations – presentations are a very easy tool to grab the attention of students. What Bulgarian teachers do is on the one hand to create presentations themselves, on the other to make students create presentation themselves, which to be shown in front of the whole class. There are also teachers who create presentations together with students and present together before the class – a lot of students shared that this is one of the most interesting method to capture their attention in science subjects;

work in nature – the method of working in nature is mainly used by biology teachers. This method is used for gathering samples of soils, flora and fauna specimens, etc.

using the links with the real life – this is a method, which has proven to be the most effective one in terms of improving students comprehension of science subjects. Teachers share that even when creating visual materials to illustrate certain topics they try to use materials from the everyday life, so for students to be easier to imagine the applicability of scientific knowledge.

Bulgarian teachers are satisfied of the activities carried out so far in the framework of Goerudio project. They contributed actively to the project activities. They especially appreciated the opportunity to cooperate with other colleagues creating either a national or a transnational network.

The activities carried out so far allowed the teachers to compare their own teaching strategy, to analyse the students' feedback on their teaching methods and to evaluate innovative solutions to improve their teaching approach.

The teachers took the chance of commenting the other colleagues' experiences in order to start to create a network at transnational level. According to their comments to the European colleagues' experiences, Bulgarian teachers have a very positive opinion about the work carried out by the project partnership. However there were also some concerns shared – that some experiences even being interesting are implacable in the Bulgarian courses; also concerns about the language and matter of description of experiences, which made it hard for Bulgarian teachers to understand the specific steps of implementing the experiments described. In conclusion, the participation in the Goerudio project made the Bulgarian teachers more open in considering using various tools and instruments in their practices. It also made them much more aware of their own practices – recognizing them as good examples they can share with their colleagues.



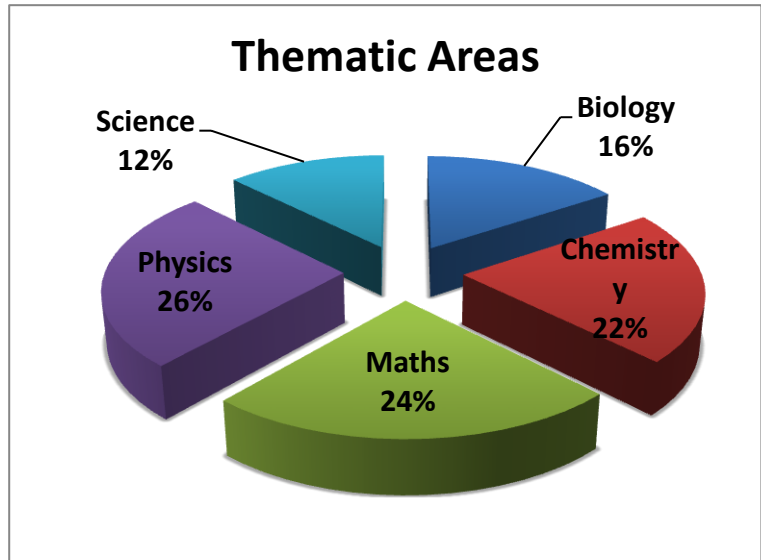


## Feedback of the Italian teachers (Pixel)

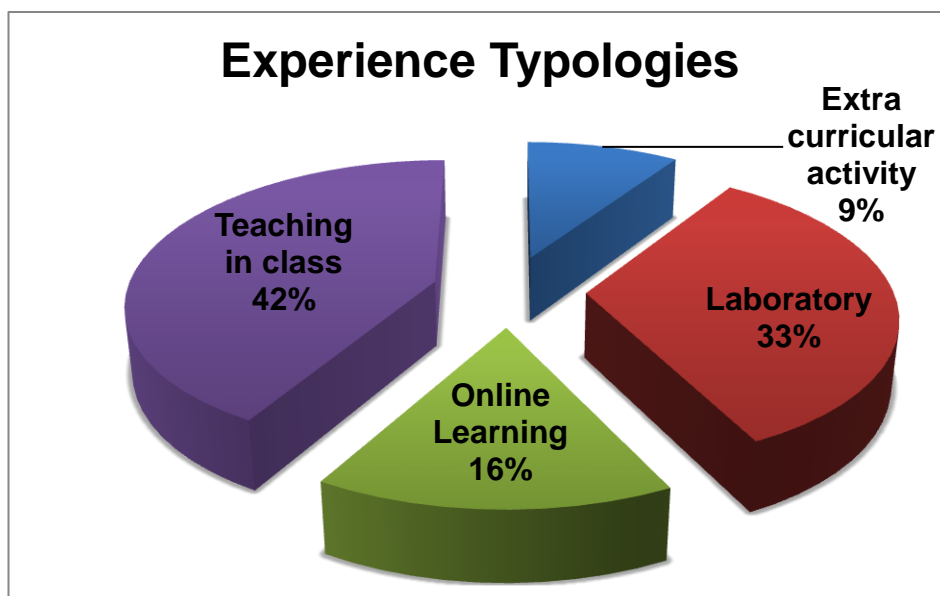
Italian teachers shared on the project portal 55 experiences related to science teaching. These latter cover all the scientific subjects mainly taught in Italian schools. Each thematic area is represented by a significant number of experiences is suitable for each thematic area.

The areas with the wider number of experiences are Physics and Mathematics. However, they should consider that in some Italian schools Biology and Chemistry are often taught under the name "Science". Therefore, these three subjects together represent the 50% of all experiences.

As far as the teaching methodology is concerned, Italian teachers' experiences suggest activities can be implemented mainly in class (42%) and in laboratory (33%). Online (16%) and extracurricular (9%) activities are not less interesting. The small number of extracurricular activities can be explained by the difficulty to implement them (mainly related to their additional costs).



It has also to be considered that many experiences require more than one type of teaching methodology. Especially the extracurricular and online experiences are often supported by in class or laboratorial lessons. This analysis considers them separately. The following graphs show a more detailed view on subject basis of the different typologies of the activities



uploaded by the Italian teachers.

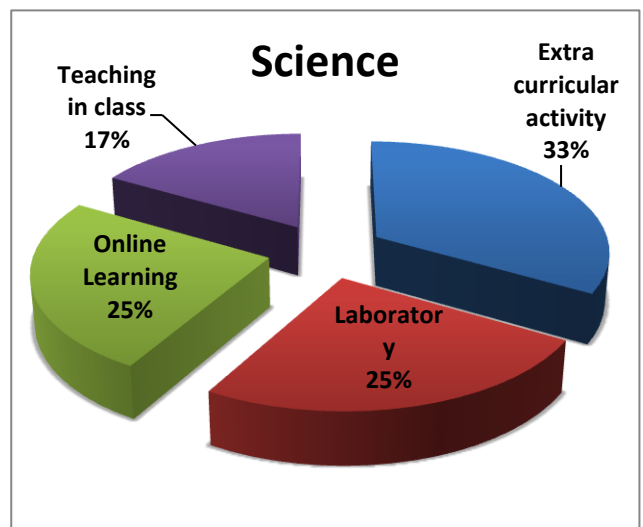
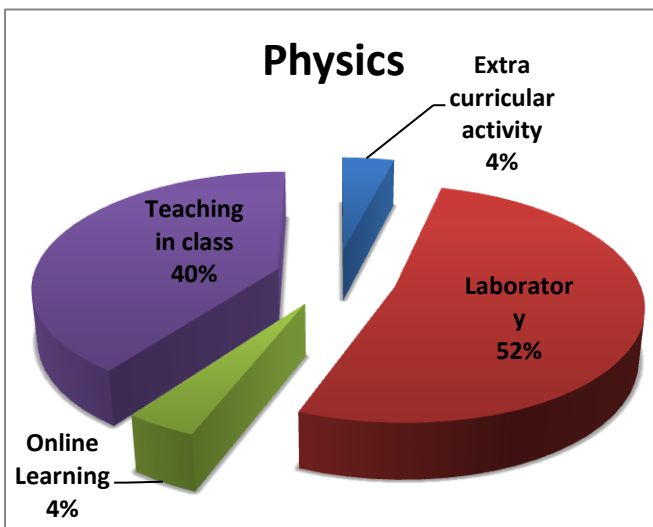
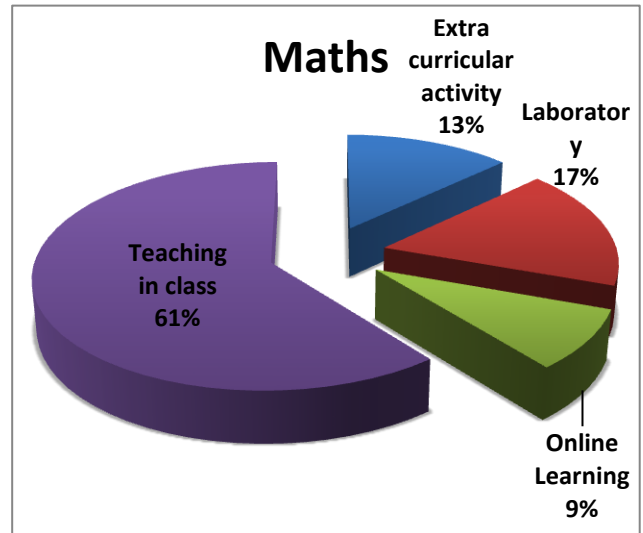
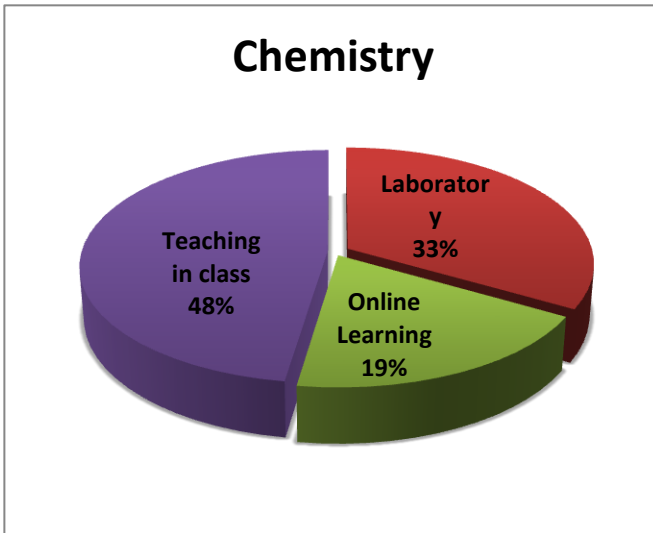
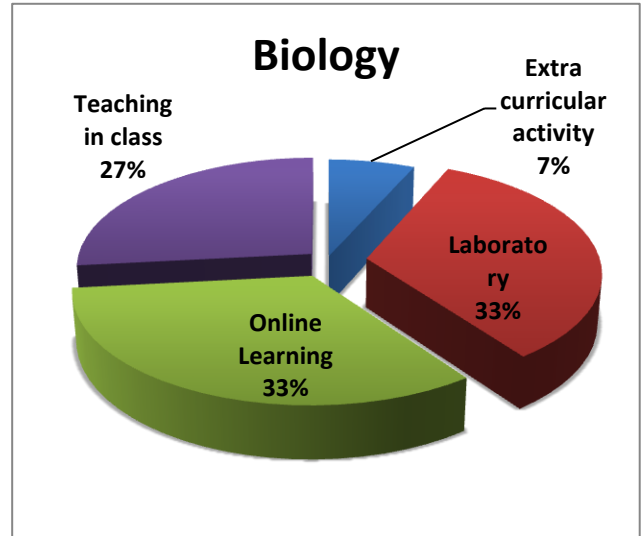
As shown by the graphs here next, the experiences on Biology cover all the teaching methods. They are almost equally distributed among Laboratory and Online learning (33% each) and Teaching in class (27%), but also the extracurricular activities are represented (7%). As far as Chemistry is concerned, it can be noticed the lack of extracurricular initiatives, but conversely there is a particular focus on the in class experiences (48%) maintaining a significant representativeness of the laboratory (33%) and a good presence of online learning activities (19%)



The graph on Maths shows a clear predominance of the teaching in class type of experiences (61%) and an almost equally repartition of the remaining percentage among laboratory (17%), extracurricular (13%) and online learning (9%) activities.

The “pie” of Physics is divided in two portions: laboratory (52%) and teaching in class (40%) activities. The online learning and extracurricular activities cover only the 4% of the experiences uploaded on the project portal.

The graph of Science shows the most balanced situation. Indeed, each teaching methodology is represented by a relevant percentage of initiatives, namely extracurricular (33%), laboratory and online teaching (25% each) and teaching in class (17%) activities.

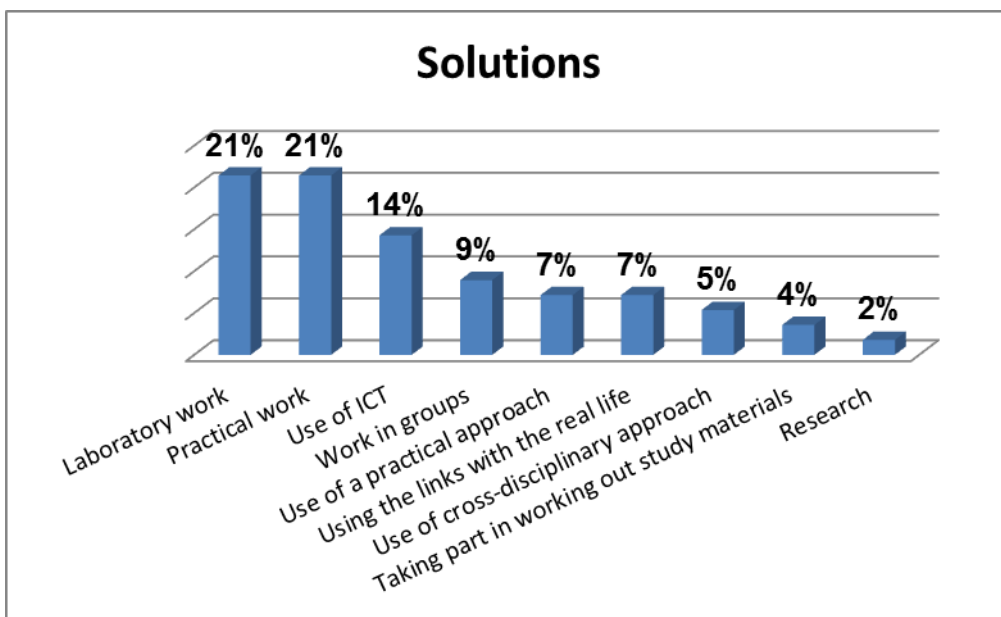
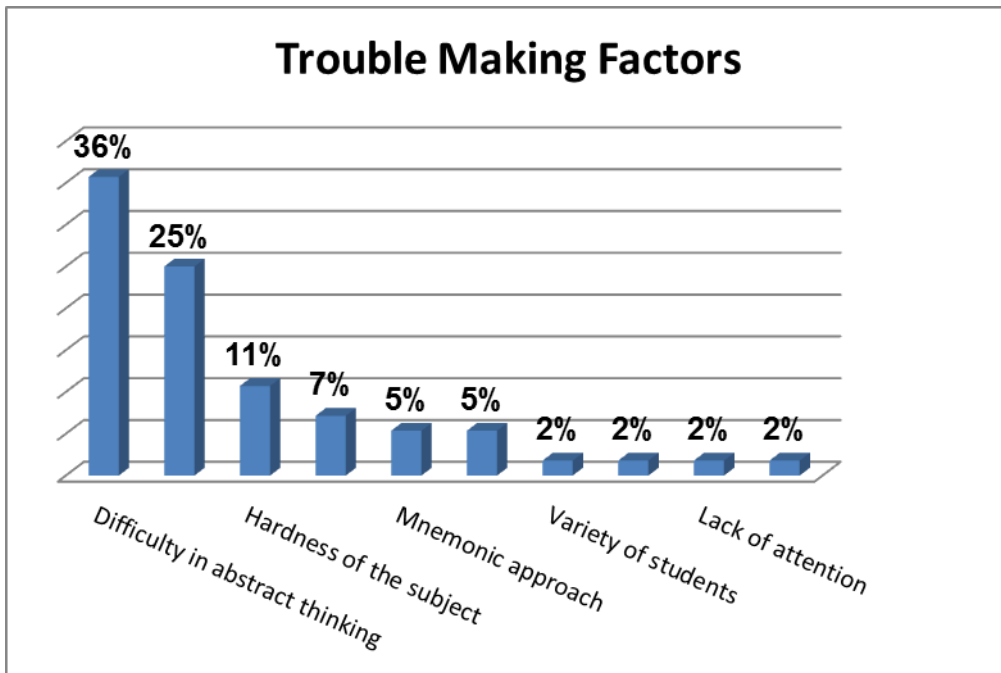






Italian teachers' experiences aim to tackle a broad list of factors that distance students from the scientific subjects. The teachers reveal that the students encounter problems mainly linked to the nature of the scientific subjects themselves like "difficulty in abstract thinking" (35%), "incomprehension of the process and the texts" (24%) and "hardness of the subject" (11%). On the other hand, the factors mostly linked to the students' behaviors or to their interest towards scientific subjects have a poor representativeness according the current survey. Indeed, "variety of students", "lack of interest", "lack of attention" and "inadequate diligence" have reached only a score of 2% each.

According to the "trouble making factors" encountered, the teachers' experiences suggest either laboratory or practical work (21% each) or, only for mentioning the principal items, the "use of ICT" (14%) and "work in groups" (9%).





Italian teachers are satisfied of the activities carried out so far in the framework of Goerudio project. They had a proactive role during the workshops, contributed actively to the project activities and provided with some critical comments that allowed to improve the implementation of the project activities.

They especially appreciated the opportunity to cooperate with other colleagues creating either a national or a transnational network.

The activities carried out so far allowed the teachers to compare their own teaching strategy, to analyse the students' feedback on their teaching methods and to evaluate innovative solutions to improve their teaching approach.

The teachers took the chance of commenting the other colleagues' experiences in order to start to create a network at transnational level. Moreover, answering to the comments received on their own experiences Italian teachers concretely contributed to improve the European networking.

According to their comments to the European colleagues' experiences, Italian teachers have an extremely positive opinion about the work carried out by the project partnership. Actually, they informally shared some doubts about the reliability of some experiences uploaded on the portal. But finally they found many experiences useful for their work. Indeed, the most used adjectives at the beginning of the Italian comments are "interesting", "amazing" and "exciting". It can be concluded that Italian teachers chose the experiences that they can replicate with their students.

In conclusion, the analysis of their colleagues' experiences has been a real step towards Italian teachers' personal and professional growth. They improved their knowledge about their European colleagues' approaches and practices for the teaching of their own subject. They took inspiration for new teaching solutions and they received constructive comments related to their teaching methodologies.

### **Feedback of the Latvian teachers (RSTS)**

The starting point of Anita Krišamane's speech was an overview of the main problems affecting the educational system in general and the learning of scientific subjects in particular. She pointed out the low level of students' motivation, their difficulty in abstract thinking and the hardness to understand the connection between real-life events and the theoretical notions.

These are the reasons why the Latvian team proposes the development of students' own models. Being created by the students themselves, these models can be easily used in other educational realities and for this reason they are considered as universal solutions conducting to longterm learning. Thus, the role of these models is to fill the gap between students' learning needs and the necessary scientific rigour.

The ICTs are commonly used by Latvian teachers. New technologies are useful tools that can help the teaching methods and can easier engage the students. But they are not the universal solution that the Latvian team is looking for. Indeed, videos, softwares and whatever other tools can be only proposed when specific conditions occur, but they can support the creation of the above mentioned universal models.

### **Feedback of the Polish teachers (36,6)**

The teachers' experience collected in Poland present very interesting ways of teaching scientific subjects, namely through: games that implied change of roles and perspective between teacher and students, organizing the classes in laboratories, factories or other facilities outside the classroom, applying computer programmes and applications to facilitate the education, organizing cross-sectoral lessons involving knowledge of several subjects, different kinds of competitions involving students. Thanks to cooperation with teachers and involvement of their students we collected experience from the following subjects: Maths, ICT, Technology, Sciences, Biology, Chemistry. The analysis of the teachers' experience show that main trouble making factors are incomprehension of the processes and the texts, lack of basic and consecutive knowledge, lack of attention. The main solutions proposed by Polish teachers to solve the problems are:





using the links with the real life, providing presentations, playing games and competitions involving students, involving students in practical work and work in groups.

Polish teachers expressed positive feedback on the project and portal. It is useful to have such a repository of experience related to different subjects. Some teachers already used the methods described by other teachers in the classes they conduct. Finding the connection between the science and real life is a good way to present complicated scientific issues and motivate students to learn.

From the analysis of the comments on the portal we can say that it is a good idea to let children create the tasks and use computer programmes during the lessons. They are keen to see other teachers' methods that engage students in the activities. Teachers express they try to organize trips and classes outside (DIY store, park, playground) to catch the attention of children and solve the problem of lack of motivation of students. The problem teachers describe is the lack of time and a lot of material to cover, and science requires comprehension and longer period of time spent on learning.

### Feedback of the Romanian teachers (EuroED)

The target group addressed was formed from 8 schools from 2 counties from Romania (schools level - Primary Schools, Lower Secondary School and Upper Secondary School) with 35 teachers (Math, Nature studies, English – CLIL, Physics, Chemistry, Biology, Informatics, Technical disciplines, Geography, Social Sciences – Logic, History and 1 school counselor) and around 363 students.

**As total results:** a number of 56 teachers' experiences and 116 students' experiences were uploaded on the project portal.

In what concerns the **experiences shared by the teachers**, most of them are about the Chemistry, Physics, Biology, Math classes. Teachers were willing to discuss about their experiences and efforts to adopt teaching methods to promote the interest of students towards scientific issues and to make their pupils autonomous in their learning process. All of them agreed that the scientific disciplines are a weak point for the students.

To be able to respond to the needs of the students and to attract them to get involved in the scientific disciplines, most of the teachers make use of different methods.

The communication is also essential in the learning process when it comes to teaching science.

Teachers are using also different methods like technologies, games, objects, former students to be presented as examples of good practices, to raise the students' interest in science.

In what concerns the **experiences shared by the students** these are from the field of Chemistry, Biology, ICT, Math, Physics, Economics, Technical disciplines, Nature science, etc. As general remarks, students appreciate the methods used by the teachers in transferring the information; some of them are learning to practice in the future in the field; science is most of the time interesting because is about them, or about the things happened around them; most of them appreciate the experiments they do in the laboratory, but they consider that is a pity that they do not have enough time to practice more, unfortunately they have a lot of concepts and formulas to understand and work with, and most of the classes are based on theory and problems solving; some of the students are not into science, they find it too abstract and hard to be understood, but in the same time they agree that this is because they are not interested in the subject and that they will not use the scientific competences in the future.

- *Teachers' feedback on the project (collected during the workshops)*

*"It is an innovative project. Its innovative quality lies in that it groups teachers and students all over Europe to highlight traditional successful techniques used in teaching science as well as state-of-the art methods promoted by European projects related to science."*







*“The project meets a need. Science has become so deeply rooted in our life that we can’t think or live without it. It touches everything. Its effects on the various aspects of human life are numerous and profound.. It goes without saying that we should do something about the way science is being taught in schools. The Goerudio project is a sensible suggestion.”*

*“What I particularly appreciate about the Goerudio project is its attempt at creating a learning community: teachers and students from Europe join their efforts to make science accessible, easy and pleasant to study.”*

*“The project definitely puts forward doable suggestions because it starts from a need: it tries to bridge the existing gap between the recent advance of science and technology, which deeply impacts our life in all its aspects and the way science is still being taught in school.”*

*“Starting from the exiting school environment, the project involves the main actors (teachers an students) in the process of improving the way science is taught in schools. Teachers and students are asked to highlight the obstacles and difficulties they encounter, share experiences that worked very well and then within the new community created to explore and analyze each other’s experiences as well as new European projects on teaching science. The ambitious idea is to collect and pool the best workable solutions to teaching science.”*

*“What I also appreciate about this project is that we can interact with teachers from all over Europe. I noticed that we share our difficulties as well as our achievements. Why not join our efforts? Teaching science is a common cause, whose solutions need time and common effort.”*

*“A very interesting project... inspiring and resourceful! An excellent idea to involve teachers and students in finding solutions to difficulties in teaching science.”*

- *Teachers’ opinion on their colleagues’ experiences (through analysis of the comments posted on the portal)*

Most of the posts **favoured experiments as the best solution**. Experiments have always been appreciated for their action-oriented demonstration and students’ initiation in scientific techniques. They not only impart information but also train in the basic scientific processes. Students are asked to make predictions, observe, and reflect on their observations. Experiments can be used to introduce or clarify ideas.

*“Students have difficulty in understanding how a chemical reaction takes place and how a change in the combination of atoms forms different molecules. I did an experiment which highlighted a redox reaction that ends with a sublimation of the iodine, resulting in a purple cloud. I like this experience because it is easy to perform, and has a quick evolution. This is what the majority of students need, because their attention doesn’t last very long. In addition, it is colorful, which means extra attention on behalf of the students and possibly increased motivation because they try to understand what happens and why it happens. Some students are not very motivated because they can’t follow things that last too long.”*

*“Sensory experiences are fun and raise students’ awareness about their senses. They are easy to do and frustration free. All pupils understand the message of the lesson as it is rooted in the concrete reality”.*

*“I have always tried to start from enjoyable simple things: experiments which open doors to students. Experiments also build up relationships between teachers and students”. “Students enjoy this form of teaching while having fun. They like doing experiments and finding the connections to theory by themselves. They can better remember and imagine different types of mixtures and later apply them to other examples.”*

*“Doing experiments ensures the success of a lesson. It stirs interest, engages students and makes everything memorable.” “A simple experiment is one of the best ways to motivate your students and raise their curiosity. Make each demonstration look like a mystery: it is the magic of chemistry. Later in the course, when you are teaching the topic illustrated by the demo, remind them of the demo. Students will remember and make the connection between the lesson and the demo, enhancing their understanding of the topic.”*





*“As I have already said experiments appeal to students because they are accessible and intriguing and because students are involved in carrying them out. They are not passive; they feel responsible for what they are doing. They know that if they follow the instructions correctly, they will witness something interesting happen. Experiments are fun, raise a lot of questions, help students find answers and make science accessible”.*

**A large group of teachers commented on the use of modern technology, which, in their opinion, definitely makes classes more challenging and stimulates students’ motivation to learn.**

*“The use of these programs catches the interest of the students, because they can build molecules, foreseeing and then confirming molecular geometry, and, above all, they can play with their colleagues, competing in finding the right geometry.”*

*” It goes without saying that taking advantage of the benefits of the new technology makes a class more interesting. PPT presentations are more colourful and sometimes an image speaks volumes. I also use PPT presentations in my classes and I often ask students to contribute to them as well or even have their own PPT presentations.”*

The use of ICT is highly appreciated because it enables students to visualize, explore, imagine or even virtually implement the theoretical aspects. Most posts stated that the use of ICT makes classes interactive and pleasant. Students are given feedback on the spot and can interact with peers and teachers from other countries as well.

**Work group** was the topic of lots of posts. The main reason was that it helps students develop skills that are increasingly important in the professional world: plan and manage time, give and receive feedback, develop communication skills, delegate roles and responsibilities, share diverse perspectives, assume responsibility, find their voice in relation to their peers. **Positive group experiences** contribute to student learning, retention and overall college success.

*“In the process of learning, teamwork is essential and in certain contexts, better results than other methods such as individual work are obtained. Group work can optimize resources, improve student motivation, can be a time saver and helps students share knowledge and experiences.”*

*”As regards the exchange of information between different groups, this is desirable and necessary because the same experiment carried out by two different groups allows the analysis of the results from different points of view.”*

*“Working in groups is fun for most students when trying to solve problems, do experiments, and work on projects with other students. Social interaction can get them excited about things in the classroom and students can motivate one another to reach a goal. Teachers need to ensure that groups are balanced and fair, however, so that some students aren’t doing more work than others”.*

Teaching through **games was also perceived** as a solution to stimulate students to learn.

*“The use of games in the learning process is always a motivating experience. In fact, in the learning process in early childhood education is done through the use of play as an educational resource. Games attract and hold students’ attention, increase interest in the subject and reinforce concepts in a funny way.” “During the game students not only practise certain formulas but they learn a lot of things about group collaboration and decision making.”*

**Creative solutions** to raise students’ interest were also among the teachers’ posts. The most creative example is the way one of the teachers explained Markovnikov’s rule to his students: *“The molecule of propene is presented by 9 students where every student plays the role of one of the atoms. In organic compounds the carbon is always 4-valent so the 4 legs of the students are the free four possible links. The*





children who will play the role of the hydrogen atom will use just one of their arms and put the other one behind their back.”

**Field trips** were the topic of some of teachers' posts because they provide students with opportunities to consolidate the knowledge acquired during the science classes. Students are not only cognitively but also emotionally involved and challenged. Field trips connect school with the world of work and show students how theory is applied in real life.

Students are not only cognitively but also emotionally involved and challenged. Field trips connect school with the world of work and show students how theory is applied in real life.

*“The visit to the Botanical gardens raised students' interest in the subject. After the visit they showed a desire to deepen their knowledge of exotic plants by reading guides and watching nature films. They also suggested that I could prepare contest on exotic plants for them.”*

2 % of teachers agreed that another solution lies in telling **the stories** which are hidden behind all **inventions**: *“I know when it comes to stories -students would listen for hours. This is also a good introduction to more abstract concepts; it creates atmosphere and definitely stirs students' interest in the topic. There are also life lessons to extract and debate...”*

## Feedback of the Slovak teachers (Transfer Slovensko)

Report of the main aspects of Slovak team's contribution during the virtual meeting:

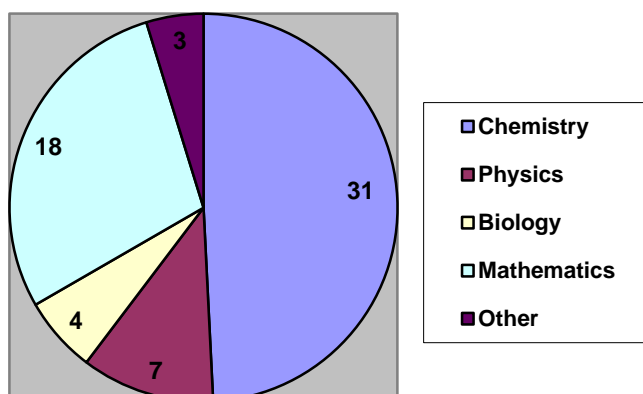
1. Main results described in the methodological report concerning the teachers experiences uploaded on the portal
2. Teachers' feedback on the project (collected during the workshops)
3. Teachers' opinion on their colleagues' experiences (through analysis of the comments posted on the portal)

### 1. Introduction

Transfer Slovenko strategy for collection of the teachers and students experiences related to teaching and learning scientific subjects was to take direct contacts to schools and teachers. For this aim they used from the beginning their participation on the national project “Restructuralisation of the vocational secondary education in Slovakia” especially contacts to Association of the car industry in Slovakia. From the 5 vocational secondary car schools they involved in the project 3 schools and the next 2 schools are one is vocational secondary school for gastronomy and turism and the last one is secondary school for electrical engineering in Bratislava.- this school is level ISCED 3 with a level final examination.

#### Collection of teachers' and students' experiences

Until 30.6.2014 they collect 63 teachers experiences and 102 students experiences and elections from teaching in science topics.





They are not do corrections in teachers experiences. During the writing of the teaching experiences teachers have questions and verify your understanding of this tasks. Support and coaching gave teachers Vlasta Dubravova and expert Jozef Strakoš. For some of the teachers was this support very helpful. The areas with the wider number of experiences are Chemistry and Mathematics, because 5 Slovak teachers are chemistry and mathematics teachers. Chemistry experiences represent 49% from all Slovak experiences and mathematics 28%. Other topics are Physics with 7 experiences, Biology with 4 experiences and Geography with 3 experiences.

First analysis of the teachers experiences bring very interesting findings, which they will use for the next support for teachers, for your needs and for the filling the project aims. They found out that the same school level (3 ISCED) and the the same curriculum allow compare experiences from the same topics and allow compare teaching methodology which teachers use by science education.. Differences between schools in material equipment and facilities are projected in teachers experiences and teaching process. Teachers use ITC programmes but only for support to your explanation. They don't teach by active experimental process. This it can be seen on used teaching methodology.

The teaching methodology is concerned on teaching in class 99%, our teachers in Slovakia prefer this traditional approach - they have in Slovakia only 1 laboratory work – Biology and 1 Online learning in Geography. The small number of extracurricular activities can be explained by the difficulty to implement them (mainly related to their additional costs). It has also to be considered that many experiences require more than one type of teaching methodology. Especially the extracurricular and online experiences are often supported by in class or laboratorial lessons. This analysis considers them separately. What is interesting is that in Chemistry they have only teaching in class and laboratory work, this reason is that chemistry teacher have not opportunity to use laboratory in your chemistry teaching and experiences topics are not focusing on this teaching methodology.

## Teachers

### Trouble Making Factor:

- Deficient knowledge from the previous studies
- Different background level of the students from elementary school
- Deficient (or no) skills development, e.g. chart or calculator tasks, construction tasks, or drafting with the scribing tool
- Curriculum topics change too fast – these content and additional demands do not allow any flow between the certain science subjects at the vocational schools
- Students very often do not realize such a big effort has always been needed to extend the world's knowledge, as well as their own new knowledge. There is missing information about the people who stand behind this knowledge in the textbooks.
- Students do not realize connection between the studies and real life situations in vocational schools.
- Students take world for granted – the teaching process should force them to reflect the complexity of the world, in which they live, but they do not have any interest to understand the basic mechanisms of the world and take responsibility for its functioning. The science subjects could be the main tool for demythologising this world, and moreover, it should be the subject, which evokes amazement and humility.
- High number of students in one classroom (31) in vocational school. Theory background increase at the expense of the practice. (Math – 1 lesson a 1 hour a week)
- Working with the internet – not all of the students have computer at home, therefore they are very often unable to bring their homework, while there is no access to the electronic textbooks.
- The real life experience – students consider this type of learning a relax and not a task.

### Solution:

- The curriculum problem – it is necessary to change the obligatory content - 70% in the state educational programme and the content important for vocational school - 30%







- Creating the own web site – suggestions, explanation, task solution preview – e. g. [www.kolbi.wbl.sk](http://www.kolbi.wbl.sk)
- Complementary lessons or additional space for tutorial and feedback, which would consequently create an open atmosphere in communication during the learning process.
- While introducing the new topic (f. e. in math), it is important to focus on how influential could it be for vocational subjects (f. e. using variables in connection to the gastronomy)
- The word problems (e. g. in math) should be built upon the students' specialization area. For instance, oriented on real life situations of the mechanist/japanner/electrician professions. Also the picture would work as an interactive sample and increases motivation.
- It is important to apply the method, which comes from pedagogical constructivism – EUR – evocation, understanding, reflection. Students should be actively involved during the whole learning process. This method allows teachers and students to reflect themselves immediately and work on their weak points.
- PC programmes – f. e. Geogebra, which allows teacher to give assignment to the groups of students (not the whole class) and then to present and compare their solutions or methods. This programme provides graphical worksheets for each student.
- Projects – increases acquiring knowledge complexity and use of curriculum in practice (e. g. statistics – students have conducted a survey on attitudes to smoking in school, but more than the result, the process of each task was more important).
- The problematic tasks give students answer on the question “What is the whole curriculum good for”. The real life connection, such as monitoring bank interests, is one of the task given for the annual period, in which also the less proficient students take part, and have opportunity to learn from the more experienced students. The first task is usually solved with the help of the teacher and then the students work in groups or individually.
- Simulation instead of laboratory, and detailed monitor of the changes, which are not receivable by the eye, also forces students to be actively involved. The interactive blackboard is necessary. For example: <http://phet.colorado.edu/en/simulation/ph-scale>
- Work with models – creating and using models: Version 1: creating an objects from paper, string (Best Object Competition) – learning utility. Version 2: model created from set of blocks. Version 3: programme Geogebra – dice cuts and other
- Skype in geography lessons – connection with the foreigners – revising the curriculum purpose, or for developing language skills
- Presentation as a school web material able to download also proves to be an effective tool for explanation new curriculum. There is an option that the teacher prints out the presentation and adds an example on how to solve an assignment for homework.
- Work with internet in order to gain information about the topic. Creating presentations allows individualization the learning process, it creates a space to express the opinion and cultivate communication. (one of the goals of the future employers in tourism)
- Real life experience as a type of learning technique (theme: ecosystem – biology – searching and harvesting plants – creating herbarium). Such learning could be used for gaining additional information and increasing motivation (about the plants).
- Work in groups – Giving tasks to each group. Students are working on their presentation and have to discuss the topic from different perspectives.
- Explaining the topic in the context of the cultural development of the human and his needs. The aim is to catch interest by introducing a story, which students may edit or ask questions, and to show how interesting science could be, what were the people like who invented new things, and an effort to explore new things through the language close to their mental age.
- Overlays on the history of science, history of human cogitation, examples on how new explorations changed the world, and who stands behind these scientific discoveries. Abuse of science as such and the role of scientists, their responsibility and our responsibility as a users of these conveniences.







## 2. Feedback from Teachers

1. Participation in project inspired teachers to use new methods in teaching. Other colleagues' experiences helped me to understand that other teachers are also having difficulties with their students' shortcomings in basic knowledge of secondary vocational schools.

- The teachers involved in the project are interested in learning new things and so far the project has provided them with the opportunities to learn something about them, when they described their experiences of teaching. First, they found it difficult, they were afraid that it will reveal their weaknesses. They didn't believe what coordinators claimed that similar problems are also described in the experiences of other teachers.

- Only in the second task they found that they can learn from other teachers in the project who teach similar courses in other European countries.

- They found that teachers are not lacking enthusiasm, but also that they can identify the problems. Ideas to improve my work were enough. Some can be used without any problems, while others can be adapted and applied also to classes in vocational schools, where students have a lower level of basic knowledge.

- Forms for planning tasks, mostly with the task WP3.A, as send by national coordinators and responses led to write the structured comments and catch the experiences in a suitable way.

### 2. Web space reflection

The website Goerudio is very good for teachers to work with it. For each task they will receive the instructions explaining how to get the material in their language, and then they only fight with the translators and dictionaries.

- Translators are not very good; sometimes they use the Google one. I have to think very carefully to understand the text.

- Even if my text is translated I cannot completely understand it. Not knowing and understanding the terminology in English causes that they are not able to understand the text properly.

- I consider the inability to communicate in English as the biggest obstacle for me to utilize all my skills in the project and to fully understand the text.

- Language barriers are for some teachers (in addition to their negative attitude to Facebook) the biggest reason why they do not engage in communication or why they do not occur on Facebook page.

### 3. Me as a member of working group

One third of the teachers in the project are involved in an international project for the first time, they have not been working on such a project before, and thus they are not able to evaluate or compare it in relation to other projects.

- I am satisfied with the coordination of the project. Tasks are given in time and with quite detailed explanation describing how they should be realized. Some teachers appreciated the support that was provided for the realization of the tasks by national coordinators.

- For some teachers involvement of experts enhance the credibility of the project.

- Nowadays teachers' work is really difficult, poorly appreciated, but teachers are able to do their work really good when they are still learning and trying to improve.

## 3. Analysis of comments to task WP3.A – to description of the teachers' experiences

### Number of comments: 30

Reactions towards **countries** where comments were made: IT: 6 BG: 4 ES: 2 RO: 3 PL: 7 LV: 1 SK: 7

**Subjects**, on which comments were made: MT: 15 FY: 4 CHE: 6 BIO:3 GEO: 0 IKT: 2





### Why is this experience important – significant?

- It is the source of inspiration
- It captures/describes similar experience with teaching at secondary vocational school (combination of practice and teaching – not effective for school, they are losing effectiveness)
- It points to the importance to draw the students into teaching process through activities, in which they experience success
- It shows how by appropriate choice of method they can get students' interest, even when it comes to abstract problems – how to use illustration when explaining and how to engage students in creating projects
- It gives an example of using didactic games that are increasing the participation of all students. They also give opportunity to success to students who think that they do not like the subject
- It shows how to create an atmosphere where math lesson can be fun and where they can succeed right from the beginning of the year
- Teachers give arguments for the use of new technologies in teaching process
- Teachers should also adapt the teaching methods according to trends and use it in a suitable way on science subjects.

### Does this experience explain the causes of low students' motivation to learn science subjects?

- Students do not always react to the new method with enthusiasm
- They do not meet teaching for life very often
- Experiences of students who are not interested in theoretical subjects are usually limited on solving the problems such as what kind of mobile phone they want to buy, they don't have enough practical experiences from life, from family, which would motivate them
- If the observation and own activity is lacking
- If students only have the opportunity to solve the tasks of the same degree of difficulty – there are students who will never get success and their attitude towards subject is getting worse
- Limited number of lessons, teachers are preferring frontal teaching and not using group work
- Experimenting is not used very often, because there are problems with equipment and materials in laboratories; or teachers are only showing experiments through media and students are learning through observation not by their own involvement
- Teachers are still preferring teaching stereotypes, teaching without using technologies and students are losing their interest in subject, although schools have classes equipped properly – with PCs and programmes, which enables teachers to engage students to activities

### Does this experience offer suitable solution for this low motivation?

- It shows how experimenting with subjects is connecting the theory and the practice, it helps with realization for the importance of theoretical knowledge
- To engage students in gathering the knowledge by giving the projects – experience with the topic is complex, because they can use internet, technologies when presenting
- Connecting teaching of theoretical subjects with reality, what is surrounding the students
- Activation of students by using mathematical objects and creating something from it on lesson of Physics, for example: town parts, they make plans for shopping centres, etc.
- For improvement of the financial mathematics teacher is focusing students' attention on shopping, creating the menus, where they can practice basic operations – addition, division, multiplication,...etc., it is the same on the math lesson, where teacher gave her students task from statistics to record the information about cars passing the school for one hour
- Interesting method which includes teachers' activity as well as students involvement: I will show you - you observe- you see- you think about it –create your own vision – you build.
- Using electronic books, interactive boards and through that increase the students' imagination on Geometry or Physics – Geogebra- they improve their results





- Didactic games are making chemistry lesson more interesting – crosswords, chemical bingo, memory games etc. Students have also created their own game, ChemistryPoly (something like Monopoly) but for practising chemistry.
- Peer learning, learning in groups, where students are able to divide the task and do the experiments, they are trying to find the solution together.
- Interesting teachers' experience - to involve more senses to learning process

#### Do you have similar experience?

- Teachers not only have the similar experience, they also specify why is their work different, in what they do differ
- They agree in what importance should teachers give to the teaching through the experience/experiment, laboratory work
- Experience of designing the bodies, enriched by material through which students can constitute the bodies – wooden sticks, gummy bears – through constructing they create the vision which they can later use for a work

Didactic games enrich chemistry lessons; teacher uses mostly those through which he/she can practice names, formulas, properties of substances, safety rules in laboratory etc

#### Feedback of the Spanish teachers (Alqueria)

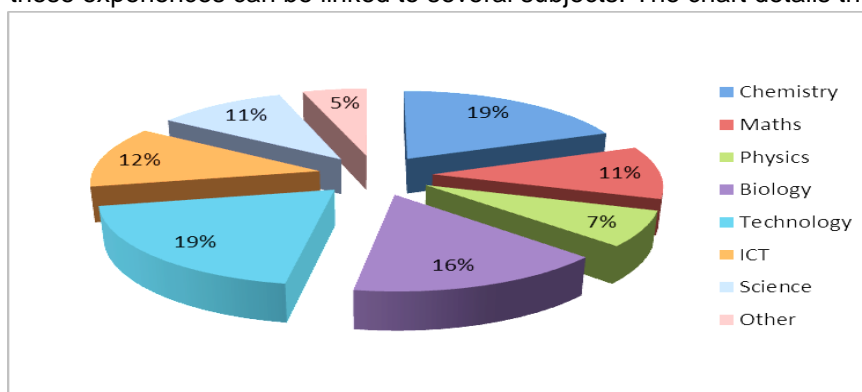
Teacher experiences have been related to subjects like computer science, biology, technology and chemistry. Some other experiences have dealt with math and physics to a less degree. The reason behind this focusing comes from the fact that teachers from this subjects have had a greater involvement in the project.

Going into detail for each subject, it may be seen like teachers from technology have used automation systems and small robots as a motivation elements. In computer science, internet technology gets most of the focus of methodology, matter contents, but game development is adopted where possible as tool and final product of students work in order to get them motivated. Chemistry, Biology and physics are increasingly using lab experiments as learning activities. In Maths, students are invited to use Mnemonics to help solve problems.

However, overall, all subjects and teachers are benefiting from new technologies in their classes. Using multimedia, slide projectors, digital boards, tablets are changing the way that classes are done. These are becoming more and more interactive. These technologies started being used in computer science classes, but have spread to every other subjects.

Finally, collaboration and working in group towards common goals is seen as another key element in methodology and motivation, which leads to knowledge sharing among students

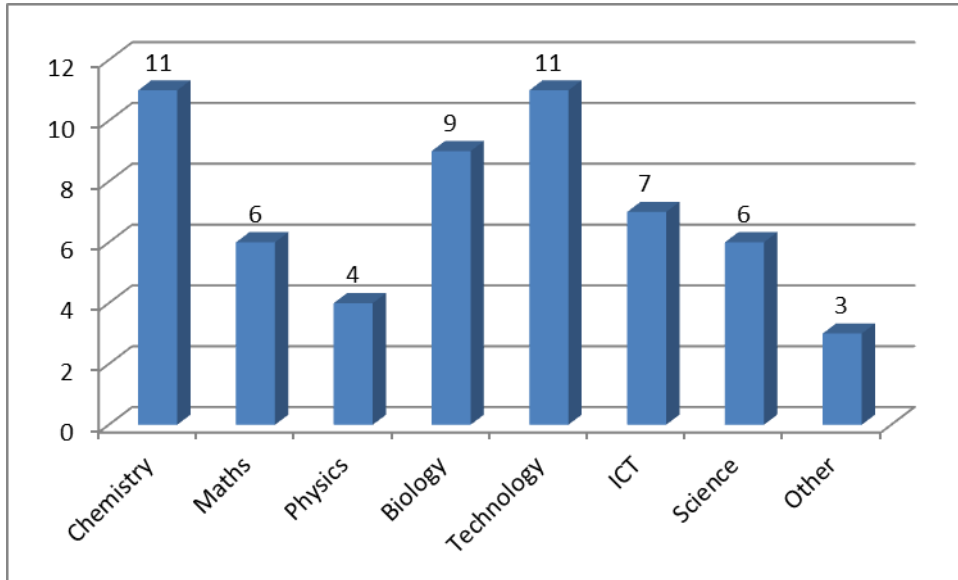
A deeper analysis of the 50 experiences carried out by Spanish teachers let see the distribution amongst matters. Some of these experiences can be linked to several subjects. The chart details the figures.



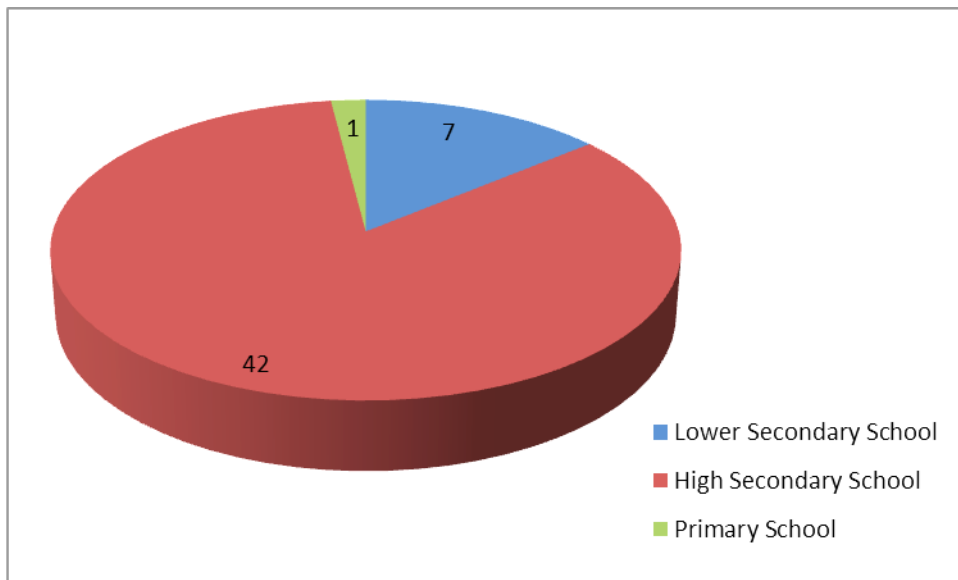


As they have pointed, many experiences use ICT, but they only have classified them those specific to this area.

The numerical distribution is shown in the following chart:

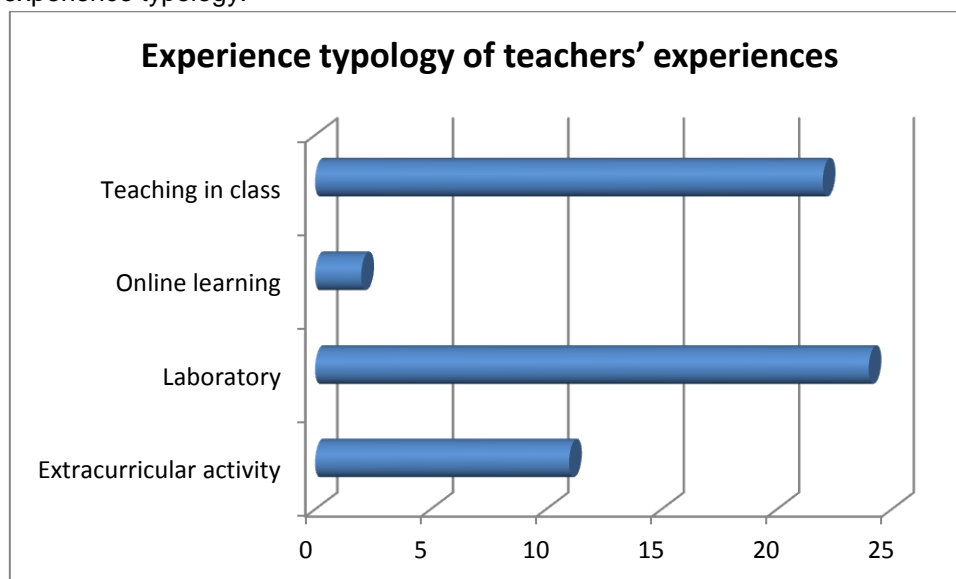


Most of the experiences (above 80 per cent) has been done in Secondary Schools. The main reason is that most of the teachers are High School teachers.





In relation to experience typology:



Summarizing the teacher comments, it may be realized that many of them don't use some of the methodologies or techniques just because we are unaware they exist, therefore this project allows professionals to meet and know other teacher's experiences and methods. Which many of them won't be applied because of different circumstances, students groups, learning environment or equipment. Some experiences seen are really interesting due to the simple and direct implementation process, requiring no special preparation. Some others pose greater difficult as they require more complex preparation.

The analysis of the experiences of Spanish teachers have been positively commented by other teachers, both by national and international participants. Teaching methods and strategies are similar to participants from other nations: using ICT as tools for motivation, exploit group work and collaborative methodologies to empower learning capabilities from students. All these are common examples in teachers nowadays.

### Conclusion of the Virtual Meeting (RSTS)

Romans Vitkovskis from Riga State Technical School drew the conclusions of the virtual meeting.

He found many points in common with the partners' presentations. He noticed that the problems each country face to are the same in spite of the different national contexts. Consequently the methods used to solve them are similar.

After the analysis of the material collected in the framework of Goerudio project, the task of the partnership is to identify the core factors that can bridge different initiatives in order to find universal solutions. So, the method of these universal solutions will be very similar to a Christmas tree wherein the trunk and the branches need to support the methodology and to connect it to the different items and teaching situations. The latter are all the decoration of our Christmas tree. The final result of such a methodolog does not eliminate the existing practices (collected on the portal), but it combines old and new solutions in order to provide the world of science education with innovative opportunities.

Since many partners complain about too little time allocated for teaching scientific subjects at school, it is necessary to maximise the hours at disposal. Each trouble of the learning process means further time to recover the situation. The risk is to enter in a vicious circle of waste of time. In this context to find out a flexible model that can be used in several situation is crucial. The Goerudio project's main aim is actually to provide teachers with such a valuable solution.

