THE FUTURE OF SCIENCE LEARNING INNOVATION

Policy paper

Working With Europe

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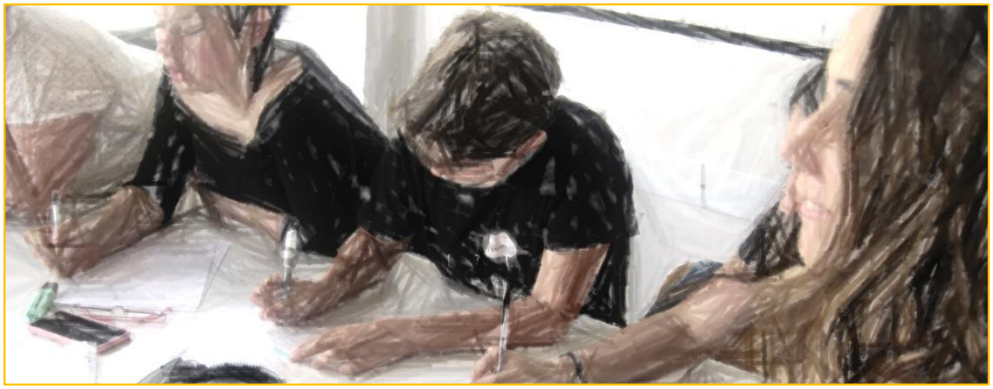
CONTENT



This paper is based on 2 years of practical experimentation with the participation of four secondary schools, teachers and students, three knowledge partners and one quality assurance partner from different European countries.

The goal of this paper is to identify the key challenges to science learning innovation, based on positive and negative experience from the project, to identify the most important challenges to make open science schooling and the critical science missions MODEL a reality, and recommend strong focuses and priorities in the 2021-27 Erasmus+ programme directly addressing those challenges.

The lessons learned are based on dialogues with the students and teachers along the project.
Key messages, unedited and authentic, from the participants are inserted.

The language of the document is non-academic and the text is constituted by short and precise statements, referring to practical experience from similar projects. The aim is to make the report content accessible and attractive to very large audiences.

In other words, the text wishes to contribute to an understanding of what further steps should be taken in the core field addressed.
Thus, the text might inspire new European initiatives based on and going further than the project.

Rich examples of the project experience can be found in the project website.

The YOUNG STUDENTS AS CRITICAL SCIENCE DETECTIVES *project 2019-21 is funded by the European Commission Erasmus+ program*

INTRODUCING THE PROJECT

Students who are best prepared for the future are change agents. They can have a positive impact on their surroundings, influence the future, understand others' intentions, actions and feelings, and anticipate the short and long-term consequences of what they do.
OECD Learning Framework 2030, OECD 2018

The idea to create the *Young students as critical science detectives* emerged from a number of Erasmus+ experimentations with open schooling and open science schooling.
The lessons learned from this rich experimentation revealed that it is difficult for secondary schools in Europe to implement and experiment with the full concept and methodology of what we understand as "open science schooling".
The challenge for many schools and science teachers are: when trying to implement the full open science schooling methodology, they experienced – not surprisingly – that the traditional school and science curricula made it almost impossible.
Students and teachers were not provided with the necessary time and space for such experimentation.

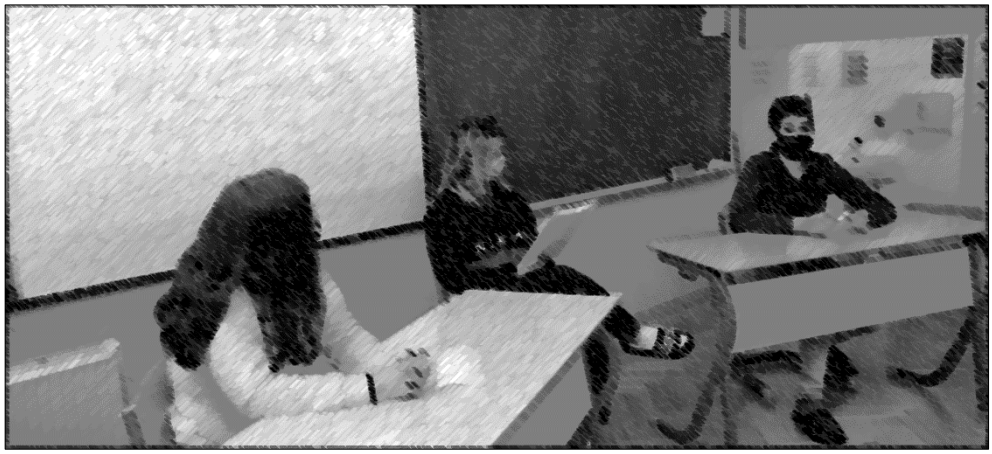
As a result of renewed studies of the most important Commission science education innovation guidelines and recent critical science learning research, we recognized that one of the major components in science learning innovation was: to be attractive to 21st century students, science and science learning should recover and rediscover the links to NARRATIVE and make efforts to communicate the learning in narrative forms.

These links to narrative forms includes for example: adventure, science fiction, exploration, detective work, curiosity – and the ability to take action in such narrative worlds: NARRATIVE AND EPIC AGENCY.

The result was the *Young students as critical science detectives* concept, at the same time able to integrate important Commission science learning policies, such as "science with and for society" and "responsible science", but also to integrate sharing the science engagement with the students' families and with other citizens.

The ultimate mission of the project was therefore to create a model of *Young students as critical science detectives* that is attractive to schools and science teachers from across Europe and appears realistic to engage in.
The model has to be co-created by the young students themselves, as this is the credo for all true educational innovation in the 21st century.

The project innovation is therefore linked to the European re-thinking science education agenda, dedicated to find brand new ways to make science and science learning attractive to young students, precisely along the years in which they strongly build their identity, personality and professional intents.



PART 1- THE FRAME

Recent research, the European Commission, as well as considerable practical experience clearly conclude that the new generations of young students are fundamentally different from earlier generations.
They learn, think, live and work in *fundamentally* different ways and the traditional education system and paradigms do not work well for these students.
After several Erasmus+ experimentations and lessons learned we can say that there are a number of key conditions for young people of today and tomorrow to engage in serious (science) learning.

These conditions are:
- the learning must be relevant to the young students' life
- be carried out in narrative forms known to and appreciated by the students
- the learning must include considerable virtual activity and interaction
- the learning must allow the students to develop critical attitudes towards science and science in society (responsible science)
-the learning must allow the students to work independently, to accomplish something real and to make their voices heard

All these conditions, refer to the meaning of 21st century students.

The European science learning innovation agenda

Promote partnerships between teachers, students, researchers, innovators, professionals in enterprise and other stakeholders in science-related fields, in order to work on real-life challenges and innovations, including associated ethical and social and economic issues.
Commission 2015, Science Education for Responsible Citizenship

STRONG CALL FOR INNOVATION
The commission, leading research communities and policy-makers are increasingly and jointly calling for dramatic innovation in all forms of science learning and at all educational levels.

Young Students as Critical Science Detectives forms part of this agenda and set out to contribute to the development of innovation and science learning and science experience.

The two years' project experience produced lessons learned about all the obstacles such project mission met, from European funding to the work conditions of the individual teacher.

The science learning innovation takes place in a strange landscape with many extremes: on one hand it seems that science teaching is conservative, restrictive and traditional of all school subjects; on the other hand, the surrounding community and world offer thousands of dynamic and exciting science cases and missions.
The problem is the giant gap between these two extremes in the science education scenario.

When discussing innovation in science education, this innovation clearly goes in the direction of open schooling.
There are, obviously, different ways of innovating science education (and education in general), but there are very strong reasons to focus the innovation on open science schooling:

- → Open science schooling is fundamentally different from classroom instruction, reading textbooks, working with artificial cases or performing small experiments in the school laboratory.
- → Open science schooling offers students real-life and real-time science experiences in the surrounding world, in the community and this means that many different lifestyles are possible in the field of science
- → Open science schooling offers students practical, realistic and action-oriented science experience and this might help change their general resistance towards traditional and obsolete classroom science. Such engagement takes place in the form of science missions, designed and carried out by the students, guided by their science teachers and in collaboration with relevant science resources in the community.
  The science engagement has to be immersive, allowing students to go deep into the science challenges. This means that the science mission should be carried out across considerable time periods – months, a semester, an entire school year. This is why it is important to integrate the science missions well into the normal life of the school.
- → Open science schooling offers all young students much more realistic impressions of what science is and what scientists do; this might help many young students overcome typical negative imaging of science and scientists as well as overcoming the resistance to science produced in the old classrooms
- → Open science schooling can, contrary to classroom science, offer young students' deep engagement in exciting missions, some of them not much different from what they experience in advanced video games; this will re-install the feeling of "adventure" in science that was totally lost in the classrooms and be attractive to both genders of digital natives

Of course, and as mentioned, there are various ways of innovating science education, but we believe that open schooling is the most powerful form of innovation.

Why Open Science Schooling is in the European Commission agenda?

The European Commission calls for re-thinking (science) education, and open science schooling is one of the educational changes increasingly recommended by the Commission as well as by critical research.
Why?

Because students in the 21st century create resistance towards science, science education and a life in science, based on negative images of science built up in secondary school.
The result of this is Europe losing most of its young potential science and innovation talent, which is unaffordable in times of serious challenges to life on earth and human welfare.
But the problem is not the young students.
The problem is science, science education and science in society.

As explained, open science schooling refers to education that works with real-life challenges in the community and globally, allowing students to learn through engaging in science challenges, problems, and innovation.
This indicates that the learning is no longer linked to the classroom but to the world outside the school.
This is no less than a revolution in (science) education, and more so as open science schooling goes far beyond punctual activities outside school such as visits to a science centre or similar.
The point is to take open science schooling to a level where the students accomplish something real.

Open science schooling is the most promising innovation in science education so far. It allows young students to create fundamentally new images of science, to influence science in real-life and to integrate new attitudes towards science in the development of their identities.
In short, open science schooling allows young students to re-engage in and change science.

It is rather a new dimension in learning and schooling, offering young students immersive, continuous and community-based experience and with the clear aim to foster interest in changing things, detecting new opportunities, engaging in interesting collaboration, playing detectives and explorers – and doing all this at the same time playfully and seriously.

Acting in real-time in the real world generates totally different sets of skills, competences and capacity than classroom teaching.
In this way, innovation missions and other forms of open schooling develops citizens dedicated to take action in and improve the communities they live in.

Open science schooling as re-thinking science learning or as "modernisation" and entertainment?

While a shift in educational discourse has been observed in many countries, too many practices remain unchanged.
UNESCO, "Education research and foresight" 2019

When confronted with the challenge of open schooling to create interest in innovation among the young students, most schools and teachers (and students!!) react in what we might call the "way of modernisation".

This way is about adding “modern” activities to traditional education in the classroom.

The short version of re-thinking science education concept is that it is not enough to “modernize” traditional science education, or to add new features such as project work or computer games.
The new generations of students and the new and constantly changing global reality call for fundamental re-thinking of what science education is and should be: re-thinking the very basic axioms of and the very discourse of traditional science education.

“Modernizations” might be visits to science resources outside the school, punctual engagement in science activities in the community, new work forms in the class – or participation in various forms of science competitions.
A popular “modernization” is to use new technology and even digital games.

One might describe this reaction as a way to “decorate” traditional education, or a way to make “alibi innovation” (“aiming to show that we are indeed doing something new…”) or a way to simply do what the school find possible at the moment.

This might sound bad: in the negative case it is bad, as it is a way to “avoid” the real challenges, but in general it must be like this: we need to dismantle old forms by acknowledging their limitations.

The European Commission states, however, that this is not enough.
We need to re-think the fundamentals of science education and we need to develop dramatically new ways of engaging young people in science.

This is why the Commission invites experimentation with open science schooling, and also why this project aimed to develop a realistic and implementable Model of open science schooling.

It takes several rounds of experimentation and evaluation to break through to what are the real challenges and the real innovation.
A spiral of learning and experience is needed to create real change. A single jump will never do the job.
And in many schools the real innovation is not even possible.

And what are the traditional reactions, or the way of “modernising” traditional classroom practice?

There is a well-known set of such measures:
- the activity is punctual, easily fitted into the curricula
- the activity is event-based: not meant to be integrated in everyday learning
- the activity is entertaining: pleasing the students and perhaps the project, at least for some time

In short, such activities are add-ons to traditional classroom teaching, they do not basically aim to change classroom teaching. And they are not open schooling.
It is important to point to the fact that these “modernisations” lack *didactic depth*: they do not change the didactics of classroom teaching, they do not create genuine

open schooling – and they do not create lasting and sustainable innovation interest in the students.
They do not succeed in becoming a part of the young student's identity, mentality and behaviour.

To become a way of thinking and acting the activity needs to give the student long-term, immersive, epic and personal experience of the "new".

We know that this works. What we don't know is how to do within the restricted reality of European education.
But if we know that this works why is so difficult to implement it?
Why is so difficult to jump from traditional education to open science schooling fostering innovation interest among students?

The answer is extremely important: *because schools and teachers and students need to create such capacity through stepwise dismantling the traditional forms of education!*

And this is not wrong, it is just simply necessary: schools, teachers and the students themselves need to dismantle traditional mentality and behaviour step by step and slowly arrive to what was actually the intention.

PART 2- THE SCHOOLS

The capacity of secondary schools to build eco-systems of open science schooling in the community - what does it take?

TEACHERS

With local institutions such as the town hall or the prefecture, the collaboration is harder. These institutions do not want to support our anti-pollution approach. Instead, I have collaborated very well with other association-type institutions and NGOs that are interested in this topic. We also established links with the environmental guard who received information about the purpose and objective of our project. At the same time, our team collaborated very well with the local press.

Students can interact with their community through various presentations and expeditions/field trips to science-based workplaces such as factories or power plants. They can also help spread information about scientific topics in their town by organizing debates and announcements.

Contributions through various after-school clubs (which would be optional to the students) as well as the implementation of science-based schooling into the main body of lessons should be a good place to start. This would ensure that students aren't overloaded with information and can sort their schedules on their own accord.

The easiest way to get to know and identify potential collaborator(s) is to get involved in community services. This can include co-organizing workshops, attending local or national conferences, or writing articles for local journals. During those voluntary services collaborators can be identified.
In case collaborations with community resources, it is also of great importance to verify internal policy regarding such endeavors at the lead organization, especially those with regard to external funding, ahead of starting a collaboration.

It is important to provide greater freedom in the implementation of the teaching material. To provide financial conditions and laboratory equipment enabling the

realisation of innovations. Provide opportunities to conduct classes in thematic laboratories, e.g. biology. Reduce bureaucracy and reporting on many school activities, the documents of which, in the vast majority, go to waste after a year. Introduce an incentive system for teachers implementing school activities and create opportunities for the headmaster to employ teachers who are involved in the life of the school.

Give more freedom to teachers in the implementation of the core curriculum in terms of content and forms of work.
A system should be created to support the work of teachers and their involvement in the organisation of extracurricular activities.

STUDENTS

Students identified key challenges for a different way of learning science, a new and more engaging way based on creativity and innovation; They understood the needs of the community in which they live and through their activities they tried to remedy the problems of the community.

Students say that the way they have been taught is the good way, and there isn't much need to change things, because they've got used to the way tasks are supposed to be carried out. But they do support the idea of work in smaller groups.

The students agree that they co-operated effectively, enough so to catch the attention of various soon-to-be partners in their community. They've done more than enough to raise awareness on the topics they discussed.

Students say that their city doesn’t not have many sciences community resources because it is a small city. They tried to find as many as they could, and they discussed with them the problems of the city and ways to solve them. That is the most important thing for a community. To try to help each other.

Teachers should have access to authentic tasks, by creating links to the local community (business, local authorities, third sector) to identify and get access to real life tasks that the teachers can use.
Budapest Agenda, “Enabling Teachers for Entrepreneurship Education”

A unanimous European policy and research community strongly recommends using co-driving and co-creation as basic principles when fostering innovation interest, skills and capacity, also in early schooling.

In practice this means that the young people will need to create innovation interest, skills and capacity through real-life and real-time and practical projects, not through classroom instruction and theoretical exercises.
This is paramount to the creation of authentic innovation interest, skills and capacity.

However, the same is true for the young teachers: they will also need to create didactic competence in the field of fostering innovation mentality, and they will also have to do this through practical projects working side-by-side with the students.

Practical experimentation in many schools from across Europe clearly evidence that no teachers are prepared to work in innovation missions or in open schooling!

The teachers engaging in such experimentation are front-runners and pioneers, dedicated to bring about change in school education.
As we can see in some of the project teachers' answers, sometimes is difficult and they struggle to make this happen, and maybe they need to step back: the obstacles are difficult to overcome and the workload too demanding.

This chapter is addressing teachers and schools that might like to take the students' innovation activities further.
They might wish to take the engagement from a student team level to a school level – a "school in the community" level, so to speak: the school doing what the student teams are doing.

Traditionally, schools are responsible for education in classes, tests and exams, not engaging in any form of community activity, in community politics or community innovation. They are increasingly top-down controlled by educational authorities and are increasingly concerned with scare financing and a lack of resources.

School boards and managers are to a lesser extent able to engage in innovation and experimentation.
Mostly they tolerate projects with reasonable funding, but they also mostly prefer to see those projects as "special events" with little impact on the school organisation and practice.
Most European schools do not have the needed room to move – their hands are tied, and that does not make life easier for pioneers' and braves teachers.

In general, teachers in secondary school are under pressure - tests, competition, funding based on student grades, evaluation of teacher performance, etc.
Most teachers therefore do not wish to engage in innovation, or they might wish to, but do not have the support or the needed resources and when doing it they have a lot of extra work.

This means that European and most local experimentation are driven by very few pioneer teachers.

When they manage to engage in for example a European project based on eco systems of open schooling like this one, they mostly have to manage everything themselves, and often without additional resources from the school.
These teachers are the real *heroes of experimentation*.
They want to change; they want to do good for the students.
But after a few years on their own, many of them burn out and give up.

The lack of serious support from the school and from the educational system usually allows these teachers a limited number of years in the project world.

But the students, at least, are openly interested in innovation, right?
Wrong.
The classroom mentality is also and sometimes very much shared by the students! They are used to being told what to do, how to do it and when to do it.
They are excited about the new project initiatives, but they are still positioned in the old educational mentality. Even if they are digital natives, they do not link education with their mobile's phones at all.

Most students at this age have long ago given up asking about the relevance of the school work and simply try to pass the school time and go home to the "real activities".

An interesting experience is that if the students get too much of the innovation, they start to ask the teacher what this is all about.

So, the classroom mentality is in the blood of all the players.

In the limited version open science schooling is about students' and student teams' learning through interaction with the community and real-life challenges in the community. In the extended version open schooling is about the engagement of the *school as organisation* in community challenges.

One thing is sure: the more "real" and "serious" the students' engagement,
the better the students' learning and the more benefit for the community!

In a 21st century context innovation is no longer expected to only be driven by public authorities or major private enterprises within a top-down approach.
On the contrary, innovation is expected to be driven by citizens, all sorts of community resources – and by any stakeholder in the community able to and willing to change things.

Such a stakeholder able and willing to create an eco-system of open schooling and driving change might precisely be… a SCHOOL!

Of course, this is not obvious if we think about a traditional school. The traditional school will mind its own business, so to speak.

But let's imagine, what about a school that:

- → organises open schooling activities for teams of students to create innovation interest and mentality
- → create permanent open science schooling resources: eco-systems
- → works to create entrepreneurial mentality among its students
- → increasingly integrates real-life challenges in the students' learning
- → would like to be a pioneer school offering its students 21st century skills and competences

Such engagement of the school as driver of change will need strategic planning, dedication and pioneer spirit – from the management as well as from groups of teachers.

Let us try to give some advice on HOW this could happen.
Each school will find its own way, but there are certain general approaches that we would like to share:

STRATEGIC APPROACH
Schools wishing to engage in such roles as drivers of change and innovation are strongly recommended to apply a strategic approach: careful discussions and preparations are needed, and in particular it is important to build on strong consensus among management and teachers, as well as create serious dialogues with potential community alliances.

BUTTOM UP
It is also of the utmost importance not to create top-down initiatives through organisational agreements between leaders and managers in the community resources: ecosystems.
The extended roles in the community of the school should build on the students' open science schooling engagement and take this engagement to a higher level.
This bottom-up approach will ensure that the school's engagement is continuously focused on the students' learning and co-driving.

STUDENTS' CO-DRIVING
The ultimate aim of the school's new ecosystems roles is to offer students' relevant 21st century learning opportunities. To maintain this aim students should always be at the centre of the school's engagement, as co-drivers of the innovation missions. The school should not attempt to replace the students' engagement, on the contrary: the new roles of the school should increase the quality of the students' learning and allow more and more students to engage in and benefit from open schooling.

CREATING ALLIANCES
One of the prominent new roles of the school, in support of the students' innovation science missions and innovation learning, should precisely be to continuously build new permanent alliances with institutions, resources and citizens in the community, this means a continuous ecosystem building process. In this way the school will allow the students to benefit from a still growing eco-system of collaboration in the community and will allow the community to benefit from a systematic and sustained engagement of the students and the school.

SHARING THE STORIES
The school should take advantage of its new roles and of the students' innovation missions: it should systematically share the stories with all relevant resources in the community and describe the benefit of the engagement for students and for the community and its citizens. Visibility is key…
Evidently, the students must be deeply engaged in this sharing, including through the social networks.

EXPLOIT FUNDING
In case the school is willing to take on such new ecosystems, the school will inevitably become a *pioneer school*. This means that the school can apply for a variety of funding – from local and national funds to the European programmes.
This is a great way to create more economy for the activities and to share the new experience in wider circles

OPEN SCHOOLING MAINSTREAMED

Most schools will start its new pioneer journey through engaging a few student teams in such innovation science missions.

It is important for the school to build further engagement on this practical experience.

However, as soon as the school wishes to extend the science missions to more students and to widen considerably the number of students engaged in such open science schooling learning, it will be necessary for the school to take the approach to a higher level: precisely to a “school as organisation” level.

It is at this point the school will benefit from engaging as driver of change in the community, as this would be the best framework for engaging more and more students in innovation learning.

Mainstreaming open science schooling for innovation learning might precisely happen through the systematic engagement in community innovation of the school as organisation.

Now, ask yourself this question: is there room in Erasmus+ projects for such “working though”?

To what extent can open science schooling be integrated in the science curricula, which are the most important challenges for secondary schools engaging in such new didactics?

TEACHERS

Research-based learning, documentation. Learning based on discovery and practice, learning through experiments.

Involving students in the accumulation of knowledge and changing the role of the teacher in the sense that he follows the process of knowledge accumulation, gives guidance on the research process and permanently helps students. The teacher has a guiding role, he has changed the classic way of teaching knowledge with a more creative and innovative role.

Science teachers understand the importance of learning based on discovery, research and innovative learning, at a time when science is "falling apart" because it is no longer attractive to students. They look forward to any initiative to revive the "sciences."

To organize Open science schooling activities for the school is very challenging, for example: we have to find a team of intelligent, creative students eager for new experiences and a lot of involvement; we have to find a team of teachers to get involved in the challenges of the project, in a fairly large workload. Both students and teachers must be willing to allocate extra time for this type of activity.

There are also problems related to the lack of logistics, problems related to collaboration with state institutions that are able to solve the problems of the community reported by us…

The project has implemented in extra school time, on Saturdays, this means that the school management is not involved, everything is about one teacher and if this teacher fails the project stops.

Education in Romania allows the use of resources - a new curriculum for optional courses / classes that are not in the common core. Our materials are a good curriculum for a new science option. In the coming years we will suggest an option course based on the experience gained in this project.

Teachers should read up on the newest science journals and ideas therein, be well-educated on each topic they present to their students and make quick science-based quizzes or reviews ("digests which could take up to 15 minutes) discussing hot topics before the beginning each lesson.

Science is encouraged passively instead of actively, because encouragement can be too active, but never too passive. The curricula shouldn't press on the student to perform specific tasks, rather it should be his/her own choice to contribute. The main principles of innovation in secondary schools seem to rely on this notion, because it takes heavily from the idea that students should have almost complete freedom of thought, ideas and expression when it comes to the dissemination and sharing of various science ideas.

The most important hurdles when organising open science schooling activities are environmental limitations, the window of time students have to adapt to new forms of schooling, and the question of how open younger students and older teachers are to new ideas. All of these coalesce into one great big challenge of how well the school and community can adapt to open science schooling-based ideas.

Science is encouraged passively instead of actively, because encouragement can be too active, but never too passive. The curricula shouldn't press on the student to perform specific tasks, rather it should be his/her own choice to contribute. The main principles of innovation in secondary schools seem to rely on this notion, because it takes heavily from the idea that students should have almost complete freedom of thought, ideas and expression when it comes to the dissemination and sharing of various science ideas.

With time, science is becoming a gradually more pressing issue than ever before, especially with the idea of climate change and covid-19. Open science schooling is a good way to integrate the studying of these ideas and sharing info, but the students' motivation to move their community forward in this area of science will surely never die, because new ideas are always being invented and the students always want to make their voice heard. To ensure their involvement, any form of scientific engagement (which they are already participating in) could be necessary, mainly in the process of their schooling.

Out of all open science schooling some can be introduced to school curricula. The basic criterion should be a taxonomy that we could use to classify curriculum and professional development open science schooling resources.

The problem education is facing is mainly one of productivity and efficiency. Here, efficiency means the balance between resources invested and the outcomes in terms of students' performance and equity. Over the past decades more resources have been invested in education. Looking just at school education, the average expenditure per student across OECD countries increased by no less than 17% between 2005 and 2013 in constant prices (OECD, 2016). But over roughly the same period, the Programme for International Student Assessment (PISA) data from the 2003 and 2012 surveys show no significant improve equality of opportunity and education outcomes between various social groups (OECD, 2013)

The most important challenge is to change the mindset of teachers and students. Teachers so far have been the carriers of knowledge and they needed to transfer that knowledge to students. So, students were just passive receivers of knowledge, while teachers were transmitters and there was limited interaction among them. In open schooling activities the teachers have to change their role from carriers of the knowledge, to knowledge managers while the students from passive receivers have to become active or better critical science detectives.

This is very difficult. The implementation of extensive curricula completely exhausts lesson time. In Poland, almost all project activities were carried out outside lessons and on school holidays. Many project elements extend the curriculum and introduce forms of practical activities, which is extremely valuable.

STUDENTS

Students like international schooling ideas, and the implementation of new science-based clubs is a good idea to them. They would also like to practice their English skills so that they can develop their info-searching skills to a higher extent.

Students are happy with the knowledge they have acquired, in a way that is easier to learn. I understand the importance of the activities they undertake and I believe that they can make a difference for the better in the community in which they live.

The students' work also meant a lot of research and documentation work. These materials made by students will be an example of good practice for other students and other schools.

The students think that slight changes to their educational curricula and schedules could work positively to encourage their engagement in scientific activities. International ideas and open-science schooling is a good starting point and sturdy guideline moving forward.

The way that they worked for this project was very different from the way that we were used to work for the “regular classes”. They liked it a lot. They say that they don’t know if they would change something because it was already something new.

This year we have a new class called “skill workshops”. In this class we are working like the way that we were working for our project. We do not know if this could happen in all classes.

We don't know the school curricula that well, but scientific excursions, meetings and experiments instead of at least some of the traditional classroom lessons would be great.

A 'whole school approach' is an ecological way of viewing a school. The school is seen as a multidimensional and interactive system that can learn and change; an open learning hub which provides support to its neighbourhood and receives support from the community
Education & Training 2020, Schools policy, EU Comission 2015

The European Commission calls for powerful innovation of science learning in schools, and for educational players to contribute to experimentation that creates good practice and useful knowledge.

The Commission in particular invites experimentation based on the open science schooling approach: schools opening the doors to the community and engaging students in real-life science challenges.

Open science schooling innovation engagement should not be a new subject in the curriculum, says the Commission, nor should it be a series of punctual events across the school year.

However, for most secondary schools developing open science schooling appears overwhelming and complicated and often conflicts with increasingly overcrowded curricula.
Most schools therefore hesitate to engage in such science learning innovation.
This is what lessons learned from several Erasmus+ projects tell us.

What are needed are open science schooling approaches that appears REALISTIC to the schools and the science teachers and can be EASILY EITHER INTEGRATED IN THE SCIENCE CURRICULA OR ALTERNATIVE CARRIED OUT IN PARALLEL TO THE SCIENCE CURRICULA and still meet the Commission’s key open science schooling requirements and criteria.

Which are then the basic principles of an open science schooling model?
- The open science schooling must be extremely attractive to young students and engage them deeply and critically in real-life science activities and most importantly offer them new images of what science is and could be for them
- The open science schooling must be realistic and implementable in average secondary schools, and without revolutionizing the entire curriculum
- The open science schooling must be carried out in close interaction with science resources in the local and virtual communities

And what is the reality?
- School curricula is increasingly overloaded in most European schools and leaves very little space for alternative and innovative learning activities.
- There are few signs that this will change in the near future, and therefore experimentation must happen *in spite of* school curricula.
- Most European governments are more interested in the average national test scores than in the young students' learning.

Therefore, when approaching the crucial question about how innovation missions can be integrated in school curricula, we need to provide answers at three different levels:

CHANGING SCHOOL CURRICULA
Schools, teachers and students should continuously put pressure on educational authorities at all levels to change school curricula with the aim to reserve considerable time in the weekly schedules for non-subject defined and test-free activities.

Such non-subject defined and test-free activities might precisely be used for innovation missions, entrepreneurial engagement – or similar forms of experimentation equipping the young students with 21st century skills.

For example, public authorities in future-oriented community, regions or countries might decide that 1 day a week is reserved for such experimentation, and that the school will be open after normal school hours to continued student engagement

INTEGRATING IN SCHOOL CURRICULA
Until dedicated time and space is reserved for such experimentation as innovation missions, the missions need, at least partly, to be integrated in the school curricula.

Teachers dedicated to working with the students in innovation science missions are constantly negotiating such curricula integration with the school management and with the other teachers.

First of all, teachers engaged in such missions need the full support of the school management, and the school management should help negotiate flexible integration of the missions in the weekly schedules.

Lessons learned from other Erasmus+ projects tell us that there are different ways to integrate innovative science missions in the curricula:
- in some schools a few weekly hours are reserved for various forms of "open activities"
- sometimes a teacher decides to devote an entire subject-semester to the innovation; the teacher will try to link the missions to that subject

- sometimes a team of teachers of different subjects agree to jointly create the time needed for the innovative missions; the team of teachers will try to integrate the subjects into the missions

In most cases the involved teachers need to combine various options to ensure the needed time for the innovation.
In most cases these mosaic strategies are rather unsolid and less satisfactory for the teachers as well as for the students.

However, no matter how flexibly the missions are integrated in the curricula over a certain period, the students (and sometimes also the teachers) need to add "personal time" to work in them.

Educational authorities and schools should therefore make strong efforts to build a new learning culture for teachers and in particular for students.
This learning culture does not need to depend on dramatic changes of the volume and restrictiveness of school curricula, as our young generations cannot wait for such changes. They need time and space to develop the 21st century skills and capacity they will need in their further education and in their professional and personal lives.

It makes sense to characterize such new learning cultures as open schooling.
Innovative science missions should form part of such open schooling cultures alongside entrepreneurial learning and community-based learning.

Open science schooling cultures would include the following measures:
- use possible free time and space in the curricula systematically
- allow student teams to pursue their interest and dedication after school hours, and by provide resources to the young teams at the school after school hours (open workshops)
- allow students to continue and deepen their mission engagement in weekends and to some extent during long school holidays and provide basic resources to the teams at the school after school hours (open workshops)
- encourage student teams to deploy their innovation missions' work to the community in collaboration with key mission resources
- encourage the students to involve family and friends
- exploit their virtual social and gaming networks to the max, including involving peers from other countries in the missions

Schools should make constant efforts to stepwise establish such open science schooling cultures despite of existing curricula.

SUMMARIZING
A way to see it might be that open science schooling and the interest in innovation will require no less than a revolution of the entire education system.
This point of view will probably and inevitably lead to apathy and giving up.

Schools and teachers cannot wait for the education system to change; first of all, because it will not change; second, because if it should change it will take decades.

Schools and teachers, and their local/regional educational authorities, are therefore challenged with the mission to find out to what extent it is possible to

create as good and authentic open science schooling engagements for the students as possible.

Policy-making should ensure increasing self-governance in schools, allowing the experimentation needed in the globalised 21st century.
Open room to move should be integrated in all educational planning and curricula.

Small first steps might lead to more engagement.

Remember that the Commission knows all this. This is why the Commission encourage "rule-breakers"; in the sense of schools and teachers experimenting with new didactics even if the education system is not moving.

PART 3- THE PROJECT

The meaning of community resources and their co-responsibility re-engaging young students in science learning and a life in science?

Collaboration between formal, non-formal and informal educational providers, enterprise and civil society should be enhanced to ensure relevant and meaningful engagement of all societal actors with science and increase uptake of science studies and science-based careers and employability and competitiveness.
Encourage "open schooling" where:
- Schools, in cooperation with other stakeholders, become agents of community well-being;
- Families are encouraged to become real partners in school life and activities;
- Professionals from enterprise, civil and wider society are actively involved in bringing real-life projects into the classroom;
Promote partnerships between teachers, students, innovators, researchers and stakeholders in science-related fields, in order to work on real-life challenges and innovations, including associated ethical and social issues;
Commission 2015, Science Education for Responsible Citizenship

In our current society, in which digitalization and technologies transverse almost (if not all) dimensions of our everyday life, science, technology, engineering, arts and maths learning and digital competences become key factors for students to obtain good life quality. Using an electronic form to apply for a job, navigating one's own online banking system, or making a windmill capable to pull underground water when there is no rain to sustain the crop, all of them are examples of how STEAM is needed for different dimensions of our lives, regardless of age, economic status, and place of residence.

Nevertheless, we see a worrisome trend in youth disengagement from science learning and science related careers that are translating in a serious shortage of capable individuals in the labour market in Europe.

The *Young students as critical science detectives* was based directly on the European Commissions' "Science Education for Responsible Citizenship" in which the Commission calls for science learning that involves young students in real-life science through an open schooling methodology.

Therefore, the project's experimentation involved not only the students, but also science resources in the community and the students' families, as strongly recommended by the Commission.

In the project "community" was understood in its widest sense: local physical community, the region, various science communities and virtual communities.
The globalised world and the 21st century students do not separate these worlds in the way the present educational systems do.
They work with the physical and virtual communities as one world, and obviously, local science engagement might very well include considerable virtual social networking.
And this is why the project invited the students to work in different forms of communities along their science missions. A number of people and institutions from various forms of physical and virtual communities were involved through the students' missions.

There are no "right or wrong" communities.

The roles of the community are many and important in open science schooling scenarios and experimentation.
In fact, the vision is that most of the science learning is expected to take place outside the classrooms and schools and strongly linked to real-life science activities, supplemented by "learning on demand and when needed".

Open science schooling is still in its first stages in schools, and even more so in the collaborating communities.

This means that innovators, entrepreneurs and research professionals are not at all used to and geared to collaborate with schools and students along considerable time periods and not at all used to integrate student teams in their research and innovation circles.
They are used to punctual engagements only: meetings at the school, students' visits, workshops, events and similar.

And the reality is that science communities and their professionals can only develop such collaborative competences through continued practice.

These players are deeply engaged in their innovation missions, but they do not know how to handle open schooling.

Open schooling includes long-term engagement of students, students following the life circle of innovation and students going as deep as possible into the mysteries of the innovation, including its many cross-subject implications and directions.

Community collaborators need a strong outlook to see the meaning of this interaction.

Once the science communities are mobilised to work with open science schooling, the community will be able to deliver important resources to the schools and to the teachers.
Then, early science learning will become a collective mission, not simply a school responsibility.

The point is, however, that the mobilisation of the science communities requires many rounds of (accumulative) experimentation, and it doesn't happen if schools and teachers are not given the needed space to create such experimentation.

So, the mobilisation of science communities for innovative science learning is depending of the resources of schools and teacher to create and drive the experimentations.

All this is closely related to how the innovation in education is depending on schools, teachers and students' motivation.

This simply means that all the players in open schooling and creating innovation interest among students must learn: the educational players as well as the innovation players, and the educational authorities that should support those activities actively, but rarely do so…
The point is, however, that the innovation players might benefit strongly from this engagement when they learn how to use the long-term contact with the future generations of citizens!

To quote once again the simple OECD words:
Users are being involved in earlier phases of the innovation process - already when companies are identifying opportunity areas. The innovation process is becoming user-driven.
OECD, New Nature of Innovation

Obviously, this will take much experimentation and much learning among the innovation players.
In particular it will take sustained activity, creation of eco-systems of collaboration and evaluation of the innovation players' benefits.

If pioneering and experimentation are not supported locally and nationally, the education systems will lose its dynamics, its creativity and its ability to change and address new challenges and therefore the schools will not have the tools to move and build such eco-systems of open science schooling in the community.

All this process needs time, years, and the problem is: *who will fund, invest in and drive such sustained and long-term experimentation?*

And,
Last, but not least, policy-making should support open science schooling as the adequate learning didactics of the globalised world – instead of restricting and narrowing the room to move for schools and teachers.

This includes supporting the motivation of resources from different sectors to work with the schools.

The vision of cross-sector learning communities is increasingly undermined by sectors focusing on their own challenges and not engaging in more complex but also more profitable and benefitting cross-sector collaboration.

All major educational innovation agendas in Europe are based on and depending on cross-sector collaboration and public and private stakeholders' engagement in learning processes.

The problem is, though, that if schools are not able to move and the sector players are increasingly focused on their own challenges, then open science schooling cannot happen.

Policy-makers should revise the way they directly or indirectly undermine such vital collaboration, and develop strategies for how to re-motivate and re-mobilise both sides of the open science schooling communities.

Policy-makers in particular at local and national levels should bear in mind that it is of paramount importance to mobilise the motivation, creativity and dedication of these educational and community players.

PART 4- THE SCIENCE MISSIONS

Learning on demand, the immersive and exciting mission-based method to engage or re-engage young 21st century students

TEACHERS

The students managed extremely well when it came to real science missions, they somehow knew exactly what to do and their ideas were fresh and new. They decided to share info in museums, make presentations (on topics such as the epidemiological situation and vaccines) and organize field trips to chemical production companies. They defined science missions as "tasks that were meant to raise awareness on important science topics such as global warming, food/water droughts and epidemiology through the lens of open science schooling".

Building capacity among teachers to facilitate and support the creation of science innovation interest is based in two interrelated domains:
1. STEM knowledge and skills for instructional (pedagogical) practice.
Capacity building should focus on instruction for all within the educational system, from teachers, to paraprofessionals such as after school educators, to school principals and administrators; and
2. Leadership knowledge and skills necessary to mobilize and support instructional practice on a wide scale. This could include creating collaboratives and other mechanisms for individuals and groups to learn from each other as they do this work and developing leadership capacity at all levels to mobilize educators and administrators. It should also include making data on effective practices and on student learning central to this work.

Student teams are complex dynamic systems that exist in a context, develop as members interact over time, and evolve and adapt as situational demands unfold. Dynamic complexity; emergent team processes and phenomena; and development, evolution, and adaptation are key themes that decide the success or no of a team. The overall covid situation also created a negative attitude to the majority of the students. So, the degree of engagement of the students' teams had to do with the interaction degree of the students. The better interaction the better was the engagement to science missions.

Our basic principles remained the same during the project's life time and they are:
-science is for all students
-learning science is an active process
-school science reflects the intellectual and cultural traditions that characterize the practice of contemporary science. Open science schooling on the other hand focuses more to the students
-improving science education is part of a systemic education reform and can be achieved only when thinking out of the box

The main impact for students participating in such projects can be summarized to:
-applying knowledge in a wider context than their course would otherwise allow
-freedom of access and enhanced opportunities for learning
-support for learner-centred, self-directed and social/informal learning approaches
The sustainability of the above is based on the school and teacher's support on the idea of Open Schooling and their support on improving science education.

It is important to allow students to act, to try, to experience, to come up with ideas. Show ways of learning based on experimentation, practice. Organise excursions where students can see unusual and interesting places, participate in workshops and meet interesting people. Suggest that the school cooperates with a university, museum or other scientific institution. Be interested in science yourself, have a passion. Only a teacher with a keen interest in science can get pupils interested in learning! It is authentic.

STUDENTS

The students like the idea of going out and partaking in scientific activities and enlightening the public, a good idea they had was to make a presentation about food science and how various toxins found in modern foods can affect our health.

The students correctly perceive the importance of the role assigned in the realization of the project, they are proud of their achievements, of the accumulated knowledge and at the same time they are eager to share with other students the experience gained by them by participating in the project.

The students think that slight changes to their educational curricula and schedules could work positively to encourage their engagement in scientific activities. International ideas and open-science schooling is a good starting point and sturdy guideline moving forward.

We believe that we did engage in real life missions and that was the thing that we liked. We realized that the things that we are taught in school, are things that we are going to use in the future. We also liked the fact that these missions were not just for one or two weeks but they lasted for more. In this way we had the chance to get deeper into science.

We need to know how we are going to use the things that we are taught in real life. To have more “on hands classes”. To “do” more and learn less by hard.

We want to choose the subjects of the missions. If the subject of the missions is something that interests us, we will do better with the missions.

Students highly value co-organised activities in cooperation with universities, which is an excellent opportunity to get to know scientists, universities and very interesting research topics. Moreover, it is an invaluable opportunity to participate in workshops in university laboratories.

Science missions are activities where we learn by doing and experiencing. They are much more interesting than theory.

We like lessons and learning outside the classroom. A textbook and a picture or film show are important and necessary, but a bit boring in the long run. We like to be surprised.

I felt important, everyone in the project respected each other a lot, I felt safe here, I wasn't ashamed to ask questions, it was a lot of fun, I became more open, I feel more confident now, I was treated like an adult, I know more.

Education institutions should be encouraged to become more entrepreneurial in their wider approach, to ensure that they develop and live a culture of entrepreneurship and innovation through their missions, leadership, stakeholder engagement, curricula and learning outcomes.
European Commission, “Entrepreneurship 2020 Action plan”

In traditional education the students are taught through the principle of “learning when scheduled”. That is: learning math Tuesday from 10-12.
To the students this is definitely an abstract justification of the learning.
The learning is organised to please the education system, not support the students’ learning.
In traditional teaching the students work with text books, artificial cases and lots of theory and abstract knowledge.

“Learning on demand” totally changes the perspective: the students learn when they need to learn, when it is relevant, when they are motived, and first of all: the students learn when they need to learn *to accomplish their science missions*.

This form of learning is based on the students' interest, not the systems.
In the project this is called "time-outs for learning on demand".
When the students work in their critical science missions, they often get stuck: we cannot progress from this point. We need to learn something first, or in parallel. Then we can progress.

"Learning when scheduled" leads to short-term remembering, whereas "learning on demand" leads to deep sustainable learning and the capacity to act.
Obviously, schools need to learn how to organise such "learning on demand" – in collaboration with community resources. This is a part of the open science schooling experimentation.

In the project, and in similar initiatives, the students learnt through working with real-life science challenges and in real-time, their missions.
Students in these missions do not look at the reality around them through subjects, classrooms and texts, but engages directly in science challenges of all kinds and in close collaborations with community science resources.
This completely alters the traditional educational set-up and places moreover teachers in brand new roles: as guides, as facilitators and as critical friends to the student teams, and even as the student teams' co-learners!

Students work in teams to learn through engaging in long missions of science challenges in the various forms of communities.
The way they learn through taking action in the community is to define, create and accomplish critical science missions.

Missions have to be projects carried out in real-life and in collaboration with real-life science players.

It is important to explain why the project used "mission" instead of "project", there are several reasons for that, all them linked to the how deep, immersive and exciting missions have to be to touch and engage the students:

- the term "project" was once very innovative, such as in project-based learning; however, today the term can mean everything and nothing
- the term "mission" is much stronger: it refers to strong intentions, the will to accomplish and the ability to critical engagement
- the term "mission" is used in all sorts of video games and most young people are familiar with the meaning of missions: working through levels and steps to be allowed to advance in the game and to finally accomplish

Let's come back to the *real-life* and *real-time* definitions and how important are as "driving forces" in the mission-based approach.

Real-life means that the innovation missions are carried out in the real social and virtual worlds outside the artificial classroom.
Traditional teaching exclusively reflects the real world through educational material and exemplary cases.
Traditional teaching does not invite students to *act* in the realities outside the classroom.
There is a big difference between "knowing about" and "acting in".

Unlike more punctual and tangential activities linked to the real world, innovation missions also strive to impact the real-world, to change it.
Real-time activity means that the innovation missions address challenges or problems here and now.
The missions need to work with things that matters to the community and its people today and in the near future.

This is one of the demanding aspects of innovation missions: the flow of activities cannot depend on the school curriculum but must follow how things happen here and now in the community, for better or worse.
And things take time and are depending on many factors in the reality.
This is why flexible and long-term engagement must be possible for the young teams.

PART 5- POLICY SUPPORT RECOMMENDATIONS

Partners' messages to educational policy-makers

TEACHERS

Local authorities should endorse scientific engagement either through various stipends or status boosts such as columns in their newsletters and media posts honouring the students which have contributed the most. National authorities could honour them further, either through presidential meetings, sponsorships or status boosts through national coverage in the media. In ERASMUS+ projects, only local authorities should be included, because national authorities can be hard to get a hold of in these trying times of epidemic.

The most important challenge is to change the mentality of teachers, to change the entire education system in Romania which is outdated and based on some rules that are no longer relevant. Updating the education system in the sense of its innovation implies creating an innovative education system, connecting to the new and open learning methods.

The local authorities do not have initiatives in this respect, they are not interested in the activities of young people in general, they are imprisoned in outdated and communist canons, they do not generally support the initiatives of young people in our country.

Perhaps if they participated as project partners in Erasmus + projects, they would understand the importance of our efforts, they would collaborate with students and school units in the sense of supporting them. Unfortunately, the political situation is extremely difficult, it is not favorable to any cultural or educational initiative, so we do not believe that things will change for the better.

Traditionally the role of public authorities was to support innovation by investing in enablers such as education, science and research, and infrastructure, and removing regulatory obstacles such as restrictions. But nowadays this is not enough. Public authorities need to collaborate with international private and public sector entities

on projects aligned to educational innovation for pursuing research through innovation support schemes and other relevant means on a need basis.

According to the EU there is the intention to create European partnerships of teacher education and training providers to set up Erasmus+ Teacher Academies that will develop a European and international outlook in teacher education. Those Teacher Academies should be based on the results of the previous projects of the EU in order to promote real school innovation. If not, we are facing the awkward reality where Academic Institution will setup Teacher Academies based on stereotypes and knowledge of the previous centuries.

Public authorities should provide funds for laboratory equipment, opportunities for students to work in smaller groups. They subside trips to universities and other scientific institutions. Enable cooperation, treating participants seriously despite their young age. Support initiatives popularising science (local, national).

STUDENTS

Students like the idea that they could be sponsored by authorities to perform their scientific activities. It would serve as a high form of motivation for them to carry out massive-scale scientific missions and raise awareness, which is a net positive for the community. It would be a healthy addition to the ERASMUS+ projects.

Students want a different kind of education system, based on learning through discovery, based on modern methods, innovative.

The students believe that the state institutions are the main culprits for the situation in which our city finds itself. They do not have expectations from the state institutions.

One thing that it is important for us, is to find a job in the future. We would like to have studies in a field that we could have a carrier. What we expect from the public authorities is to create the appropriate circumstances for us to have a job in the future.

The people that make these decisions about the future of education should listen more to the teachers and students. These are the ones that have to do with education.

Some of us travelled every Saturday for 5 months this year to attend a full day Youth Nature University class, 340km round trip. It would be nice if the local authority would pay for the journey.

Schools should develop sustainable and systematic partnerships with businesses, social enterprises and NGOs rather than ad hoc links.
Create 'open door' policies in schools to make them accessible to their local communities; and enabling them to draw on the skills and talents of local people.
Budapest Agenda, "Enabling Teachers for Entrepreneurship Education"

Let us conclude this policy paper by providing some recommendations for educational policy-making and some ideas for the schools willing to change their directions
The **RECOMMENDATIONS** at the same time show and summarize thoughts and messages from the partners.

SCHOOL'S SELF-GOVERNANCE
Policy-making should ensure increasing self-governance in schools, allowing the experimentation needed in the globalised 21st century.
Open room to move should be integrated in all educational planning and curricula.

STRONG STRATEGIC FOCUS ON TEACHER EDUCATIONS
Policy-making should focus strongly on innovation in teacher education, in particular on initial teacher education.
The young generations of teachers are not able to manage the new open schooling and entrepreneurial approaches and the Commission's educational innovation.
Dramatic changes are needed across all teacher educations, including much more practical collaboration with schools and communities.

STRONG NATIONAL COMITTMENT
Policy-making should at national level take seriously the Commission's strategic educational innovation and support the implementation of the innovation instead of undermine it.

LOCAL ENGAGEMENT
Policy-making should ensure much more local engagement from local governments.
Local governments have important roles to play in the field of open schools and cross-sector collaboration – for example supporting the creation of local eco-systems of innovation and entrepreneurial learning.

INVOLVE COMMUNITY – OPEN SCHOOLING
Policy-making should support schools at all levels to create open schooling in collaboration with relevant community stakeholders, including from the private sector.
The Commission strongly recommend educational collaboration with the private and social sectors, but very few local governments are taking action to support this.

BOTTOM-UP INITIATIVES, NO EVOLUTION
The evolution of the educational system towards open schooling and 21st century didactics will not happen.
The last two decades have clearly demonstrated this beyond reasonable doubt.

Therefore policy-making should support a bottom-up approach in which the innovation increasingly emerges from pioneer schools and teachers.
Local policy-making should support, celebrate and reward pioneer schools and teachers.

COMMISSION EVALUATION AND CRITIQUE OF NATIONAL EDUCATIONAL POLICY
The Commission should take action to evaluate and criticise national educational policy and make an effort to ensure that Commission educational innovation is followed up at national level.

How to get help and support schools?
Are Erasmus+ projects an appropriate way to experiment with open science schooling?


TEACHERS

Yes, because international ideas work to refresh the innovative mind of the students and push them to executing their utmost in scientific engagement and dissemination of ideas. If they want to work on something scientific, they are more than welcome as well as endorsed to do it now, as opposed to before, when there was no big reason to step out into the unknown and enlighten the public. ERASMUS+ encourages international work through the lens of science and missions, which helps today's youth communicate and work together regardless of country borders or even epidemics.

If at all possible, extra funding could be provided through wholehearted partnerships, maybe from some parents and local communities that are willing to endorse the students' work or scientific communities from around the country or Europe in general. Other than that, Erasmus+ has already accomplished a lot in this field.

We believe that an important scientific development of the community is achieved with the help of Erasmus + projects. An example is the project we participate in that challenged us to a different kind of schooling - "open schooling"

We believe that by participating in this Erasmus + project, through the work of its implementation, a real progress has been made regarding the awareness of the school population regarding the “open schooling”.

Erasmus + projects are a challenge for our students and teachers. It represents a breath of fresh air - that is, the connection to new learning methods, to new knowledge, to an "innovative" way of learning and therefore to a personal development of our students and teachers.

There is a need for public authorities to collaborate with international private and public sector entities on projects aligned to educational innovation. This works if the entities in the eco-systems make available the basic resources, infrastructures and collaboration to schools and students to help them conduct and accomplish science missions. And Erasmus+ seems like a fine instrument if you want to promote that kind of collaborations.

The funds are arriving with a huge delay, which is unacceptable. In addition, the local authorities require the translation of all documents. In the end, this task is given to the already heavy workload of the coordinator, the teacher. The distribution of resources is unfair. Time tables between countries are fundamentally different. In addition, only a few school projects make it possible to create conditions for the additional payment of working time to those involved in the project.

The focus should be on cooperation and creating conditions for decisions to be taken in partnership.
Financial differences should also be minimised.
Select committed partners to the project.
All partners should be co-authors of the final work, not only knowledge partners.

STUDENTS

The students love ERASMUS+ and use every opportunity they are given to participate in international work. They like the idea of diversity and sharing their culture and ideas abroad, making their country better-known in other places. International ideas have always pleased the students and they wish to work further in this avenue.

The students find the participation in these projects useful, I see them as an opening to the new, to the future. These are a step towards their school development and their personality.

Students appreciate as positive their educational development achieved by participating in this project.

Students consider participating in Erasmus + projects a real opportunity for their development. They improve their English language skills, manage to communicate information and exchange opinions with the partners, understand the thinking and action of students from other countries. And regarding the "open schooling" they understood that it is possible to "learn” more innovatively and more creatively.

We know that if we did not participate in this project, we would not have the opportunity to work in this way, collaborate with this people and learn all these

interesting things. We know it because we know what friends from other schools do. So, we are happy that we participated in this project.

The European Union should continue to invest in such projects so more students could have experiences like ours.

Erasmus is great. It is a pity that international meetings are made difficult or impossible by the pandemic.

The project gave us knowledge, new skills. We enjoyed going outside the school and the classroom. We felt important. I got to know other pupils better, I learned to cooperate.

Perhaps you are a school benefitting from the valuable project material. However, your school and your teachers would still like to receive some kind of extra support and help from resources with practical experience in open science schooling to create innovation interest and capacity.

The need for such process support or peer support is quite understandable and justified. In particular if it is the first time the school engages in such experimentation.

From where can you get such support? And what sort of support is possible?

Let's make clear that such support does not come easily: in very few countries and regions in Europe such support is available.
Typically, the school will have to find its own way.

Anyway, there are different kinds of support:

LOCAL
Typically, local support is difficult to obtain.
In some cases, the municipality is in favour of new learning activities and new opportunities for young people in the community, but that does not mean that they can provide support.
In other cases, science community resources might wish to engage and support, as open science schooling for innovation interest is linked to creating competences and science reengagement on students.
But again: interest does not mean capacity to support.

NATIONAL
If the school is lucky, they might be able to identify higher educations or research and science innovation institutions working with innovation in education and perhaps even with open schooling.

Such institutions might be interested in collaborating with a school that wishes to engage in practical experimentation.

In some cases, national educational authorities make available various forms of funding for pilot projects or different kinds of educational innovation.

If schools have strong school networks, they might try to organise a group of schools that might be able to put some pressure on the national educational authorities.

EUROPEAN
It is always difficult to get support and help for pioneer educational projects.
In particular if the school is among the first schools in the region to engage in such experimentation.

Many schools in Europe therefore end up concluding that the most efficient way to get support and help is through European resources.
Strange as it may sound, it is true for many schools.

In our context this means two forms of support and help:
-support and help through participating in European Erasmus+ projects (like Young Students Critical Detectives)
-support and help from the Young Students Critical Detectives project itself

Let's take a closer look at these opportunities:

ERASMUS+ PROJECTS
Any secondary school in Europe can join school partnerships and apply for funding in the Erasmus+ programme.
Of course, this would provide the needed support and help and engage the school in a partnership working towards the same goals.
In this way the school would also be able to finance its experimentation, at least for a 2 years period.

At least in principle because it is not easy to find such partnerships, to write applications and to get the applications granted!

In this case the school and the teachers' teams should as a first step focus on creating a network of schools in Europe or identifying and joining such networks.
Some help might be obtained from the National Erasmus+ Agencies or through contacts to other schools in Europe, such as the schools and partners in the Young Students Critical Detectives project.

It is a lot of work, but it is also the most solid way to start working with open schooling for innovation interest and to get support and help from qualified and dedicated peers.
And: students can be involved along the entire life circle of such projects, for example through mobility.

THE YONG STUDENTS' CRITICAL DETECTIVES SUPPORT

The project is terminated. What remains is the inspirational material available on the project website.

This does not mean that schools cannot establish contact with the project and with the different partners.
Of course, such collaboration is not financed, but there are ways to collaborate informally and still benefitting both parties.

Let us briefly describe what kind of support and help might be obtained from the project leaders and partners:

- guidance through simple mailing
- contact to interested schools
- a workshop visits to the Young Students Critical Detectives resource from the school's teacher team (self-financed, of course)
- consultancy along the school's experimentation from project resources (to be financed)
- support and help to join European projects
- …

There are obviously more opportunities and they will need to be discussed and negotiated in each case and when a contact is established.

Schools are free to contact the project resources and discuss what kind of support and help might be possible