

A stylized tree with a white trunk and branches. The tree is decorated with various elements: a green vine with leaves at the top left, a yellow flower with a red stem and green leaves, a green leaf with a black outline and a small black dot in the center, and three colorful pots (red, purple, and blue) at the base. The background is light gray with several large, white, stylized leaves scattered around the tree.

Open Schools for Open Societies

Open Schooling Roadmap

A Guide for School Leaders and Innovative Teachers

S. Sotiriou, S. Cherouvis, N. Zygouritsas, F. Bogner



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**A Guide for School Leaders
and Innovative Teachers**

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Executive summary

OSOS Roadmap a unique path to schools' openness

This document is the final version of the OSOS Roadmap supporting the diffusion of the Open Schooling Model in schools all over Europe. The 2nd version of this document (D2.4), published in March 2019, was enriched with examples and concrete evidence of the proposed school's opening up journey. In this final version we present plenty of evidence on how schools have evolved in this transformative process towards openness and responsible innovation. The large-scale implementation work with 1,200 schools across Europe offered a unique opportunity to test the effectiveness of the proposed Roadmap. The Roadmap proposes a concrete overview of the implementation of open schooling approaches, offering a clear description of the necessary steps that schools will need to take in order to become hubs of responsible innovation that bring together as many educational stakeholders as possible with an aim to produce ideas and solutions that address local issues and challenges. Applying the OSOS approach in local settings has made it clear that schools have much to gain by fostering connections between formal and informal learning, between existing providers of education and new entrants. The OSOS approach has supported (and will continue to do so) the transformation of schools into open schooling environments in the participating countries and beyond. The project team has been working with numerous experts and with the national coordinators who are researching the specific context and work with local governments to build their capacity, and that of school leaders and teachers in a select number of schools, to establish the desired open schooling cultures. A tailored package of supporting materials, including the OSOS Self-Reflection tool and the Open School Development Plan, have been developed to support schools as they transform into Open Schooling Hubs, offering a clear mentoring approach to schools with a vision for the future. Guidance has also been provided to local and system-level stakeholders.

This roadmap must be used together with the OSOS Strategies document that exemplify the project's overall approach on how we can best support schools in their attempt to evolve, transform and reinvent their structures towards a more open, localized and socially responsible learning environment. In this framework, schools facilitate open, more effective and efficient co-design, co-creation, and use of educational content (both from formal and informal providers), tools and services for personalized science learning and teaching that form the basic ingredients for innovative student projects. Such projects understood as best practices are the so-called incubators and accelerators on school innovation. The data from a core group of schools (400 schools from 11 EU countries) demonstrate that the OSOS approach and the OSOS Roadmap had a significant impact to the openness of the participating schools. OSOS has demonstrated an extremely successful journey in the diffusion of innovation in school settings. Recall how an Open School Culture requires schools, in cooperation with other stakeholders, to become agents of community well-being. In this framework, families are encouraged to become real partners in school life and activities; professionals from enterprises and civil and wider society are actively be involved in bringing real-life projects in the classroom. These projects developed by school that forms successful networks with a taste for responsible innovation. The OSOS School Hubs created communities of practice to implement their innovative projects, involving numerous schools that progressively adopt the open school culture. 100 OSOS School Hubs have managed to set in motion a network of 1,200 schools in 15 EU countries.

Executive summary

OSOS Roadmap a unique path to schools' openness

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Figure 1.1 presents the results of an in-depth analysis of the 400 Open Schools' performance in openness – following the clustering/mentoring approach introduced by the OSOS approach. The data demonstrate significant growth in openness (>15% on average) while the growth is much higher for less advanced schools (goes up to 45%) in a one-year intervention. Further analysis demonstrates that the school's performance towards openness continues also after the second year of intervention at the same level (see Deliverable D6.4, Figure 1.2, Figure 1.3). OSOS has demonstrated at scale the process of transforming schools to innovative ecosystems, acting as shared sites of learning for which leaders, teachers, students, and the local community share responsibility, over which they share authority, and from which they all benefit through the increase of their communities' science capital and the development of responsible citizenship.

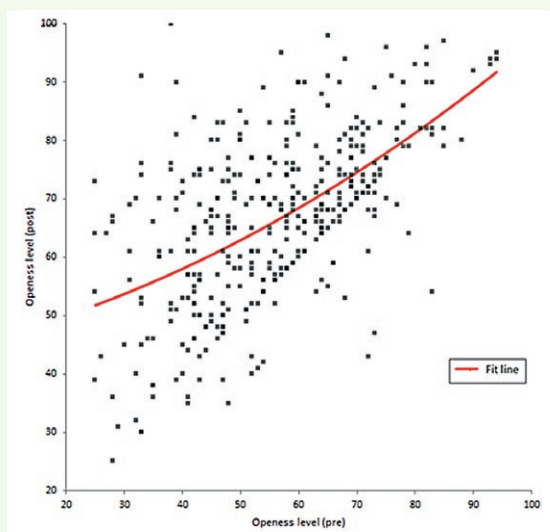


Figure 1.1: Open Schools' performance in openness – following the clustering/mentoring approach of the OSOS Coordination Action (data from 400 Schools). OSOS School Hubs create communities of practice with other less-advanced schools supporting them in the adoption of the open school culture. The data demonstrate significant growth in openness (>15% on average) while the growth is much higher for less advanced schools (goes up to 45%) in a one-year intervention.

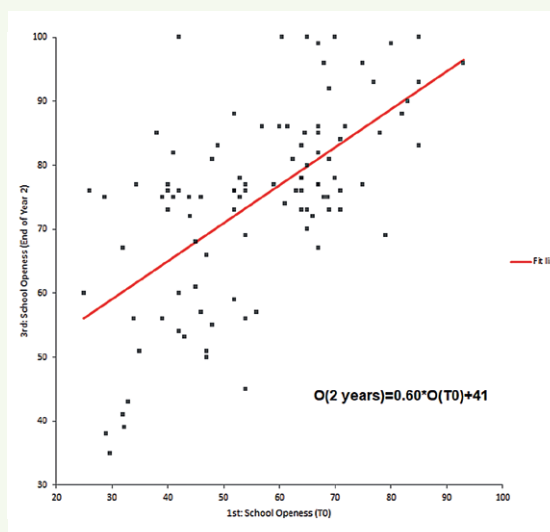


Figure 1.2: 100 Open Schools' performance in openness after two years of intervention. Schools show a significant growth of 20% on average to their scores. The fit line shows the impact on the different schools according to their starting point $O(T_0)$: openness at the start of the process. A school with initial score at 50 will jump to 70 after two years of implementation of the OSOS Roadmap.

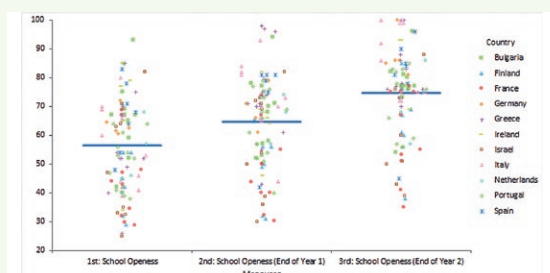


Figure 1.3: 100 Open Schools' performance in openness: The graph shows the initial scores of the participating schools (T_0), their scores after one year and after two years of adoption of the OSOS Roadmap. These data demonstrate the impact of the OSOS Approach to the participating schools.

From Scenarios to Practice: The OSOS Open Schooling Roadmap

*Innovation is not an isolated event; it is a movement. Innovation is the word we use when an idea is so well received that it becomes the new norm. While a single person trying something new, that person might be considered an innovator, but often this practice does not spread throughout an entire system. However, if people rally around that idea, sharing their failures and successes, this is what we could call **systematic innovation**. The best model we have then for innovation is a **chain reaction**.*

*One of the most incredible chain reactions is that of nuclear fission. Fission occurs when a subatomic particle disrupts the nuclear structure of an unstable atom. When the nuclear bonds are broken, energy is released in addition to more subatomic particles, which in turn could disrupt another nucleus and trigger this process all over again. One of the most common fuel sources is Uranium 235 because it is already radioactive, that is to say it is highly unstable and it naturally releases particles which could cause a fission reaction. Yet it does not. In order to induce a **self-sustaining, cataclysmic release of energy, conditions need to be just right**.*

Critical mass is the term used to define the condition under which a chain reaction is imminent. If critical mass is not reached, it means that even when a new particle is released, there is a good chance that it will not hit another nucleus and the reaction will not continue. Think about a line of dominoes spread too far apart. The concept of critical mass simply explains that if there isn't enough stuff in a given space, a chain reaction will not occur.

*One of the **biggest barriers to educational innovation** is not the lack of great teachers or even the access to proper tools, it is the **isolationist structure and dispersed nature of many schools and school authorities**. Even when you have the best teachers coming up with the most original ideas, a chain reaction of innovation is very unlikely to spread throughout the organization. The dominoes are too far apart. Schools should consider how they can create a critical mass of innovators, the condition where a chain reaction of great ideas is imminent. It just so happens that nuclear physicists have several tricks up their sleeves which are essential to creating this condition. These tricks are acting as **catalysts to the process**:*

- **Increase Mass**- *The more dominoes you have the longer the chain you can make. Be on the lookout for talent and get more of the right people in your school. The more innovative individuals you have in your school community the greater chance they will influence each other.*
- **Increase Density**- *Even having a lot of innovators might not guarantee a chain reaction if these people never get together. The closer these people are, the more likely they will be to share. Open days, workshops, and other in person events are great examples of moments of increased density. You will be amazed at the innovative energy produced by bringing the right people together in a closed space.*
- **Increase Temperature**- *Temperature is really just a measurement of how fast molecules are bouncing off one another. Craft specific times for staff sharing and exploration. The more opportunities you have for teachers to interact with other stakeholders, the more likely these innovative ideas are to move. Open the channels of communication and sharing in your community, mobilise local actors and encourage the transmission of ideas. Open to informal learning settings and industry. Involve more players from the out-of-school world in the process.*
- **Increase Reflectivity**- *Even in a dense mass of radioactive material there are particles which stray outward, away from the other atoms.*

From Scenarios to Practice: The OSOS Open Schooling Roadmap

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*Surrounding the nuclear fuel in a highly reflective shielding directs those stray particles back toward the center to increase chances of a reaction. Reflective practices can help collect ideas which would otherwise float away into thin air. Through **self-reflection and peer-assisted-reflection, innovators influence themselves and others around them** by directing their discoveries back into the system for deeper investigation.*

Our schools should be incubators of exploration and invention. They should be accelerators of innovation. They should promote Open Schooling. School leaders should set a vision for creating learning experiences that provide the right tools and supports for all learners to thrive. Teachers should be collaborators in learning, seeking new knowledge and constantly acquiring new skills alongside their students. **A holistic approach to innovation is needed.** We need to facilitate the process with a provision of the necessary catalyst:

*This is the foreseen role of the OSOS project, to describe and implement at scale a process that will facilitate the **transformation of schools to innovative ecosystems**, acting as **shared sites of science learning** for which leaders, teachers, students and the local community share responsibility, over which they share authority, and from which they all benefit through **the increase of their communities' science capital and the development of responsible citizenship.***

Five Reasons to invest on the development of an Open Schooling Agenda

OSOS can provide the participating schools with numerous opportunities to engage in local, national and international activities with lasting benefits for the school heads, the students, the teachers, the school and the local community. Here are the main ways in which the school could benefit:

1. Provide unique professional development experiences for school staff (Increase Mass)

In the framework of OSOS project community building is considered as a major professional development activity. Giving teachers and school heads the opportunity to get involved with international professional development opportunities is a great way to invigorate the school teams. More and more teachers are expected to be involved and to contribute to the shared vision of school openness. The activities enable teachers and other school employees to acquire new learning and teaching methods and tools, and explore a variety of learning and teaching practice across Europe and beyond. The proposed OSOS activities (called incubators and accelerators according to their aims) are catalysts for change – for participants and the whole school.

2. Connect with stakeholder organisations, policymakers and the community (Increase Density)

environment. School heads, staff members and students can benefit through participation in activities that enable them to engage with local businesses, research centers and science centers, policymakers and community members. Such stakeholder engagement can help tackle challenges in school (e.g. student motivation, low achievement, dropout rates, gender issues) through forging links with parents and social services, as well as businesses and other organisations that may help improve the relevance of learning. Stakeholder engagement may also help raise the school's profile locally, improving teaching and learning by providing opportunities in real world settings.

3. Expand pupils' horizons and raise their aspirations (Increase Temperature)

OSOS activities can enable staff and students to work with partner schools on learning activities and learn from other students and teachers. Through collaborative activities with peers in other countries, students can move beyond the textbook and explore data, knowledge and experiences in a direct and immediate way. The proposed OSOS activities include projects and activities that simulate the real scientific work (e.g. nanotechnology applications in different sectors, organic farming and healthy food, implementing project with aero-space industry, analyse data from large research infrastructures like CERN or networks of robotic telescopes). In this way, students develop key skills and intercultural understanding and gain new perspectives on their own learning. Teachers and students can also collaborate online with other schools through ERAMSUS+ and eTwinning activities that will be promoted



Five Reasons to invest on the development of an Open Schooling Agenda

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by the project or proposed by the schools of the network.

4. Improve teaching and learning (Increase Reflectivity)

Whether the aim of the school is to improve teaching and learning, foster interdisciplinary and project-based learning, in the framework of OSOS schools will have numerous tools available to assess their innovative practices and provide valuable feedback on students' performance while being involved in the OSOS activities. European activities provide opportunities for staff and pupils to develop and reflect on learning and teaching together with staff and pupils from other schools and organizations (such as universities, libraries, museums and science centres).

5. Raise your school's profile

Being part of international activities signals that the school is ambitious, with bold expectations for pupils and staff. By sending teachers and students abroad, and working with other schools and other organizations in the framework of OSOS, the school will demonstrate its potential to evolve to a reference point for learning in the local community. The OSOS approach recognizes the unique achievements of the participating schools through the establishment of a core network of high performing school communities which will name Open School Hubs demonstrating these schools will act as reference points for all participating schools. These schools are expected to develop innovative curricula, or implement new ways of teaching, all of which increase school's standing and influence at local, national and international level.

OSOS project aims to support the transformation of a number of schools into open schooling environments in the participating countries. The project team is working with numerous experts and with the national coordinators who are researching the specific context and work with local governments to build their capacity, and that of school leaders and teachers in a select number of schools, to establish the desired open schooling cultures. A tailored package of supporting materials, including the **OSOS Self-Reflection Tool** in line with the **Open School Development Plan**, have been developed to support schools as they transform themselves into **Open Schooling Hubs**. Guidance is also provided to local and system-level stakeholders.

The Open Schooling Roadmap offers a clear and step-by-step outline of how a school can embark on the process of opening up to its local community, through the use of RRI-enriched student- projects that address local issues and propose solutions that have been studied with the support of stakeholders such as universities, science centres, museums and businesses. Despite the detailed and rigorous nature of its guidelines, this document is not a one-to-fit-all solution and has not been designed with the purpose of “locking” a school to an inflexible process. Schools, according to their needs, past experience, local conditions and culture are rather free to select aspects of this mechanism and implement it accordingly and in a non-linear approach.

This document has to be used in parallel with the **OSOS Strategies** documentation that exemplify the project’s overall approach on how we can best support schools in their attempt to evolve, transform and reinvent their structures towards a more open, localised and socially responsible learning environment. In this framework, schools will facilitate open, more effective and efficient co-design, co-creation, and use of educational content (both from formal and informal providers), tools and services for personalized science learning and teaching that will form the basic ingredients for innovative student projects. Such projects understood as best practices are the so-called incubators and accelerators on school innovation. The OSOS Open Schooling Roadmap is making an attempt to combine the overall OSOS services in a step by step guide.

Figure 1 presents a graphical representation of OSOS Open Schooling Model that represents the innovation process as a “**chain reaction**”:

- we need to **“increase the mass” of the innovators**,
- we need to **bring them together to exchange ideas and experiences (increase density)**,
- we need to **motivate them by providing them with tools according to their educational needs (increase temperature)**,
- we need to **reflect on their practices and provide guidance for future actions (increase reflection)**.

Figure 2 presents the OSOS Package of supporting services and tools which is organized in the same way to support the transformation process. Finally Figure 7.3 presents a possible way of implementing the Open Schooling Roadmap in a three phases period (three Academic Years) while the school is trying to stimulate, incubate and accelerate the innovation process. The process could last longer while different factors (both external or internal) could act as obstacles of the process.

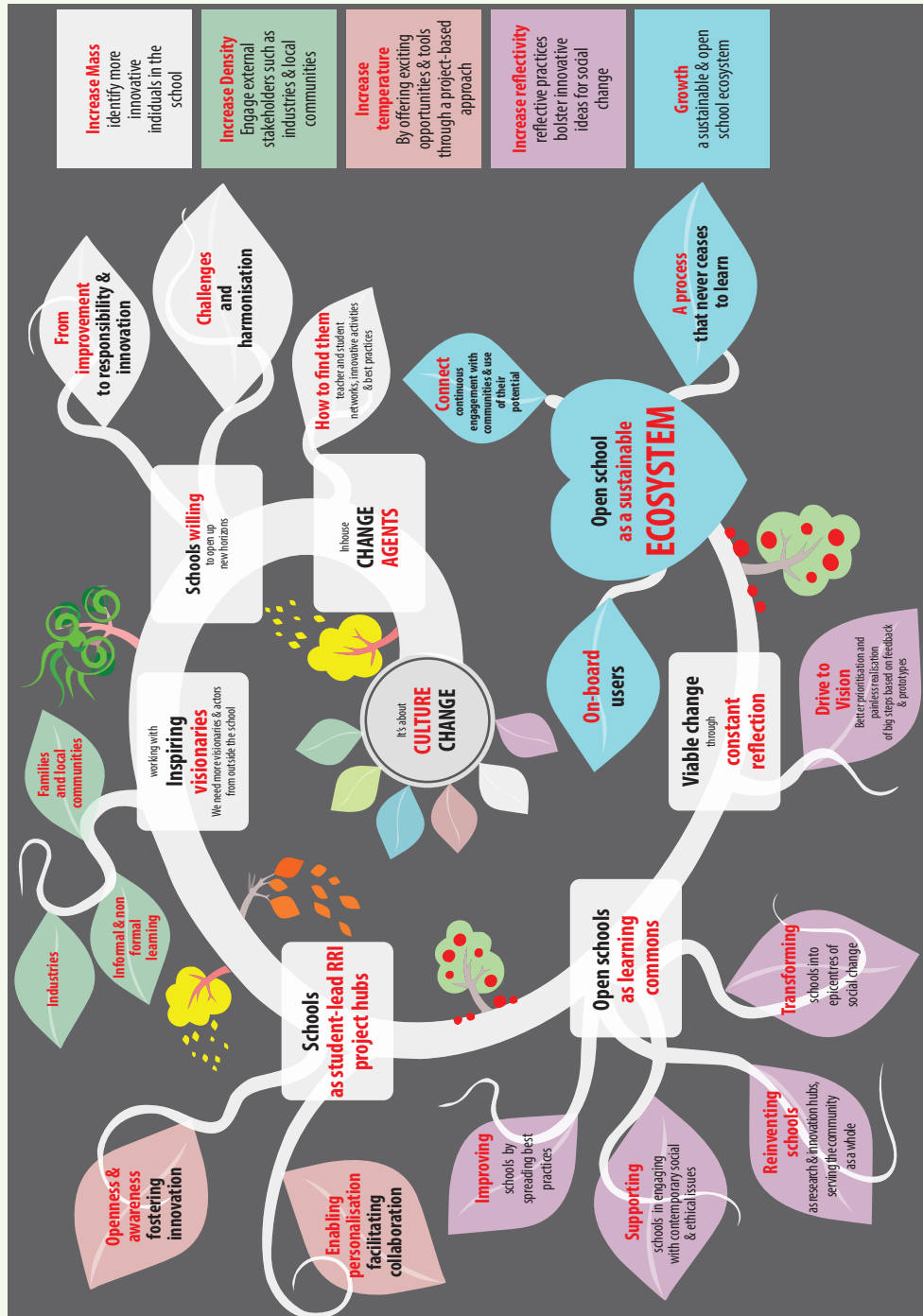


Figure 1: The full cycle of the school transformation with the support of the OSOS support services. The process starts with the Change Agents who are becoming Inspiring Leaders of the school community. The OSOS support services offer open, interoperable and personalized solutions meeting the local needs, supports school leaders capture innovation, to decide on the appropriate strategy to diffuse innovation to the school and through constant reflection is guiding them towards the transformation of the school to Open Schooling Hubs and finally to sustainable innovation ecosystems.

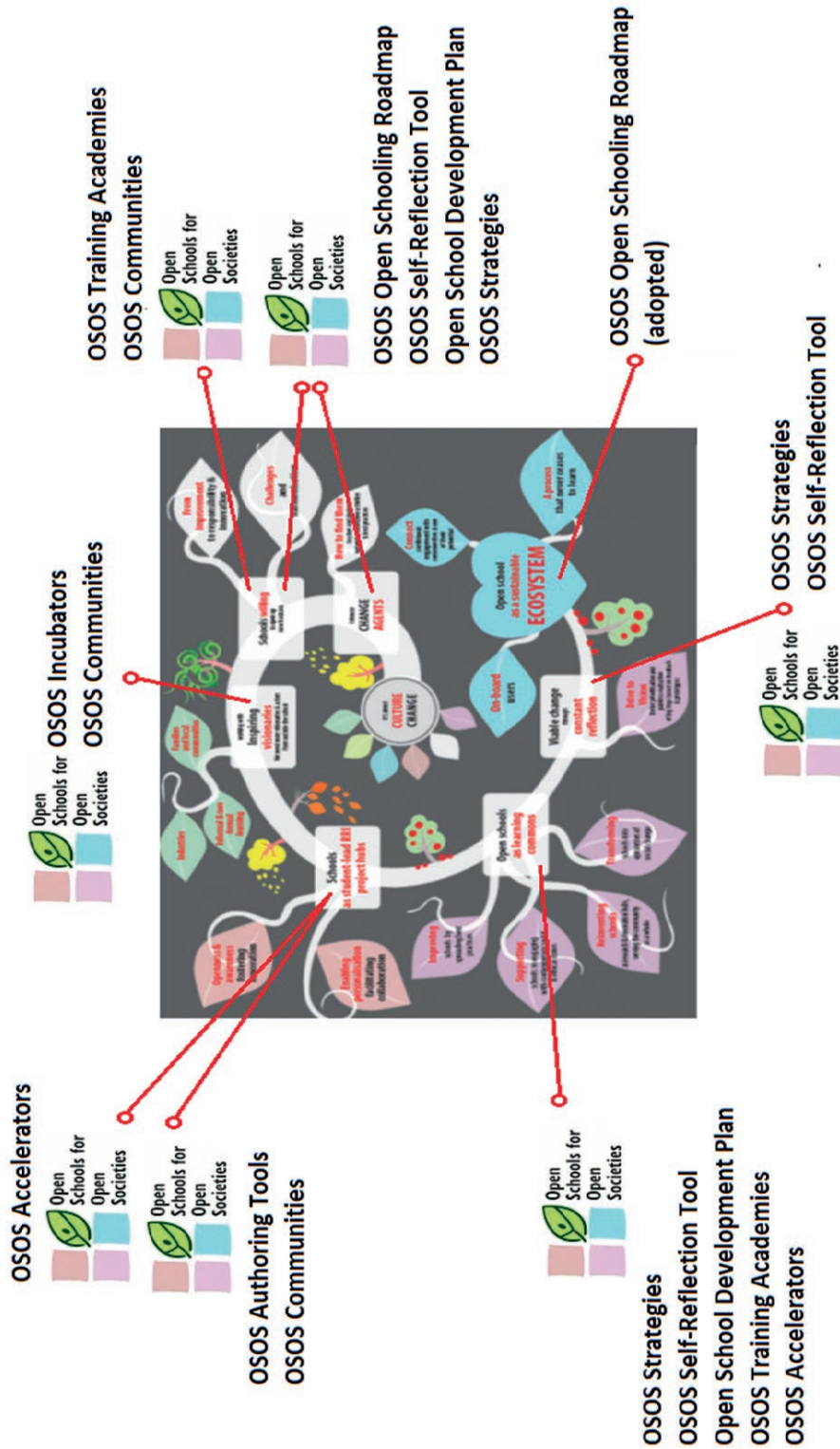


Figure 2: The full cycle of the school transformation with the OSOS support services that will be available to the school heads and to teachers who will be involved in the process. The OSOS Documentation (Open Schooling Roadmap, OSOS Strategies and the Open Schooling Development Plan) are indicated also in the figure.

Phase 1

Step 1: Assess School Openness

(OSOS Self-Reflection Tool)

Step 2: Plan for Action

(School Development Plan, OSOS Strategies)

Step 3: Creation of the Change Team

(Community Building Tools - OSOS PLatfrom)

Step 4: Empower the Change Team

(OSOS Incubators and Accelerators, Training Academies - OSOS PLatfrom)

Step 5: Extend Learning Beyond School Classroom

(OSOS Incubators and Accelerators - OSOS PLatfrom)

Step 6: Assess School Progress

(OSOS Self-Reflection Tool)

Phase 2

Step 1: Plan for Action

(Update of School Development Plan)

Step 2: Establish a Culture of Inquiry, Exploration and Innovation

(OSOS Strategies)

Step 3: Promote Team Learning and Collaboration

(Community Building Tools - OSOS PLatfrom)

Step 4: Empower the Change Team

(OSOS Incubators and Accelerators, Training Academies - OSOS PLatfrom)

Step 5: Extend Learning Beyond School Classroom

(OSOS Incubators and Accelerators - OSOS PLatfrom)

Step 6: Assess School Progress

(OSOS Self-Reflection Tool)

Phase 3

Step 1: Creating a forward looking Open School profile

(OSOS Strategies, Informed by all the lessons learnt in the process of opening up, Adopted Open Schooling Roadmap)

Step 2: Creating Opportunities for Deeper Learning

(OSOS Incubators and Accelerators, Training Academies - OSOS PLatfrom, OSOS Assesment Tools)

Step 3: Creating Viable Change

(OSOS Incubators and Accelerators, Training Academies - OSOS PLatfrom, OSOS Assesment Tools)

Figure 3: A possible way of implementing the Open Schooling Roadmap in a three phases period (three Academic Years) while the school is trying to stimulate, incubate and accelerate the innovation process. The process could last longer while different factors (both external or internal) could act as obstacles of the process.



1

Introduction

1 Introduction

*Innovation is not an isolated event; it is a movement. Innovation is the word we use when an idea is so well received that it becomes the new norm. While a single person trying something new, that person might be considered an innovator, but often this practice does not spread throughout an entire system. However, if people rally around that idea, sharing their failures and successes, this is what we could call **systematic innovation**.*

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As stated in the recent report on “Rethinking education. Towards a Common global goal?” (UN-ESCO, 2015) the changes in the world today are characterized by new levels of complexity and contradiction. These changes generate tensions for which education systems are expected to prepare individuals and communities by giving them the capability to adapt and to respond. Overcoming the complex societal challenges of today will require all citizens to have a better understanding of science and technology if they are to participate actively and responsibly in science-informed decision-making and knowledge-based innovation as it is stated in the recent report to the European Commission “Science Education for responsible citizenship” (EC, 2015) produced in 2015.

On the other hand, there is growing concern, among the world’s developed countries, about levels of student engagement in science learning at school. This manifest itself most obviously in dropout rates, in poor levels of achievement, and in disengagement with what many perceive as a boring and irrelevant experience. However, focusing on students who drop out from school masks a bigger issue, because it only takes account of the visibly disengaged. There is a much larger group of students who do reasonably well in school but do not become self-motivated, self-directed learners: they may appear to succeed in exams but struggle when left to their own devices at University, or at work. Schools and businesses are becoming increasingly conscious of “disengaged achievers”: students who are adept at achieving high marks, but not at dealing with the more complex challenges that they will face as 21st century workers and citizens. Additionally, many disengaged achievers decide that the way learning is “delivered” in school education is not for them and, even though they have the requisite qualifications, decide to end their formal education upon leaving school. Arising from this came two obvious questions:

Which are the main characteristics of the environments which are engaging for the students?

What design features might we need to incorporate into learning activities to see more students deeply engaged?

1.1 Characteristics of the Open Schools

In the framework of the OSOS project the participating schools were supported to set forward an innovation agenda that helps schools to:

- **Promote the collaboration with non-formal and informal education providers, enterprises, parents and local communities** to ensure relevant and meaningful engagement of all societal actors with science and increase the uptake of science studies and science-based careers, employability and competitiveness. With the focus on science learning in both primary and secondary education level the OSOS innovation agenda proposes new and diverse models

of collaborations between the above-mentioned stakeholders. By building on the best of current practice, the OSOS approach aims to take us beyond the constraints of present structures of schooling toward a shared vision of excellence. Such an innovation programme holds great potential. If we want a powerful and innovative and open culture in schools that is self-sustaining, we have to empower system-aware practitioners to create it, whilst avoiding simply creating interesting but isolated pockets of experimentation. We have to instill a design-based approach of **collaborative learning and inquiry between professional practitioners, thus creating a “pull” rather than “push” approach**. To promote such an approach in the current schooling practices, an **ecosystemic standpoint** should be taken from the side of the remedying initiatives. More specifically, the latter should aim to capture the profiles, needs, contributions and relationships of all these school-related actors and elements towards a **sustainable innovation ecosystem** that will operate under a **holistic framework** of organizational learning and promotion of educational innovations.

- **Become an agent of community well-being.** OSOS aims to support schools to develop projects that are proposing solutions to the needs of their local communities. To do so the OSOS approach explores the notion of well-being of the school’s students (including concepts of equity, gender inclusion and empowerment). By creating a model of collaboration with local stakeholders and by using activities that require the involvement of different actors, the participating schools were linked with their local communities in a much deeper level. The adaptation of the activities entails linking their subjects to issues of national interest in connection with the grand global challenges. Schools thus aim to “act locally but think globally”, a motto developed already a few years now but still far from the reality of most schools in Europe today. In this way, these schools enrich the science capital of the local communities and promote responsible citizenship.
- **Promote partnerships that foster expertise, networking, sharing and applying science and technology research findings and thus bringing real-life projects to the classroom.** The project partners, both individually and in collaboration, have been developing, testing and promoting innovative educational applications and approaches for European schools (supported by relevant appliances and resources) for many years, which promote sharing and applying of frontier research findings in schools, supporting the developments of 21st century competences through creative problem solving, discovery, learning by doing, experiential learning, critical thinking and creativity, including projects and activities that simulate the real scientific work (e.g. nanotechnology applications in different sectors, organic farming and healthy food, implementing project with aero-space industry, analyse data from large research infrastructures like CERN or networks of robotic telescopes). Each school bring together representatives from industry and civil society associations who – in cooperation with school community – scan the horizons, analyse the school and community needs and cooperate to design common projects and to propose innovative solutions.
- **Focus on Effective Parental Engagement.** The innovation agenda builds on the notion of

science capital of schools' communities. Whilst science and technology are often seen as interesting to young adolescents, such interest is not reflected in students' engagement with school science that fails to appeal to too many students. Girls, in particular, are less interested in school science and only a minority of girls pursues careers in physical science and engineering. The reasons for this state of affairs are complex but need to be addressed. Many students who express high levels of interest in science may not choose science subjects because: a) they think that choosing science leads only to working in a laboratory; and, b) that science is for other people. These are issues of identity – of science and of the students themselves. For example, the role of students' families in their selection of future career has been much stronger than what previously expected. So, what can be done to modify this situation? The OSOS approach is suggesting four courses of action: effective parental engagement in the projects that are developed by a) *Planning*: Parental engagement must be planned for and embedded in a whole school or service strategy. The planning cycle includes a comprehensive needs analysis; the establishment of mutual priorities; ongoing monitoring and evaluation of interventions; and a public awareness process to help parents and teachers understand and commit to the Open School Development plan. b) *Leadership*: Effective leadership of parental engagement is essential to the success of the OSOS Open Schooling Strategies. A parental engagement programme is often led by a senior leader, although leadership may also be distributed in the context of a programme or cluster of schools and services working to a clear strategic direction. c) *Collaboration and engagement*: Parental engagement requires active collaboration with parents and should be proactive rather than reactive. It should be sensitive to the circumstances of all families, recognize the contributions parents can make, and aim to empower parents. d) *Sustained improvement*: A parental engagement strategy should be the subject of ongoing support, monitoring and development. This includes strategic planning which embeds parental engagement in whole-school development plans, sustained support, resourcing and training, community involvement at all levels of management, and a continuous system of evidence-based development and review.

- **Teach science for difference: Gender Issues.** Instructional methods that foster students' understanding while decreasing competitiveness in science classes might contribute to girls' participation and performance in advanced science classes while also supporting the learning of many boys. The Open Schooling approach recommends replacing the competitive-type classroom environment by a more girls friendly instructional approach in which enough time and conditions are given to think, inquire, and understand thoroughly. This could be accomplished by for example sharing ideas, arguing, asking questions and analyzing data in small groups of students who work in collaborative manner. This is an approach that clearly reduces the competitive nature of the whole classroom (teacher-centred) approach. The OSOS educational activities and projects are based on pedagogical approaches that produce the outcome of proportional participation of both genders. More specifically the proposed standardization process:
 - Adopts and integrates informal and formal educational experiences that intervene and reverse

traditional patterns of low participation; encourage girls' interest, enthusiastic participation, and election of continued study in math and science; increase confidence; and give girls positive images of math and science learning and careers.

- Integrates awareness of gender bias in educational environments, and change organizational commitment, policy, and action to remedy under representation through student and faculty programs, for example, undergraduate departments in engineering, physical science, or computer science making a concentrated effort to increase recruitment and retention.
- Adopts and integrates new courses and curriculum that are gender-neutral or appeal particularly to girls and women. For example, ways of teaching math that utilize girls' verbal skills, sequencing material in computer science to introduce real-world applications of technology before intricacies of programming languages, teaching young girls principles of engineering design and invention in everyday life.

OSOS will identify the "model approaches" to be adopted, its theoretical basis and the research or evaluation basis for the "model," and address the benefits and issues bearing on integration in their educational setting.

1.2 Design Features of the Open School Activities

The activities that were implemented in the participating schools are based on the essential features of creative learning including exploration, dynamics of discovery, student-led activity, engagement in scientifically oriented questions, priority to evidence in responding to questions, formulations of evidence-based explanations, connection of explanations to scientific knowledge, and communication and justification of explanations. These elements support creativity as a generic element in the processual and communicative aspects of the pedagogy and proposing innovative teaching strategies that offer students high participation and enable them to generate highly imaginative possibilities.

At the same time, the OSOS framework is based on the main principles of Responsible Research and Innovation process: **learners' engagement, unlock of their full potential, sharing results and provide access to scientific archives, designing innovative activities for all.**

Based on that, the OSOS Open Schools promote a series of educational activities in the form of real-life projects that utilize innovative ideas and creativity and empowers students to actively engage themselves in the learning process and improve their conceptual understanding in various scientific topics. It is therefore intended that the educational practices and strategies presented allow science educators and specifically late primary and early secondary school teachers to identify creative activities for teaching science. Furthermore, the proposed pedagogy aims to enable teachers to either create new creative activities or to properly assemble parts of different educational activities into inter-

disciplinary learning scenarios. In the framework of the OSOS project the proposed activities had the following four characteristics. They were

- **Placed:** The activity is located, either physically or virtually, in a world that the student recognizes and is seeking to understand.
- **Purposeful:** The activity feels authentic, it absorbs the student in actions of practical and intellectual value and fosters a sense of agency.
- **Passion-led:** The activity enlists the outside passions of both students and teachers, enhancing engagement by encouraging students to choose areas of interest which matter to them.
- **Pervasive:** The activity enables the student to continue learning outside the classroom, drawing on family members, peers, local experts, and online references as sources of research and critique.

These four criteria can provide a useful checklist for teachers formulating their learning designs, but also suggest what a science classroom and a school as an organization needs to offer to become more engaging in itself: **a place-based curriculum, purposeful projects, passion-led teaching and learning, and pervasive opportunities for research and constructive challenge.**

These activities were adapted by the Open School members that involve representatives from educational providers, industries, civil society associations and even students themselves. The activities used in the project promote collaborations and the opening up of the classrooms to the society. The participating schools include both primary and secondary education level and activities were selected and adapted accordingly to fit the different levels.

1.3 The Driving Forces of the OSOS Open Schooling Model

1.3.1 Rethinking How Schools Work

There is a focused movement to reinvent the traditional classroom paradigm and rearrange the entire school experience — a trend that is largely being driven by the influence of innovative learning approaches. Methods such as project based and inquiry learning call for school structures that enable students to move from one learning activity to another more organically, removing the limitations of the traditional timetable. The multidisciplinary nature of these contemporary approaches has popularized the creative application of technology and fostered innovative designs of school models that link each class and subject matter to one another. As learning becomes more fluid and student-centered, some teachers and administrators believe that schedules should be more flexible to allow opportunities for authentic learning to take place and ample room for independent study. Changing how learning takes place in classrooms is also requiring shifts in the business models of schools, which are increasingly becoming more agile and open to trying new approaches.

This trend is largely a response to the overly structured nature of a typical school day, which some be-

lieve hampers learning. Traditionally, bells have signified the beginning and end of each day, ushering students from one class to the next. In many ways, the bell symbolizes the separation of disciplines, making a clear statement that each should be kept disparate. In the past few years, many teachers have made progress toward bolstering interdisciplinary learning, also commonly referred to as integrated studies. Edutopia describes this model as combining “curriculum from two or more disciplines, allowing students to see how ideas are connected.” They point to collaboration, critical thinking, and knowledge retention as three positive outcomes for students. Technology use is at the heart of this design as activities such as integrating 3D printing in science classes and media production into humanities courses become more pervasive.

The goal is for students to understand the various intersections between any subject matter, acquiring a skillset that is desired in the contemporary workforce.

1.3.2 Shift from Students as Consumers to Creators

A shift is taking place in schools all over the world as students are exploring subject matter through the act of creation rather than the consumption of content. A vast array of digital tools is available to support this transformation in K-12 education; indeed, the growing accessibility of mobile technologies is giving rise to a whole new level of comfort with producing media and prototypes. Many teachers believe that honing these skills in learners can lead to deeply engaging learning experiences in which students become the authorities on subjects through investigation, storytelling, and production. Other components of this trend include game development and making, and access to programming instruction that nurtures learners as inventors and entrepreneurs. As students become more active producers and publishers of educational resources, intellectual property issues will become a key component of K-12 curricula.

There is growing support for empowering learners as creators that demonstrate their mastery in forms that surpass traditional tests and worksheets. Emerging instructional frameworks are encouraging teachers to use digital tools that foster creativity along with production skills. This trend also implies that teachers are increasingly becoming creators, too, and are therefore in the position to lead activities that involve developing and publishing educational content. Large scale initiatives as Open Discovery Space (portal.opendiscoveryspace.eu) have helped teachers streamline the process of creating, editing, and publishing educational materials. Such tools offer a way for teachers to develop digital lesson plans that are in line with the needs of their classrooms. As teachers become more comfortable using media, they can offer better guidance to their students.

1.4 Valuable Guidance for Schools to develop their own Roadmaps

In our view the OSOS school environments should provide more challenging, authentic and higher-order learning experiences, more opportunities for students to participate in scientific practices and tasks, using the discourse of science and working with scientific representations and tools. It should enrich and transform the students' concepts and initial ideas, which could work either as resources or barriers to emerging ideas. The OSOS schools' environments should offer opportunities for teaching tailored to the students' particular needs while it should provide continuous measures of competence, integral to the learning process that can help teachers work more effectively with individuals and leave a record of competence that is compelling to students.

The involvement of the schools to the OSOS project does not impose the implementation of a specific strategy towards openness. Through the intensive collaboration between the school community and the OSOS team we are aiming to examine every collaboration as a separate case. In all cases however OSOS goal is to provide valuable guidance and to develop a sustainable support mechanism to assist both the school leadership as well as the teachers during the transformation process. In this report we are going to present a strategic implementation model and related milestones that could as a pathway towards the implementation of innovation in the school setting.

It has to be noted though that in each school case, in each participating country, multiple factors have to be examined before a design and implementation model will be placed in action. Factors taken into account in each case are: Local legislation and educational policies currently in place, Local educational culture, Current status of the school(s) in regards to existing curriculum/existing educational resources/ selected pedagogical approaches, Current status of the school(s) in regards to administration/teacher readiness towards embracing educational innovation and adopting an open schooling culture, Current status of the school(s) in regards to existing technological infrastructure, Current status of collaborators (government officials/school administrators/teachers/students), Scale of collaboration in regards to number of schools/teachers/students/other participants, Duration of collaboration and Total budget allocated.

In Europe there are many different school systems. An important and very crucial parameter for the introduction of innovation in the school setting is the level of autonomy at school level and the different levels of authority within the schools. The major challenge for OSOS is to find ways to propose activities and approaches that could be used from school heads in countries with a relatively low level of autonomy (e.g. Greece, Portugal, Italy, France) while at the same time attention should be given to education systems that can be categorized as autonomous (e.g. Finland, the Netherlands). In these countries, school heads tend to have a more managerial role that requires the school head to focus on motivational aspects.

The OSOS Roadmap can be perceived as an organisational change methodology, enabling the change agents to introduce the innovative OSOS approach. Well known organizational change methodologies prescribe a recommended pathway of stages or phases, consisting of particu-

lar activities to work through in order to achieve lasting change. In comparison with the most popular organisational change methodologies, the OSOS Roadmap includes the following steps in order to be regarded as suitable for education systems with a high level of autonomy at the school level:

- **Inspiration and Establishment of the need for change**

In some western European countries, teachers and school heads jointly decide on their pedagogic choices. In a few countries, the teachers have the final say in this matter. For both the innovative schools and the more traditional schools this proposed step is a vital part of an innovation implementation plan. In innovative schools there is a need to inspire teachers because the OSOS initiative may be one of several proposed innovations that a school implements. Therefore, the teachers need to be convinced that the OSOS project is more relevant than other options. In traditional schools the emphasis could be put on the urgency to change. These schools (the vast majority of schools in Europe) have less experience with innovative projects. The school heads and teachers at these schools should be made aware of the need to change. This step, the inspiration of teachers and staff should be considered as a continuous process during all phases of the implementation and in most instances one of the main tasks of the school head.

- **Establishing a change team**

In most schools, innovations start small. A few innovative teachers, together with the school head lead the way and enthuse their colleagues during the implementation. School heads will initially engage teachers with low levels of resistance to change. During the project phases, teachers often look for other change agents to further implement the project in other subjects as well. The school head's role is to find the first few change agents and facilitate their work. This support could include an appropriate time compensation scheme.

- **Empowering the change team**

The change agents should be supported by the management of the schools during the implementation phases. Preferably, the change agents will be regarded as role models in their schools. Secondly, the change agents need to be supported by the continuous inspirational efforts of the school heads.

- **Organisational change**

Implementing change requires a teacher to experiment with innovative (from the teachers' perspective) pedagogic approaches. From an organisational perspective, the school head will

1 Introduction

need to implement an environment that supports experimentation by celebrating success and regarding failures as unique chances to learn. In true learning organisations, teachers are supported to take necessary risks (all changes come with risk taking and perceived uncertainty) and feel appreciate when they share the successes and failures.

It's about
**CULTURE
CHANGE**

Inhouse
**CHANGE
AGENTS**

2
**Increase
Mass and Density**

working with
**Inspiring
visionaries**

Schools
willing
to open up
new horizons

2 Increase Mass and Density

Be on the lookout for talent and get more of the right people in your school. The more innovative individuals you have in your school community the greater chance they will influence each other. Open days, workshops, and other in person events are great examples of moments of increased density. You will be amazed at the innovative energy produced by bringing the right people together in a closed space.

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Before schools can embark on innovative practices, they need a clear vision and leadership. More specifically school leaders need to create a shared vision of how science education best can meet the needs of all learners and to develop a plan that translates the vision into action. This vision and planning processes should be based on holistic view of the current innovation status of the school. This transparent overview will allow for more targeted planning to address the specific issues that each school is facing, thus optimizing the efforts to overcome them. The vision begins with a discussion of how and why a community wants to transform learning. Once these goals are clear, science and research findings can be used to open new possibilities for accomplishing the vision that would otherwise be out of reach. A series of system changes can then occur: When carefully designed and thoughtfully applied, innovative projects can accelerate, amplify, and expand the impact of effective teaching practices. However, to be transformative, teachers need to have the knowledge and skills to take full advantage of the process and the outcomes of these project-based activities. In addition, the roles of teachers and teachers' trainers, parents, and learners all will need to shift as scientific inquiry enables new types of learning experiences.

Building teacher and leader capacity is vital to successful transformation. A successful change strategy requires professional development, feedback and support for teachers along with a well-researched monitoring and evaluation system. Organizational capacity, strategic planning and quality assurance are crucial parameters during the transformation journey.

At the kick-off of the transformation journey

In this year the school has activated in greater measure moments of confrontation between teachers, meetings for the elaboration of projects in collaboration with the territory. A Tutor has been appointed who has defined useful materials in the planning phase of activities with the territory, monitoring and evaluation. The materials have been distributed to other class council teachers. The number of stakeholders has increased, and even scientific issues have increased. The objective of next year is to stimulate a greater number of teachers and students in the phase of sharing the good practices started and to involve more teachers and classes in the OSOS project.

IIS_Santorre_Santarosa, Italy

Open Schools must provide learning opportunities not just for students, but also for the teachers. Any significant modification to the way instruction is delivered requires watchful change management. Professional development should be a continuing, integrated part of teachers' instructional careers. Current practiced development requires careful planning, job-embedded and hands-on activities directly linked to the curriculum, plenty of follow-up, built-in evaluation using several assessment techniques, adequate time, sustained funding, and the willingness of educators to take on new and expanded roles. School heads and teachers have to invest time and resources to create a successful implementation and professional development.

There are a series of challenges that schools heads should consider when planning and implementing professional learning for their teachers:

- Selecting and introducing ideas in ways that foster trust and interest;
- Balancing administrator leadership and control versus teacher autonomy and independence;
- Planning, initiating, and monitoring implementation of training that inspires ambition as opposed to ambivalence;
- Ongoing support of industrious implementation, even in the face of challenges or setbacks; and
- Recognizing, celebrating, and rewarding accomplishments in ways that sustain positive change.

These actualities highlight the continuing need to change teaching practices in modern schools. This modification only could be created through professional learning opportunities that confirm currency with pedagogical methods, including developing technologies.

The next section describes the initial actions that need to be taken by schools' heads willing to take up the opening-up challenge proposed by OSOS. The chapter includes tips for success that could facilitate the process.

2.1 Establishing and Empowering a Change Team

This initial phase is focusing on the analysis of the school needs and has the aim to identify areas in which the school can best demonstrate innovative approaches and projects. The development of a **critical mass of Change Agents**, innovative teachers who will share the vision of the school head to take the school to the next level, is of major importance at this phase. Initial innovative scenarios are being implemented to pioneer future-oriented practices and to experiment with scientific data and resources as well as with innovative technological services and practices. At this phase, the OSOS project offers a rich database of creative initiatives with access to numerous resources, guidelines and support (also online through webinars and hangouts) as well as examples for the coordination of action plans offering funding opportunities for the realization of the school action plans focusing on teachers' professional development and the adoption of an **Open Schooling Development Plan** for the participating schools. Obviously, each school should strive to include all members in a journey for change. Yet resistance to this change is always a possibility and OSOS provides a set of actions that address the issue. It is however expected that when discussing an Open Schooling model, the K-12 administration will place significant efforts into cultivating a continuous teacher development attitude, not just by providing external mentorship to the teachers, but by encouraging open sharing of resources and experiences (both positive and negative) within the school and beyond.

2.2 Supporting Behavioural Change

Apart from their training, for teachers to introduce innovation in their everyday routine, they will have to per-

form a change in behavior and to adapt a new culture and philosophy. For the OSOS approach to assist this change, we must introduce a solid theoretical framework and underline the main actions that need to be taken. There are four key prerequisites for accelerating and establishing change in the school environment:

- **A purpose to believe in:** “I will change if I believe I should” The first, and most important, condition for change is identifying a purpose to believe in. In our case, we must persuade teachers of the importance of scientific literature in terms of social value, importance to their students and personal achievement through learning and teaching these important subjects. We must carefully craft a “change story” underlining the benefits that the project can offer to all the involved actors. Furthermore, we must cultivate a sense of community, making the teacher feel part of a cohesive multi-national team. This sense of belonging will prove very important for motivating teachers and asking them to take then next, possibly “painful” steps, of learning new skills.
- **Reinforcement systems:** “I will will change if I have something to win”. From a pure behavioristic point of view, changing is only possible if formal and informal conditioning mechanisms are in place. These mechanisms can reinforce the new behavior, penalize the old one or, preferably do both. In our case, we can use informal reinforcement patterns in order to make teachers commit more to our project. A short list of such methods could include competitions, challenges, promoting the best teacher created project or lesson plan, offering e.g. the participation to a summer school as rewards.
- **The skills required for change:** “I will change if I have the right skills”. A change is only possible if all the involved actors have the right set of skills. In the case of the OSOS project, we should make sure that our training program is designed in such a way that teachers acquire all the skills they will need, both technical and pedagogical.
- **Consistent role models:** “I will change if other people change”. A number of “change leaders” will need to be established, acting as role models for the community of teachers. These very active and competent teachers will be a proof of concept for their colleagues that the change is indeed feasible, acceptable and beneficial for them. To achieve that we will have to identify the high flyers among the participating teachers and pay special attention into motivating them, supporting and encouraging them.

2.3 Promoting Team Learning and Collaboration among the School Staff

Open schools should promote professional working and learning cultures that motivate teachers and school heads. Fostering a desire and providing capacity in schools to learn and improve together will help teachers and school heads better adapt to changing needs of learners and society. Motivation can be influenced by internal and external factors and should be taken into account when considering the recruitment and retention of staff. Collaboration, distributed leadership and networking offer significant potential for a professional culture that supports working and learning in an open school. The open school is rooted in a shared ethos and culture around learning and improving collectively. The school is characterized by its promotion of team learning and collaboration, which is seen as a defining direction in transforming practice. In an open school environment, a range of dispositions among members of staff must be developed, and allowed to flourish.

2.4 Establishing a Culture of Inquiry, Exploration and Innovation

Establishing a culture of inquiry, exploration and innovation is one of the key dimensions of the open schooling concept, linked to the opportunities for staff to innovate, take risks and experiment in a spirit of inquiry and open mindedness that leads to better learning. This will stimulate teachers' motivation and competence to engage in research with the purpose of informing and enabling action across the system. Researchers should have opportunities to disseminate their work, share expertise, and exchange information and ideas with students and teachers.

2.5 Establish a culture of trust and professionalism

It is important to establish a culture of trust and professionalism as a condition that supports learning in an open school environment. The shift in culture is critical to making sure teachers feel supported and empowered to take on new roles, and to ensure that daily work and interactions are aligned to the open schooling plan and vision. Trust empowers individuals to be their best selves and creates a sense of shared accountability between and among the staff. Shared accountability can encourage greater feelings of trust among teachers and between teachers and school heads. School heads who trust teachers and treat them as professionals may also invite teachers to share in the leadership of the school with them, meaning teachers have substantial influence on school-based decisions, especially around issues of teaching and learning. Teachers feel more comfortable wearing multiple hats—formally and informally assuming roles such as grade-team coordinator, teacher mentor, teacher leader, and coach. In this new paradigm, teachers also often take on responsibilities many principals save for themselves, such as hiring staff, creating school schedules, developing partnerships with out of school organizations or businesses, and even dealing with funders. In a culture of trust and professionalism, school heads value their teachers' vast experiences and wealth of knowledge and want them to be active participants in the construction and tailoring of professional development. Because teachers design their own professional development, they are very engaged and work productively with their colleagues to ensure that professional development is growth-driven, collectively constructed, context specific, and embedded in the school.

2.6 Modelling and Growing Learning Leadership

Leadership is the essential ingredient that binds all of the separate parts of the Open School together. Learning leadership provides direction for learning, takes responsibility for putting learning at the centre of the school's mission, and translates vision into strategy so that the organisation's actions are consistent with its vision, goals and values. It is at the heart of daily practice in Open Schools. By engaging in professional learning as Change Agents and creating the conditions for others to do the same, school heads model and champion such professionalism throughout the school and beyond the school's boundaries. School heads have a vital role in establishing a learning culture and promoting and facilitating organisational learning. They are responsible for

shaping the work and administrative structures to facilitate professional dialogue, collaboration and knowledge exchange, all of which are crucial for promoting organisational learning in schools. They have to create a safe and trusting environment in which people can change their behaviour, take initiative, experiment and understand that it is expected that they challenge the status quo. This means that school heads too need to develop the capacity to challenge their own habits and current ways of thinking and operating. School heads need to realise that becoming an Open School requires adaptability and creativity, and depends on how they interact with their staff, particularly when staff resist change. In Open Schools, staff are encouraged to participate in decision making. Distributed leadership develops, grows and is sustained through collaboration, team work, and participation in professional learning communities and networks. Research evidence shows that teachers tend to report a greater sense of self-efficacy and more job satisfaction when they are given the opportunity to participate in decision making at school. Evidence also shows that leaders of the most successful schools in challenging circumstances are highly engaged with and trusted by parents and the wider community. Efforts to improve the performance of low-performing students requires school heads to become more involved with partners beyond the school, such as local businesses and community organisations. While committed school heads are key to the success of Open Schools, the support of policy makers, administrators and other system leaders (e.g. local educational authorities, educational counselors etc.) is crucial. They encourage professional learning and development, promote innovations and school-to-school collaboration, and help disseminate good practice. Without government/policy support for collaboration and collective learning, Open Schools will continue to operate in isolation (if at all), especially in an age of accountability.


An important cultural center for the community

In a small country as Merlara, the school is an important cultural center. The OSOS project allows our school to enhance her role among the local community and make the teaching/learning more interesting for the students. Students played a very active role in the project because they chose the topic and they propose some activities. They were aware to have an important message for the community and they appreciated to raise awareness about the environment. At the same time, they were interested really in the activities outside the classroom (especially the organic garden and the exhibitions). The students were involved in interdisciplinary project so they were able to learn beyond the singular subjects.


The school also wanted a more deepen collaboration with parents and other stakeholders in order to enhance the education system but also to have the possibility to show to the community the great work students and teachers were doing every day.

School of Merlana, Italy

2.7 Stories of inspiring transformation - Increasing Mass



Ort Dafna
Israel



Open
Schools for
Open
Societies

"Ort Dafna" school is a middle school located in Kiryat Bialik.

The school strives to educate every student in the school to be a thinking person, with Jewish and universal values, an involved citizen, an entrepreneur who contributes to the community and society and an autonomous person who realizes himself and functions well in a changing society.

8th and 9th grade students at ORT Dafna Middle School in Kiryat Bialik, Israel, worked in an OSOS project as part of their math classes. Their plan focused in initiating educational collaboration between several schools in the town. As part of their math studies, students created "Escape Boxes" focused on geometry. Escape Box is a game designed for a group of participants whose purpose is to crack the code for opening the box by struggling with tasks, puzzles and clues. In this way, the students, who work in teams, practice the subjects taught in geometry in an experiential way that increases motivation for mathematics studies. At the same time, they also develop skills that are particularly relevant to 21st century life: communication, teamwork collaboration, critical thinking, creativity and innovative thinking. As part of this opening up action the students delivered math Escape Boxes to the younger students in nearby schools.

The activity allowed Elementary Students to learn geometry in a novel and nice way. As one of the students said: "It was really fun. We solved exercises in math, but it didn't feel like a lesson, it was more like a game." Another student stressed, "It was really nice to me that the people who gave the activity were the students and not the teachers."

This type of OSOS engagement has left a great impact on the city's educational setting. The project has led to the creation of a learning community in the town, which consists of several schools that can now collaborate with each other. This unique interpretation for the OSOS approach, in which older students teach young students, has two advantages: On the one hand, it is a great opportunity for older students to step into their teachers' shoes, take on responsibility and teach other children - and on the way to learn for themselves more significantly! Indeed, all Middle School students agreed that it was an empowering and growth experience for them. On the other hand, this is also an opportunity for ORT Dafna to make quality contacts and get closer to the Elementary Schools around it. After all, it is the students of those Elementary Schools that will go in a few years to that Middle School.

This is a wonderful example of how one aspect of the OSOS Open Schooling Roadmap, focusing on Increasing Mass and Density, where mass here is understood a critical group of schools, teachers and most importantly students are coming together with a clear development plan to enrich STEM education with an excellent innovation (that of escape boxes), addressing at the same time the theme of collaboration, one of the most vital skills in today's school education.

2.8 Stories of inspiring transformation - Increasing Density



As part of its engagement with OSOS, Confey College in Ireland started to develop a community garden with the intention of bringing the wider community in to work with students on sustainability, agriculture and construction projects. The local men's shed where extremely supportive and many sessions were spent with a wide selection of the students. Substantial donations of materials were received from local businesses and educational establishments. Crops grown in the garden were used in home economics classes as well as being supplied to some of the elder members of the local community. There was a real focus on growing traditional Irish crops. Among these were the lumper potato, the variety that has no blight resistance and was a major factor in the Irish Famine. This was used to bring history to life with classes in the school. Wild-flower seeds, and the 120 tons of topsoil from prime agricultural land, which grew a massive crop of poppies, both helped to bring in and support colonies of local bees. The garden is a huge success and continues to grow from strength to strength, making a focal point of the school and the local community.



3

**Increase
Temperature**

**Openness &
awareness
fostering
innovation**

**Enabling
personalisation
facilitating
collaboration**

3 Increase Temperature

The more opportunities you have for teachers to interact with other stakeholders, the more likely these innovative ideas are to move. Open the channels of communication and sharing in your community, mobilize local actors and encourage the transmission of ideas. Open to informal learning settings and industry. Involve more players from the out-of-school world in the process.

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OSOS aims to support schools to establish effective collaboration with external stakeholders. Through the development of a European Network of schools, science centers and museums, industries and local communities OSOS provided a common basis/experience for “connecting” teachers across schools and external organizations, within and across national boundaries – engaging them in an ongoing exchange of experiences across school, regions and countries. An extended (beyond the school) community of practice can provide a structure for fostering growth, sharing experiences and best practices and enhancing learning goals. Partnerships and capacity building for change are equally important at this stage. For example, a public-private education partnership has the potential to be a significant catalyst for systemic change. Science Centers and Museums could also catalyze the transformation process by bringing in their open and creative culture. Outreach groups of research organizations could offer unique insides on how science works as well as on how scientists work. Communities and local business as well as industrial partners can contribute to the school openness at this level. The selection of the partners must be done according to the School Development Plan and the real needs of the school. These communities are sharing responsibility on students learning and they are developing innovative and meaningful educational activities related to the school needs. In the framework of the proposed educational activities the consolidation of good practice was achieved by:

- **Bringing into the classroom a unique collection of digital resources and tools** that are based on real-world problems. The resources will involve students in finding their own problems, testing ideas (from small to big ideas in science), receiving feedback, and working collaboratively with other students or practitioners beyond the school classroom. The eLearning tools will provide scaffolds that enhance learning, support thinking and problem solving, model activities and guide practice, represent data in different ways, and form part of a coherent and systemic educational approach.
- Giving students and teachers more opportunities **to evaluate the quality of their own thinking and products** for feedback, reflection, and revision.
- Giving students and teachers the **opportunity to interact with working scientists**, receive feedback from multiple sources.
- **Building local and global communities where teachers, teacher trainers, education policy makers, parents, students, practicing scientists and other interested members of society** are included in order to expand the learning environment beyond the school walls and expand opportunities for teachers’ professional development. This will include helping teachers to think differently about students and learning, reduce barriers between students and teachers as learners and creates new partnerships among teachers, students and parents.

An inclusive environment to support the local community

The school team decided to add more aspects to one of its current projects, which dealt with technological solutions to people with disabilities. In order to reach this goal, the team looked for relevant stakeholders in the community and started to contact with them. A significant part of the improved project was an encounter of the students with the people from the disabled institute. The students performed interviews with the people, taking advantage of the specific tools brought by their teachers.

The students began to work on the solutions to the problems they defined beforehand. Part of the work was done inside to workshop of the Bloomfield Science Museum in Jerusalem, with the assistance of the museum's experts.

Further on, the school recruited more people from the community, including parents, retiree people from technological subjects, former students, etc. The school initiated a hackathon event in which the students worked on technological solutions for the problem defined by them (after the interviews with the disabled people) – working in collaboration with the community stakeholders that were specially recruited for that.

Reut Middle School, Israel

"Bio-hackathon" in Haifa, Israel. 160 students from Reut middle school - an Israeli OSOS Hub - worked on technological solutions based on biomimicry principles and inspired by nature. The students, together with mentors from the local community, prepare their projects to the city event in April - in which all OSOS schools in Haifa will present their works.



At this stage the aim is to diffuse innovative practices in numerous areas (curriculum, parental engagement, interactions with actors outside from the school) of the school operation. The OSOS approach aims to encourage the uptake of project-based and resource-based learning practices and to engage a wider school community (by involving more teachers in the projects and initiatives, technical staff, parents, community members, local industry) in implementing innovative projects in various curriculum areas, as well as to reflect on the use of tools, resources and practices through the systematic assessment methodology that will be set in place to act as a reference system for the school development as an Open School. This phase aims to create the steady and supportive development of new learning methodologies, leading to sustained improvement. The development of strong communities of practice around the school-lead projects is regarded as a crucial element in the success of proposed interventions. At this phase, the OSOS offers numerous tools for the school communities. Apart from community building and support tools numerous content creation and content delivery tools will be available for students and teachers. The aim is to help them to become creators of educational activities which will reflect on the real educational needs of their classrooms as well as they are providing solutions to their local communities. They will be able to adopt existing content, enrich it with numerous resources and tools in order to provide integrated solutions to the local problems. The OSOS team will adopt the following four-step process in guiding students to develop their projects:

3 Increase Temperature

- **Feel:** Students identify problems in their local communities. They can also select topics related to global challenges. Students observe problems and try to engage with those who are affected, discuss their thoughts in groups, and make a plan of action, based on scientific evidences.
- **Imagine:** Students envision and develop creative solutions that can be replicated easily, reach the maximum number of people, generate long-lasting change, and make a quick impact. They are coming in contact with external actors, they are looking for data to support their ideas and they are proposing a series of solutions.
- **Create:** Students are implementing the project (taking into account the RRI related issues) and they are interacting with external stakeholders to communicate their findings.
- **Share:** Students share their stories with other schools in the community and local media.

HOW TO ENRICH THE CLASSROOM WITH RRI

The integration of Responsible Research and Innovation (RRI) principles can be strongly beneficial for students, as it supports them in the development of critical thinking and collaborative learning skills while accommodating multidisciplinary and stronger student engagement that is crucial for achieving a society of responsible citizens. Hence, it is essential for the OSOS project to lay out guidelines that will support the implementation of RRI-enriched science student projects.

- When researching student projects, critical **considerations on gender balance and social inclusion** can be triggered while learning about different roles and levels of expertise needed in collaborative endeavours and reflecting on their importance in real contexts.
- Teachers can dedicate some time in identifying and reflecting on **key RRI-aspects** related to particular lessons.
- **Reflection and discussion games** could be used to trigger talks and debates on social issues, scientific issues, ethical and legal aspects of specific topics. Considerations on the sustainability and ethical aspects of certain scientific process processes would also address the RRI areas of anticipation and reflection and it could easily be implemented in classroom discussions.
- Identification of **attractive research questions** that students could solve through the utilization of scientific methods often used in research methodologies. In particular, the organization of events (such as workshops, exhibitions, open days or school fairs) with the aim of disseminating the results of a class activity or a school project supports the acquisition of communication and reflection skills and can be especially relevant for RRI processes if it involves stakeholders, such as parents, external experts and local communities.
- Prior to introducing RRI principles teachers should also embark on a self-reflection process to determine how RRI-oriented their practices are. Teachers may also develop lesson plans and/or seek professional development courses.

The following sections describe the actions that need to be taken by schools' heads willing to take up the

Sustainable Specialization

The characterisation of olive oils in terms of cultivation variety, geographic origin, genuineness and quality is a matter of great interest for the local community of San Giovanni in Fiore (Calabria, Italy) where the school is located. Oil is an important resource for the perspectives of economical and commercial development of the countries of the Mediterranean.

Samples of extra virgin olive oils obtained from the olive trees of the territory of San Giovanni in Fiore (CS), Italy, and samples common brands of extra virgin olive oils sold on the national territory, have been analysed according to EU regulation n. 61/2011 of the Commission of 24 January 2011.



The project allowed to know local economic realities interested in the activities promoted by the schools and to promote skills that can be made available to the territory.

IIS DaVinci, Italy

3.1 Create shared responsibility for student learning

First, a learning culture must be established that values the need to learn, as well as students' need to learn how to learn, to become self-directed, and to develop an academic mindset that potentially will help them to consider scientific careers in the near future. This culture is established or signalled most commonly through the creation of a clear and visible set of core values that are then reflected in the design of the school, the way in which students are introduced to and oriented to the school, what is assessed, and the consistent language used across the school, including what is posted on the walls. An understanding and reflection of these core values can be seen in everything from the language that teachers and students use to talk about learning to the way the school interacts with the community. The corresponding condition in support of teaching for

deeper learning is a culture in which everyone is collectively responsible for student learning. This culture has to be purposefully established for learners and educators alike, and is most commonly developed by building relationships that ensure learners are known well by both adults and peers, and that there are regular and systemic opportunities for frequent conversations among educators, learners, peers, and other adults.

3.2 Extent Learning Beyond the School

School Heads and teachers who focus on developing an open schooling culture in their schools and classrooms connect learning to real issues and settings in order to make it more meaningful for students. Teachers ensure that there are frequent opportunities for students to experience workplace conditions and expectations and address real world challenges and problem solving by interacting with professionals and experts in relevant fields, taking on a professional role when doing a project, or by connecting historical events to current issues. In addition to connecting to the “real” world, teachers in open schooling environments find ways to extend learning beyond the school and construct powerful student learning experiences in a range of settings. As a result of long-term formal and informal relationships with local businesses, institutions, and community groups, the classroom walls drop away and the entire community becomes an annex of the school in which students have access to rich content, outside experts, additional resources, an authentic place and context for learning, and work based experiences.

LEARNING WITH AND FROM THE EXTERNAL ENVIRONMENT

- The school scans its external environment to respond quickly to challenges and opportunities
- The school is an open system, welcoming approaches from potential external collaborators
- Partnerships are based on equality of relationships and opportunities for mutual learning
- The school collaborates with parents and the community as partners in the education process and the organization of the school
- Staff collaborates, learn and exchange knowledge with peers in other schools through networks and/or school to-school collaborations
- The school partners with higher education institutions, businesses, and/or public or non-governmental organizations in efforts to deepen and extend learning
- ICT is widely used to facilitate communication, knowledge exchange and collaboration with the external environment

We have students attending the Walton club within Trinity college Dublin. Recently Trinity allocated 12 places to our students to attend math tuition on Tuesday nights to help with their junior cert. The higher-level students have shown an increase in confidence and teachers mentioned an increase in their ability with a quicker pace in these two-hour intensive sessions that run over 12 weeks.

Firhouse Community College, Ireland

3.3 Work for Effective Parental Engagement

The OSOS approach aims to facilitate the transformation of schools to innovative ecosystems, acting as shared sites of science learning for which school leaders, teachers, students and the local community share responsibility, over which they share authority, and from which they all benefit through the increase of their communities' science capital and the development of responsible citizenship. The open schooling culture of OSOS will build also on the notion of science capital of students' families. The OSOS approach is suggesting four courses of action: effective parental engagement in the projects that will be developed by

- **Planning:** Parental engagement must be planned for and embedded in a whole school or service strategy. The planning cycle will include a comprehensive needs analysis; the establishment of mutual priorities; ongoing monitoring and evaluation of interventions; and a public awareness process to help parents and teachers understand and commit to the Open School Development plan.
- **Leadership:** Effective leadership of parental engagement is essential to the success of the OSOS open schooling strategies. A parental engagement programme is often led by a senior leader, although leadership may also be distributed in the context of a programme or cluster of schools and services working to a clear strategic direction.
- **Collaboration and engagement:** Parental engagement requires active collaboration with parents and should be proactive rather than reactive. It should be sensitive to the circumstances of all families, recognise the contributions parents can make, and aim to empower parents.
- **Sustained improvement:** A parental engagement strategy should be the subject of ongoing support, monitoring and development. This will include strategic planning which embeds parental engagement in whole school development plans, sustained support, resourcing and training, community involvement at all levels of management, and a continuous system of evidence-based development and review.

Deeper Learning in STEM through Arts

The accelerators used in the school are related to a new classroom with interdisciplinary and multidisciplinary lessons. The interrelations of mathematics, natural sciences and music, of natural sciences and human science are more engaging for the students and inspiring them for deeper learning. Examples are;

- *Fractional music – is exploring the interrelation between mathematics and music. This project is linked to the OSOS accelerator 'Music of Science'. The students were introduced into the vast world of science and arts by the mathematics and music teachers. They were led skillfully to combining their knowledge of music and immeasurability with comparing, adding and subtracting*

3 Increase Temperature

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ordinary fractions. The students gained knowledge through songs, dance and interactive entertainment. The teachers challenged the kids to reflect on the infinity of music and mathematics and their interdependence.

- Stars and galaxies – a project with students of fifth grade; it essentially implements the IBL principle. The students and their parents were involved in pre-set tasks - drawings and mock-ups on space, exploring myths and legends about constellations, stars and galaxies. The students were happy and worked with enthusiasm in joint teams solving their tasks and summarizing their knowledge by completing interactive pyramid. They gained knowledge, developed skills and positive attitude to work.
- A different view on mathematics – an open mathematics lesson where students together with their teacher make a journey in time and space looking for the geometry shapes and body forms in Nature, In churches, museums, ancient homes. This multidisciplinary lesson explores the relations between mathematics, natural sciences, history and society.

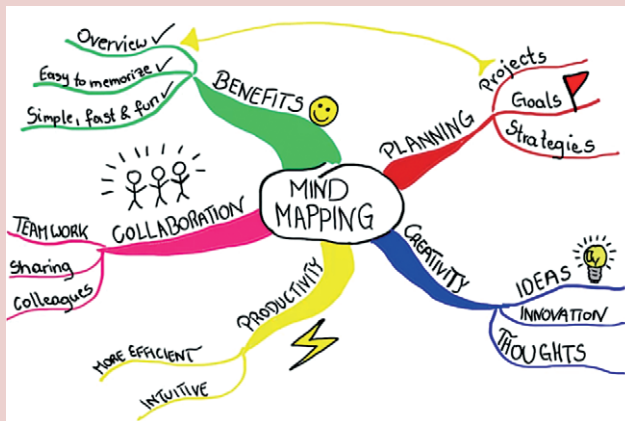


Prof. Ivan Batakliiev, Bulgaria

3.4 Stories of inspiring transformation - Increasing Temperature

The Escola Secundária Jaime Moniz school in the Madeira island in Portugal has been an excellent example of a transformative experience occurring as an exercise in which the effort is focused on increasing temperature: This is a major step in a school's journey where teachers and school leaders attempt to reach and engage the local community in school projects addressing major local environmental issues with a global resonance too. The school joined OSOS in 2018. The school followed the typical OSOS pathway of performing an assessment using the OSOS self-evaluation tool the placed the school in the Consistent category (50). The school devised an OSOS School Development Plan identifying key areas of action and selecting particular accelerators.

11 teachers worked on two different topics. A team of 11 innovative teachers is rather significant in the context of OSOS, as it proves that the school had already mobilised a critical mass of actors.



The Bees for the Future project focused on the importance of Bees for all life on planet and on the discovery of the level of awareness of the communities regarding their importance. In this project, students were also in charge of researching how bees were treated in their island and in what state the bee population was. Students performed a series of research activities (interviews, investigations, etc.) to discover how the people in their island relate to bees and the level of awareness

about their importance. Students also investigated what the people in their community were willing to change to protect the bees. Students worked on solutions that included the planting of particular trees and flowers that support the bee population.



The UV Radiation: Friend or Foe project, focused on the study of the benefits and dangers of the UV radiation on human health. Through this project, students travelled through physics, Astronomy and Human health, discovering the light spectrum, how different animals see differently and how humans should behave towards UV radiation.

In this framework, students were in charge of evaluating the level of awareness of their families in relation to both dangers and importance of UV rays and teaching them about the best health habits related to the topic. 39 projects were created by the students. Developing these projects, students engaged with external professionals to learn more about the topics. Students working on the UV project, visited several places in their community like the local farmers' market, medical centres, pharmacies, their school, etc., to collect information about the level of awareness related to the dangers but also to the benefits of the UV radiation for human health. Students investigated the different levels of UV Radiation throughout using UV sensitive beads and worked on graphics and analysis. Students delivered a series of raising awareness activities and also programmed a game on scratch where a player has to choose from a selection of benefits and dan-

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gers of UV radiation. Finally, the school has been invited to present their work to various events including the local tv station in the island of Madeira.

This opening up exercise has resulted in an increase of 24 points in the level of school openness (74), but, crucially, has facilitated a transformation process in a school that is already making plans for more projects and community engagement for the next academic year.



Improving
schools by
spreading best practices

Supporting
schools in engaging
with contemporary social
& ethical issues

4
**Increase
Reflectivity**

**Reinventing
schools**
as research &
innovation hubs,
serving
the community
as a whole

**Drive to
Vision**
Better prioritisation and
painless realisation
of big steps based on feedback
& prototypes

Transforming
schools into
epicentres
of social change

4 Increase Reflectivity

Through self-reflection and peer-assisted-reflection, innovators influence themselves and others around them by directing their discoveries back into the system for deeper investigation.

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Responsive and creative use of the outcomes of the projects which will be developed in the framework of the process is a powerful way to improve curriculum and assessment outcomes for students, teaching practices and for the school as organization. Technology-enabled assessments and support mechanisms based on analytics support learning and teaching by communicating evidence of learning progress and providing insights to teachers; school heads, policy makers; parents; and, most importantly, the learners themselves. These assessments can be embedded within learning activities to reduce interruptions to learning time. For example, the organization of the inquiry activities in the framework of the students' project preparation allows for the introduction of methods to analyze the effects of the implementation of such activities that fostering complex problem-solving abilities.

The objective of this phase is to accelerate the educational changes regarded as effective and to expand them to significant parts of the school, always keeping in mind the school's main needs. Attention is given to exploiting knowledge management techniques (sharing what is known within the participating school communities); synthesizing evaluation and accelerating diffusion within national agencies (to reach more users). Insights from the use of the OSOS support mechanism, data from the school communities, the development of the teachers' competence profiles, the content that was created and delivered locally, the interaction of the communities and their members will create a unique data base for future recommendations and for the identification of best practices.

SUCCESS INDICATORS OF SCHOOL OPENESS

- The school has a clear vision and strategy (School Development Plan) detailing how the school will support students and staff become an Open School
- Strategies to encourage Problem Solving, Team Work, Active Citizenship, Critical Thinking and Gender Equality exist
- Strategies/Plans for professional development of teachers to foster a change in behaviour, enabling teachers to adapt to a new OSOS open schooling culture and philosophy
- The school supports the development of an interdisciplinary environment where students/teachers are encouraged try new ideas and approaches exists
- Students identify and align stakeholder needs with matters of local social and economic concern
- School actively promotes the collaboration with non-formal and informal education providers, enterprises and civil society organisations
- School engages in a number of projects which demonstrate external stakeholder involvement
- There is evidence of parental engagement in school projects
- Schools show evidence of engaging in virtual and physical platforms to develop innovative projects, share ideas, identify and collaborate with other schools to develop new projects aimed at addressing the grand societal challenges

- Teachers/students show evidence of adapting activities and linking subjects/projects to issues of national or local interest in connection with the grand challenges
- School has an ongoing system of teacher and student self-reflection, discussion and learning set-up
- Schools set up a system to reflect, track and monitor how open school practices have shaped the school organisational culture
- Schools encourage and engage in reflection, discussion and debates on scientific and social issues
- There is evidence of an economic benefit-associated engagement of all partners
- Schools engage with policy makers to inspire curriculum change

The OSOS proposed best practices (Accelerators) will help innovative schools to proceed more and develop their innovative ideas to new localized projects that could provide new solutions for the school and its community, for bringing the gap between formal and informal learning settings and creating new opportunities for personalization at different levels (student, teacher, school). At this level, innovation has to be the norm in the school operation that will act as an **Open Schooling Hub**, an environment that shares a culture that imports external ideas that challenge internal views and beliefs and, in turn, exports its students – and their assets – to the community it serves.

4.1 Developing an Open School Profile

The core aspects and results of the opening up process, reflected in the use and outcomes various assessment tools and educational activities implementations, can be brought together in a simple but thorough Open School Profile. In order to describe the current situation and the desired future developments, schools should compile their profile at the beginning of the process and adjust the profile during and after the review periods. This is a process that is proposed to be repeated annually. This is a school's window to the world with info about the school, its areas of interest and expertise, information about how the school contributes to local society and how this affects the learners and the perception of the external parties of the school as well. It is also an instrument to attract national and international collaborations, especially in the designing and delivering of RRI projects and on themes and challenges that are shared with other schools, but also with actors such as research institutions, universities, museums, businesses that may also be in the hunt for partnerships.

4 Increase Reflectivity

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Open School Hub: An innovation Hub for the Local Community

Today the school is a professional reference school at the national level. In the community the school is no longer seen as “the school of the ignorant” or the “school of those who do not want to do anything”, to be a school of reference, and this has been verified by the students who choose the school. We have not only students who have retained in his academic career, but also have good students of regular schools, seeking to ensure school academic record, because they want to develop projects that give them a curriculum.



At this moment we no longer have difficulties in involving stakeholders, because when we present our projects in competitions of science and entrepreneurship, we have made known our work and the way we work. In this way, the institutes and universities contact us to develop the projects in partnership with them.

Escola Profissional Oliveira Hospital, Portugal

4.2 Creating Opportunities for Deeper Learning

In such an environment it is important for school heads and teachers to recognize that there are key conditions that support deeper learning outcomes and strategies, and that these conditions are sequential and rely on and build upon one another. The cornerstone condition is a school-wide culture that focuses on learning and promotes the belief that everyone is collectively responsible for student outcomes. These are two different concepts, and both are critically important. There are six strategies and pedagogical practices common across the schools committed to deeper learning outcomes for learners. School heads and teachers must:

- Empower learners
- Contextualize knowledge
- Connect learning to real-world experiences
- Extend learning beyond the school
- Inspire learners by customizing learning experiences
- Purposefully incorporate technology to enhance learning

COMMON PEDAGOGICAL PRACTICES ACROSS THE SCHOOLS COMMITTED TO DEEPER LEARNING OUTCOMES

- **Empowering learners.** Teachers who focus on deeper learning see their first responsibility to empowering students. For this reason, they use pedagogical approaches that help learners become self-directed and responsible students rather than passive rule followers. The centerpiece of instruction is helping students develop an understanding of learning as a complex and ongoing process that entails seeking feedback, revising work and regularly reflecting on what one has produced, as well as on the choices and decisions made throughout the learning process. “Revision toward mastery” is therefore a main feature of the culture and the language used by schools committed to deeper learning. Teachers provide feedback, as well as opportunities for students to receive feedback from peers, reinforcing the idea that learning does not end with their first effort. Improving their work through rounds of feedback, revision and reflection encourages students to better understand the amount of effort required to produce high quality work.
- **Contextualize knowledge.** Teachers who work to achieve deeper learning student outcomes also contextualize knowledge so it is coherent as a way to help learners acquire content knowledge. Teachers use guiding questions, common themes, and big ideas to provide a context for every assignment, classroom activity, and project. Teachers are involving students in project that are relevant to them and to the local communities. Teachers also can involve learners’ projects related to global challenges. Teachers often work together across multiple subjects to design integrated learning experiences to connect their otherwise separate subject-specific content.
- **Connect learning to real issues and settings.** Teachers who focus on developing deeper learning competencies connect learning to real issues and settings in order to make it more meaningful for learners. Teachers ensure that there are frequent opportunities for learners to experience workplace conditions and expectations and address real world challenges and problem solving by interacting with professionals and experts in relevant fields, taking on a professional role when doing a project, or by connecting historical events to current issues.
- **Extend learning beyond the school.** In addition to connecting to the “real” world, deeper learning-focused teachers find ways to extend learning beyond the school and construct powerful student learning experiences in a range of settings. As a result of long-term formal and informal relationships with local businesses, institutions, and community groups, the classroom walls drop away and the entire community becomes an annex of the school in which learners have access to rich content, outside experts, additional resources, an authentic place and context for learning, and work based experiences.

- **Inspire learners by customizing learning experiences.** Teachers who focus on deeper learning inspire learners by customizing learning experiences. Teachers are intentional in establishing strong relationships with learners for the purpose of finding what will ignite their interest to pursue their own learning. Teachers use independent projects to both customize learning and provide inspiration for all of their students.
- **Use technology in service of learning.** Teachers who focus on developing deeper learning competencies use technology in service of learning. Teachers purposefully incorporate technology to enhance, rather than automate learning; regularly employ technology tools to support student learning and to engage learners in their own education; and shift their role away from being the sole gatekeeper to knowledge.

For teaching to shift to facilitate powerful learning experiences like the ones described above - where students are empowered and inspired and learning is contextualized, connected to real life, wired, and extended beyond school - the role of the teachers has to change to that of learning strategist. For a teacher to be a coach of learning, he or she must fluidly shift among a range of roles, including learning designer; facilitator; networker; and an advisor who coaches, counsels, mentors, and tutors depending on what is most needed to promote student learning.

Open Schools for Responsible Citizenship

The choice of the "Debate Competition"¹ and its version in Greek "Διαγωνισμός Αντιλογιών"² has also been guided by our school's interest in the subject. The school had experimented with mini debate contests and activities in the classroom before but used this accelerator to approach the subject of students' critical skills holistically with an emphasis in situating and testing such skills in the context of contemporary scientific issues and challenges. In addition, this accelerator offered another excellent opportunity for building a network of local schools with a similar interest in critical skills and debating in the classroom.

The "Debate Competition" is a competition between 11 year old students, who deliberate on scientific issues affecting contemporary life in all its manifestations. Through the activity students learn to construct good arguments and take position in front of an audience. It is an extended educational activity in which students:

- *Examine aspects of scientific research*

1 <https://portal.opendiscovery.space.eu/en/osos-project/debate-competition-849486>

2 <https://portal.opendiscovery.space.eu/en/osos-project/diagonismos-antilogion-849933>

- *Come in contact with issues of ethics, law, politics and science*
- *Cooperate with their classmates and share information and ideas*
- *Take up different roles (debater, judge)*
- *Take a position on issues that influence our lives*
- *Take action in the school and the local community*

Through this activity, students are expected to:

- *Cultivate their communication skills, by analysing and composing views and arguments, conversing, disagreeing and resolving conflicts*
- *Cultivate their ability to effectively and creatively use the spoken language, so that they can actively participate in their school and wider community*
- *Learn to collaborate, working in groups, sharing information and ideas*
- *Cultivate scientific reasoning, research and study skills*
- *Acquire new knowledge and skills relating to scientific issues and how science influences our everyday lives*
- *Prepare for active participation in school life and adult society as responsible citizens*

Ellinogermaniki Agogi, Greece

4.3 Creating Viable Change

The OSOS Open Schooling Model put emphasis on creating viable change to school settings that lasts and expands. It aims to create strong school networks which are ready to share their experiences with others. It is built on numerous national and international initiatives and provides a unique resource for a school reform towards a more effective school environment. Thinking about the future or even performing isolated experiments is not enough for decision makers in education. It is also necessary to conceptualize how to change current systems in specific powerful ways. System change evolves as a result of major alterations in demographics, technology, and other social forces. But we want to accelerate the development of good changes like the spread of professional learning communities. The key to this involves conceptualizing sustainability and using leadership to change context or the environment by a) **increasing leaders' participation in wider contexts** and b) **helping to develop leadership in others so they can do the same.**

After about 5 years of working on European-wide reforms (including the Opening-Up Education Initiative by the EC, 2013), the OSOS consortium noticed the following phenomenon: Individual school heads became al-

4 Increase Reflectivity

most as concerned about the success of other schools in their areas as they were with the success of their own school. This is a direct result of being engaged in a larger purpose and getting to know other schools through walk-throughs and other lateral capacity-building strategies. These strategies might involve small clusters of schools working together to improve literacy or principals and teachers conducting walk-throughs of a school or schools to provide critical feedback to the staff. Their world-views and commitments increased to encompass the larger system, but at the same time, they helped change the very system within which they work. They literally changed their context. **The key to sustainability is to change context:** “Sustainability does not simply mean whether something will last. It addresses how particular initiatives can be developed without compromising the development of others in the surrounding environment now and in the future”. Sustainability is about changing and developing the social environment. **The OSOS Open Schooling approach is not about the proliferation and the development of single schools; it is about creating new environments across the system through tri-level development, at school level, at the community level and at national level.** The following eight items are elements of sustainability and part of the writ large agenda:

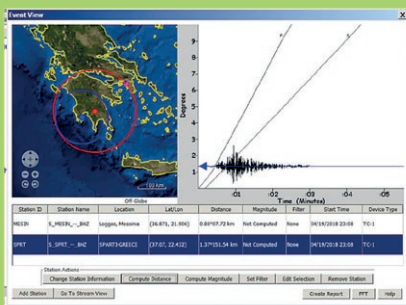
- **Public service with a moral purpose is an explicit commitment** on the part of the system to endorse and pursue an agenda for raising standards and closing the gap.
- **Commitment to changing context at all levels** involves the realization by leaders at all levels that they are changing the culture of schools and districts.
- **Lateral capacity-building through networks** means identifying and investing in strategies that promote schools learning from each other.
- **Intelligent accountability and vertical relationships focus on developing great self-review capacity** in the context of transparent external accountability.
- **Deeper learning** means that the system is continually pushing the envelope to address the fundamental learning goals of thinking and problem-solving skills, teamwork, and learning across the curriculum.
- **Dual commitment to short-term and long-term results** requires system leaders to realize that they must pursue simultaneously short-term increases in student achievement and mid- to long-term results. They must lay the foundation for the long-term learning of all students.
- **Cyclical energizing** emphasizes that “achievement at all costs” is self-defeating. Capacity must be built over time. Periods of intense development must be coupled with opportunities to recoup. Sustainability is about energy more than it is about time. Thus, monitoring and stimulating energy are key.
- **The long lever of leadership**—school heads fostering the development of other school heads by widening their sphere of commitment and participation—is an integral part of this agenda. In this sense, the main mark of a school heads at the end of his or her tenure is not just his or her impact on the bottom line of student achievement, but equally on how many good leaders he or she leaves behind who can go even further. This is the long lever of leadership. Leaders also need to help provide wider learning experiences through networks, clusters, paired schools, and other lateral capacity-building strategies.

Responsible Research and Innovation in Schools

Ellinogermaniki Agogi set out to intensify the process of engagement with external stakeholders despite Greece's rather strict educational setting that does not allow for greater school autonomy, which is a precondition for any opening-up process. Yet, the school aspired to and benefited significantly from its collaboration with the Institute of Educational Policy Greece (the OSOS national coordinator in Greece), especially in understanding and engaging with various tenets of our national educational policy and striving to turn in-house good practices into OSOS-lead national initiatives in the country. This is the case with the subject of seismology and the study of earthquake-related material, that, through OSOS, it has become a country-wide activity with the national school competition 'Build your own seismographer' (<http://seismografos.ea.gr>). OSOS offered an opportunity and a clear pathway to responsible innovation to science teachers in the school with an interest in seismology to engage in projects in the field. The school has installed a seismographer and that became the focal point of EA's OSOS implementation. Here is what has been achieved:

- *A development and operation of a strong school network with seismographs (installed in 24 schools) ready to support new innovative educational activities both in the school and in collaboration with research institutions and other schools.*
- *An introduction of an Inquiry-Based approach for the teaching of science using a real-life phenomenon such as earthquakes greatly affecting the country and many parts of the world*
- *EA's team, in collaboration with the Geodynamic Institute of the National Observatory of Athens, organized the school contest "Build your own seismograph" (seismografos.ea.gr) for secondary school students. In the context of the competition, groups of students were invited in collaboration with their teachers to build an improvised seismograph and record the whole process in a presentation accompanied by photographic or other audiovisual material. 100 Greek schools took part in this contest.*
- *The creation of a student-lead virtual company, that of "Seismoving", that collects and distributes seismological data, but crucially offers information to the general public. Seismoving also helps in case of emergency after earthquakes.*

- *The designing of a large-scale country-wide research¹ in order to collect data on public awareness of aspects of the phenomenon of earthquakes by two target groups, adults and school students.*



Ellinogermaniki Agogi, Greece

1 http://seismografos.ea.gr/sites/default/files/Earthquakes_OnLine_report.pdf

The learning from each other concept is a very crucial point in moving this ambitious agenda forward. We know this but need to address it explicitly with respect to tri-level reform. School cultures improve when teachers within the school learn from each other on an ongoing basis. Communities cultures improve when schools learn from each other, and when local communities learn from one another. When schools or their communities want to know where to start reform, they would be wise to conduct site visits to other schools or communities that are further down the road. During a site visit, teams from the visiting school or its community prepare questions for the host school and then gather data to address these questions. They then examine their findings and identify specific actions to take. The current organization of the ERASMUS+ programme for schools' cooperation and exchanges offers unique opportunities for this to happen even at an international level. This is an example of continuous learning that includes seeking out better information and learning from one's own experiences and from the experiences of others. In addition, member states engaged in tri-level reform need to learn from each other (both within and across countries). The learning principles are no different, just applied on a larger scale. Paying attention to the growing knowledge base, problem solving and learning through reflection, cultivating networks of interaction, and enlarging the world view are all part and parcel of increasing capacity and changing.

Open Schools: A model to introduce change model in the school

This project was introduced by a teacher who wanted to change the overall problematic landscape in our school. However, as it has been a project that has presented very positive results, which exceeded expectations, reflected in the decrease in the rate of school drop-out and absenteeism, in the increase in the number of students pursuing higher education and in increasing numbers of students that is part of the Labour Market, has become a working methodology for all, teachers and students, the school's core educational project and model of work.

Escola Profissional Oliveira Hospital, Portugal

Finally, it would be a **fundamental misunderstanding of systems theory to assume that the system should change first**. Each of us is the system; there is no chicken and egg. We must connect with others to change whatever parts of the system we can. Whenever one is acting to promote professional learning communities, there should be an obligation to connect it to larger issues—bigger dots, if you will. Waiting for others to act virtually guarantees preservation of the status quo. If individuals are proactive, they stimulate others and make it more likely that the system will begin to change, resulting in new breakthroughs.

Open Schools to impose a systemic change

The accelerator “The internet too hot to handle” describes the history of communication and how internet infrastructure is developed in Ireland. How Ireland compares to Europe and why internet access is so unfairly distributed. The choice of accelerator was topical to the catchment area, our school population is varied, and their internet access is extremely varied. Thus their ability to access internet is extremely varied. There is a divide in an integral part of their education at home. In the pilot group within the school who took part they gained an insight into how certain policies affect them every day. Large portions of our group were at either side of the spectrum in internet access ranging from 0.5mb/s to 100mb/s.

Creating a visual heat map of the area allowed discussion into why certain areas might be given access to fiber optic internet while others never have seen any improvement. It really shocked the kids that in their own class there was such a big divide and how it put them at a disadvantage each night when they went home. They researched how government have such a crucial role in providing its citizens high quality internet across the entire country. Students really feel empathy for each other and mentioned that they would like to of had an opportunity to lobby/ send letters to the communication minister at the time. They mentioned that they would like to update and maintain the student matrix within the school and students could access it and

copy content off it and bring it home. They mentioned that the digital ambassadors in transition year should regulate it and update it once a week in the different subjects offered in the school.

Firhouse Community College, Ireland

4.4 Stories of inspiring transformation - Increasing Reflectivity

Varsinais-Suomi 23 (VS23) is located in the Finnish town of Salo, where the school has implemented various small projects in their nearby forest to engage students in meaningful and interesting activities which provide benefit for the whole town community. The school provides special education for grades 1 to 9 (ages 7 to 16) across all subjects. The students of the school have extensive learning difficulties and behavioral and emotional troubles. Most students have a low socioeconomic status, and also many of the students have low self-esteem. From the point of view of students' overall development, it has been important to provide them with socially significant activities and to provide students with experiences of success and sense of togetherness. The main partners of the school have been the sports office of the town, four other local schools, local small businesses (e.g. a sawmill) and the University of Turku.

The roots of VS23 joining the OSOS project lie in 2012, when the forest club of the school got permission from the city to build a nature trail in a nearby recreational area. The forest club began by building a nature trail and bridges over the ditches. Furthermore, the school has built a grill at a lean-to in the area, been responsible for keeping the area clean and usable, and during winter they also kept the nature trail clear of snow. During craft lessons the students have built birdhouses and taken care of their cleaning and repairs. The area has also been used for home economics lessons.

From these myriad ways of utilizing the area arose the idea of sharing the experiences with other local stakeholders, and thus the school joined the OSOS project seeking to enhance reflection on established opening-up actions. The intention was to share the development work done in the area with other locals, so that they could also benefit from using it, but also offer their unique take on improving such community approaches to learning. At the same time, the school expanded their collaboration with the city by building a Frisbee golf course in the forest. Through collaboration with the University of Turku the school was able to share their work with other local schools. The project received very positive feedback from both the teachers as well as the students.

The school has benefited greatly from the project around the recreational forest area, with the culture of working with outside stakeholders expanding. Through working on the project the teachers at the school have begun to reflect on the power of structured and purposeful opening up initiatives with an emphasis on collaboration. The school recently began a new project with the Finnish National Opera and Ballet, where students from the school will produce an opera piece in collaboration with opera professionals. The production will also include collaboration with students from nine other schools from around Finland. Overall, this school experience shows how small projects delivered in an opening up framework with the appropriate supporting tools can grow over the years to change the whole culture of the school.

**Open school
as a sustainable
ECOSYSTEM**

**On-board
users**

5

Adapting the Open Schooling Roadmap

Connect
continuous
engagement with
communities & use
of their potential

**A process
that never ceases
to learn**

5 Adapting the Open Schooling Roadmap

Our schools should be incubators of exploration and invention. They should be accelerators of innovation. They should promote Open Schooling. School leaders should set a vision for creating learning experiences that provide the right tools and supports for all learners to thrive. Teachers should be collaborators in learning, seeking new knowledge and constantly acquiring new skills alongside their students. A holistic approach to innovation is needed.

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As mentioned in the introduction and thoroughly analysed in Chapters 3, 4 and 5 schools that attempt to embark on an educational journey to openness may adapt this Roadmap according to their contexts and past experience. Becoming an Open Schooling Hub cannot be seen as an isolated “project” – it demands a root-and-branch rethink, not just in pedagogy, but in every aspect of the way the school is organised: its structure, culture, and the use of space, place, and time. An Open Schooling Hub will be an open, curious, welcoming, democratic environment which will support the development of innovative and creative projects and educational activities. It is an environment which will facilitate the process for envisioning, managing and monitoring change in school settings by providing a simple and flexible structure to follow, so school leaders and teachers can innovate in a way that’s appropriate for school local needs. It will provide innovative ways to explore the world: not simply to automate processes but to inspire, to engage, and to connect. Now we need to define in practical terms for the school heads and the individual teachers, a) the package of the supporting services and b) the tailored OSOS Strategies to support the local schools as they transform themselves into open schooling environments. Guidance will be also provided to schools, local-level stakeholders through-out the OSOS pilot implementation.

5.1 Different Schools – The OSOS Package of Supporting Services for their Transformation Process

The OSOS tools are categorized in four different but complementary areas according to their impact to the innovation process which is represented as a “chain reaction”: we need community building tools to **increase the mass** of the innovators, we need authoring tools to offer them the opportunity to exchange ideas and experiences (**increase density**), we need innovative scenarios that are meeting their educational needs (**increase temperature**) and finally we need to assess and reflect on their practices and provide guidance for future actions (**increase temperature**). This set of tools is described in the next sections.

- **School Competence Assessment Tools.** As a crucial tool for assessing the openness level of a school, a self-evaluation instrument, the **OSOS Self-Reflection Tool** is offered to the participating schools head masters. It will assess the use level of the school openness of with an emphasis on the introduction of the RRI culture in six key areas: (1) leadership and vision, (2) curriculum and use of external resources, (3) open school culture, (4) professional development, (5) parental engagement and (6) resources and infrastructure. Based on the school’s reference data, actionable analytics will be provided, allowing head teachers and key stakeholders to monitor the school development and the impact of the proposed innovation process.
- **School Development Plan Templates.** Participating schools will be asked to cater for a holistic school development plan in using a provided template (**School Development Plan**). That plans will provide a robust base for automating and facilitating the task of periodic school self-as-

assessment based on reliable criteria, such as development of innovative projects and initiatives, school external collaborations, teachers' professional development plans and school portfolios that may also include information on teacher-generated content, effective parental engagement strategies. It will be used in the framework of the first pilot phase (Academic Year 2017-2018) and it will be tested in about 100 schools in different European countries.

- **Community Building Tools.** OSOS project capitalizes on the ODS school communities which currently involve 5.000 schools from all over Europe (portal.opendiscoveryspace.eu). The communities are the places for exchange of ideas and best practices, collaboration and networking but at the same time the places where user generated content is being created and shared with peers. The communities created by the teachers are automatically related also with the School where these teachers are working to. The level of access of the Communities define the also the level of their content. The "public" communities are accessible to all visitors of the portal and the content follows the restrictions that their creator enforce. The "private" communities allow access to the content only to their members and as a next level the restrictions of the creators of the content are applied. Each community might contain several modules that serves the organization and promotion of its members activities. These modules are Groups, Events, Discussions, Activities, Blogs and Polls), they follow specific structure in the portal and they are created by the members of the communities.
- **Advanced Search Mechanisms.** The OSOS platform acts as a harvester of educational resources, in aggregating targeted contents from a variety of science-related sources and using the appropriate search and filtering mechanisms. Users can also search for schools involved in the project, as well as for thematic communities organized by teachers to share materials and experiences.
- **Educational Design and Authoring Tools.** In order to help teachers to become developers of educational activities and scenarios a series of simple and more advanced authoring tools are available. The authoring tools are promoting the development of projects and they are adapting the inquiry learning cycle as a core pedagogical model, allowing always flexibility to the teacher to modify the sequence of the educational process. In order to facilitate the creation of high-quality teacher-generated content and scenarios, model templates capturing rather popular science education approaches (learning cycle, 5E model), as well as cross-curricular scenarios and lesson plans, were developed as a source of inspiration for teachers. Each OSOS community member will be allowed to customize the sources and even the platform components that they used to create, search and curate content. An **advanced authoring tool** has been developed to facilitate the creation of the students' projects. The aim is to help them to become creators of educational activities which will reflect on the real educational needs of their classrooms as well as they are providing solutions to their local communities.

Training Academies. With the aim of supporting the effective engagement of teachers, headmasters and school communities (including parents), OSOS training academies provide the starting point for equipping them with the competences they need to act successfully as

change agents in their settings. OSOS training academies will provide extended online materials, webinars and hangouts on a regular basis (both nationally and internationally) while delivering guidelines for the generation of creative training events and activities, such as face-to-face workshops, week-long courses at national or international level. Collaborative professional development is expected to have a positive impact on teachers' repertoire of teaching and learning strategies, their ability to match these to their students' needs, their self-esteem and confidence and their commitment to continuous learning and development. During the implementation process, personal and individualized support is a prerequisite (in addition to the provision to the suite of supporting tools) to empowering teachers to engage in innovative practices. Instead of suggesting a one-fits-all approach to the forms and types of pilot activities, the schools will be free to choose or design the types of school-based activities and the curriculum areas that they will target. An implementation thus includes multiple types of activities, ranging from school-based interventions (that design, develop and implement small scale projects and local stakeholders) to collaborative activities across countries designed by the schools in collaboration with national coordinators. The Academy will thus develop and test a complete training program for headmasters and teachers to enable the introduction of responsible innovation in the European schools. In addition, it will build a permanent support mechanism for the introduction, the adoption and the acceleration of responsible innovation in schools through the creation of an OSOS sub-network of schools and teachers willing to participate in innovative training activities. In line with the OSOS approach the training academy will focus on a methodological & pedagogical framework outlining the key stages of the development of innovation support in schools and will include areas such as

- School needs analysis tools,
- School leaders and teachers supporting structures
- Tailor-made and CPD relevant Teacher/Learning online communities,
- A guide to how turn innovative ideas into real classroom activities
- A guide to teachers in becoming authors of educational content.

The professional development training program for teachers and school leaders will help facilitating the implementation of the necessary changes, the development of the necessary diagnostics and intervention skills to best plan and then diffuse innovation in their own contexts. An effective professional development approach will provide the starting point for equipping teachers with the competences they need to act successfully as change agents, developing a terminology necessary to describe the dynamics of innovative change processes, and making them able to recognize different forms of resistance and addressing it in their own context.

5.2 Different Schools - Different Strategies

The OSOS strategies exemplify the project's overall approach on how we can best support schools in their attempt to evolve, transform and reinvent their structures towards a more open, localised and socially responsible learning environment. In this framework, schools will facilitate open, more effective and efficient co-design, co-creation, and use of educational content (both from formal and informal providers), tools and services for personalized science learning and teaching that will form the basic ingredients for innovative student projects. Such projects understood as best practices are the so-called incubators and accelerators on school innovation.

In the framework of the project we are proposing the following school typology according to the school profile and its level of readiness to adapt an open schooling culture:

- Schools that are in an initial stage of incorporating educational innovation in the classroom and beyond. The **OSOS Strategies** document describes the characteristics of the strategy and the tools that will be used to initiate the transformation process for schools that are in the initial phase (Increase Mass and Density).
- Schools that have achieved a certain level of innovation and openness through specific measures, educational ICT tools, best practices, CPD, but they still consist isolated cases without a network of other schools and external partners to facilitate the process. **OSOS Strategies** document describes the approaches proposed for these schools emphasizing on the role of OSOS accelerators, in helping schools in their endeavor to open up to their local communities and to external stakeholders (Increase temperature).
- Schools that have achieved a high degree of innovation and openness and they have already established cooperation with community stakeholders and other external partners. **OSOS Strategies** document discusses how schools that are considered greatly advanced in their approach to modern and open education can test RRI-enriched best practices that not only allow for the engagement of local stakeholders but offer impact and possible solutions to local issues (Increase Temperature and Reflectivity).
- There is a fourth though rarest category of schools that are considered rather extreme cases of schools that offer a glimpse to the school of the future. OSOS Strategies document discusses the role of advanced RRI scenarios in this context and the deeper learning opportunities these schools can offer to their students.

OSOS Strategies document addressing a schooling environment, in relation to its openness, up-take of innovation and responsibility. Following the use of the OSOS Self-Reflection Tool school

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to assess the level of openness of their school heads will need to refer to the **OSOS Strategies** document as a reference document to support them in the development of the **Open School Development Plan**.

References for Further Reading

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