Intellectual Output 1

A1: Rationalization Phase – Qualitative & Quantitative verification

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IPin STEAM

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SCOALA GIMNAZIALA METROPOLITANA ARC
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1. Introduction

1.1 The scope of the project

On the point of creativity and innovation being the roots of European cultural and socio-economic growth, respecting others' work becomes a far-reaching need both for professional and personal development of individuals (EUIPO, 2017). On the other hand, nowadays that online sharing of information is rife, one cannot help but wonder whether people are aware of proper ways to attribute others' ideas along with the necessity to reap the benefits of intellectual potential given the fact that most innovations are now highly related to technology.
Au contraire, the absence of Intellectual Property (IP) protection of educational materials and innovations – with online learning only deteriorating the situation – reveals a significant problem in many European countries. In fact, while uncontrolled access is given to educational resources across the Web, the majority of learners are not aware if IP is implemented in their work as well as ways to protect their own intellectual property (Evans, 2016).
On the grounds that STEAM comprises continuous innovation, invention, discovery and understanding of technical knowledge that lead to (commercial) products, the protection of inventions becomes more and more complex (National Inventor Hall of Fame, 2019). Conceivably, this reveals the rationale behind the lack of IP in school education. In particular, recent research has depicted the knowledge and implementation gaps related to IP, resulting in lack of knowledge about working definitions of IP in the field of Arts. In conjunction with the fact that most European countries are not in position to capture the relevance of IP in STEM, the need to integrate IP in STEAM curricula becomes even more significant (Office for Harmonization in the Internal Market, 2015).

1.2 The project objectives

In order to address the lack of IP knowledge resulting in inefficient implementation of IP in the world of inventions, the IPinSTEAM project aims at promoting IP strategies in schools and more specifically in STEAM education under the prism of confronting this issue from its roots. To achieve generating awareness about Intellectual Property across European educational institutions, the project will develop an innovative ICT-enabled training package focused on the needs of K-12 STEAM teachers.
Towards that purpose, the project will develop and validate training materials tailored to the real needs of school teachers, educational institutions and STEM departments towards giving shape to the integration of IP concepts into STEAM curricula.

1.3 The project target group

The **direct target group** of the project involves STEAM teachers, mainly primary school and lower secondary school teachers (ages up to 12). They will learn the key concepts of Intellectual Property along with useful information and guidelines about ways to efficiently implement IP strategies in STEAM-related subjects and integrate them into their curricula. By all means, all school STEAM departments can be regarded as direct target group of the project.
The **indirect target audience** of the project comprises:
- Students up to 12 years old
- Schools and educational institutions teaching STEAM-related subjects
- Law schools and departments
- Policy makers responsible for the design and implementation of actions relevant to ICT strategies for educational purposes
- Other institutions or organizations that are active in school education

- Authorities or organizations that can organize specific actions in order to contribute in the development of high-quality education
- Networks, voluntary associations and other NGOs that are active in school education
- Research communities active in the broader field of lifelong learning
- E-learning enthusiasts

2. National state of play

2.1 The scope of the report

The objective of the present report is the diagnose and analyze the current situation of the project target group with regards the implementation of Intellectual Property aspects in STEAM teaching. Documentation on the main findings will result in the identification of the actual needs of K-12 teachers based on their level of IP knowledge and the skills required to properly integrate relevant concepts into their curricula. Consequently, the goal is ultimately the formulation of a complete training package covering their needs in terms of bridging the gap between the current state of play and the desired situation.

2.2 Main findings

1. **Which are the most commonly taught STEAM subjects in your country's school curricula?**

STEM is an educational concept that is based on the process of training and the education of students in four areas: science, technology, engineering and mathematics, using a multi-disciplinary and applied approach.
International research shows that school systems have a responsibility to enable young people with fundamental level of STEM literacy, to facilitate STEM engagement through effective curriculum. The designed STEM curriculum will meet educational standards while ensuring that students also develop the critical-thinking, problem-solving and technical skills needed for the workforce of tomorrow.
Today, the Romanian educational system needs to make science, technology, math and engineering education more challenging. There are few initiatives in Romanian curriculum for an interdisciplinary and applied approach to include STEM in class, to revive the interest for studying science, technology, math and engineering subjects. Teachers need to teach practical concepts, using the STEMA process which requires children to solve real-world problems, teaching approaches and assessment resources to improve learning outcomes in the classroom, more playful and above all more imaginative and inspiring for today's students, the citizens of tomorrow's world.
STEM is a curriculum based on the idea of educating students for a cohesive learning paradigm based on real-world applications.
In Romanian high school, education is based on the implementation of subjects leading to a bridge between training and opportunities in the labor market. What distinguishes STEM model from traditional education is the cohesive learning that shows pupils and students how the scientific method can be applied in everyday life.
The STEM approach integrates these disciplines into a paradigm for instruction based on real-world applications, introducing technology and engineering in the students' activity, the problems being solved through discovery, learning and exploratory training.

Given the STEM approaches in Romanian schools, the students' participation and activities carried out under the research projects, facilitating links between specific concepts of science, technology, engineering and mathematics, enabling a better understanding as well as the immersion of knowledge acquired in the real world. The curriculum is split into modules containing plan lessons, focusing on core STEM subjects such as engineering, technology and robotics that can be directly applied to a STEM career.

A new vision is needed for the support of STEM education in Romania, from primary to tertiary education which involves a sustainable partnership on long-term; this vision includes the implication of multiple stakeholders, from teachers to industry, from policy makers to local communities. (Momete, 2018)

Key priority 1: *Redesign the school*, as a part of a community network, connecting with community organizations, public libraries, museums and mentors (scientists, engineers, entrepreneurs) Some companies in private sector adopted a school to inspire the pupils to be active during the whole school year, offering scholarships.

Key priority 2: *Improve curricula* for STEM. Teachers are connected with policy makers specialized in education, with teachers' associations, parents' associations and inspectorates, to create better curricula for STEM topics. The learning experience should be enriched with collaborative problem-based learning (Momete, 2016), scientific experiments and debates.

Key priority 3: *Increase investments*. Local authorities should be involved in the school activities, investing in STEM facilities in schools and IT-environments.

Key priority 4: *Improve teachers' training*. The teaching and learning STEM disciplines should facilitate the development of an authentic learning ecosystem, where the online collaboration applications designed for children, interactive digital games and technology are incorporated into the learning experience.

Key priority 5: *Motivate through fun activities*. The fun part based on STEM activities should act as a motivation tool for science workshops, summer schools based on hands-on activities designed for young pupils; STEM topics should start from an early age.

Key priority 6: *Attract and reward qualified teachers*. The STEMA teachers act as inspiration for pupils to select a STEM career. This is possible using a rewarding system for teachers.

Although several STEMA initiatives were followed by few schools in Romania, mainly private schools, a very important element in Romanian educational system should be linked within a community network.

2. What teaching skills do STEAM teachers regard as the most important?

The STEM curriculum is designed to develop transferable and long-term management, thinking and problem-solving skills which contribute to creating a better future for individuals and society.

Romanian students will learn transferable skills responding to the challenges of the complex environmental, social and economic pressures of this century; young people will require to be creative, innovative, enterprising and adaptable, with the motivation, confidence and skills to use critical and creative thinking purposefully.

Teachers valued STEM education and were willing to apply constructivist pedagogical methods to help solve the real-world problems. It is hoped that an integrated STEM approach can transform education into an innovative and inclusive education for social equity and sustainable development.

Design thinking, problem solving and inquiry are key ways that STEM challenges are addressed through an iterative cycle to develop, test and refine solutions. Design solutions may be in the form of a product, service or STEM environment. Students will learn to consider how data, information, systems, materials, tools and equipment (past and present) impact on their lives, and how these elements might be better

designed and managed. In STEMA class students will get a betting understanding of physical computing, gamification, algorithms, logical reasoning, and conditional programming with the help of a variety of coding activities. The activities in curriculum will help them develop important skills such as problem-solving, attention to detail, patience, attention to detail, abstract thinking, communication, and empathy.
STEMA learners will build their visual and spatial thinking and will create STEM solutions, experimenting, drawing, modelling, designing and working with digital tools, equipment and software.
After completing the STEM curriculum, students will become familiar with programming basics, algorithms, logical reasoning, and coding activities. Students will be able to understand the basics of robotics, algorithms, with the help of a wide variety of hands-on activities, selecting appropriate simulations, or projecting possible viewpoints, variables, applicable data sets and formats.

3. What is the level of awareness of Intellectual Property concepts in your country? How IP is implemented (sections, purposes and target groups)?

Romania is a member of the Paris Convention, the WIPO Convention and of the TRIPS Agreement. Romania has concluded a bilateral agreement with the EU obliging the country to introduce standards of intellectual property protection corresponding to the EU standards and a bilateral Agreement with the USA.
Regarding the Intellectual Property rights in Romania each individual, company, organisation can apply for protection of its intellectual property covering Patents, Trademarks, Industrial Design or Sample and Copyright.
Patent protection may be given to any invention in all fields of technology, provided it is new, involves an inventive step and is industrially applicable. Novelty is absolute. An industrial design may be protected by registration at the OSIM when it is new and has an individual character.
The following industrial property rights are protected in Romania by registration with the State Office for Inventions and Marks (OSIM): Patens, Plant Variety Rights, Topographies of Integrated Circuits, Industrial Designs, Trademarks, including collective and certification marks, and Geographical Indications. All respective laws have been passed in the years since 1990 and Romania has succeeded in its aim to provide for industrial property legislation that is harmonized with European legislation and is in line with the respective provisions of the TRIPS Agreement.
The term of national patents is 20 years from the filing date. For European patents, the term shall run from the date on which the regular national filing of the patent application was effected, pursuant to the European Patent Convention. Topographies are protected for 10 years, beginning with the date of registration or the date of first commercial exploitation, whichever date is earlier. Plant varieties are protected for 25 years.
A positive development is Romania’s 2018 entry into a Memorandum of Understanding with the World Intellectual Property Organization (WIPO) establishing a single procedure for addressing issues in international IP litigation. Despite these positive developments, online piracy, the use of unlicensed software, and a drop-in customs seizures of counterfeit goods present unresolved challenges for U.S. IP-intensive industries in Romania. Trademark concerns include obstacles to the assignment of certification marks, the unavailability of default judgments in opposition and invalidation proceedings, inadequate transparency in opposition proceedings, and the lack of administrative cancellation proceedings.
The concept of Intellectual Property in the field of education it is introduced in Romanian schools.

4. Is copyright implemented in STEAM? If yes, how and in which subjects?

Romania protects authors' rights under Law No. 8/1996 (Copyright Law), which provides for protection of both moral and economic rights. Rights normally arise in the natural person who created the protected work. Any type of work can be protected as long as it is the author's own intellectual creation.
The copyright and related rights sector is regulated to a large extent and would benefit from deregulation. This should include a review of the role which the legislator has attributed to the Romanian Copyright Office (ORDA). Although ORDA intervenes in almost all areas of copyright and related rights, its role is particularly strong in the field of exercise of rights and enforcement.
In line with the EU's Duration Directive15, Romanian copyright law grants a general term of 70 years post mortem and a general term of 50 years in the field of related rights. The terms of protection which are currently in place are reviewed in the following in more detail. However, in view of the different terms of protection, it is again important to distinguish between copyright and related rights.
The Copyright Law also provides for exceptions and limitations to the exercise of copyright, such as the use of a work previously published or the reproduction, distribution, broadcasting or communication to the public of a work, without authorization from the right holder, in certain cases and provided that certain conditions are met (such as being devoid of direct or indirect commercial or economic advantage and/or giving proper attribution whenever possible).
An application for a patent can be made through one of the following routes:

- Directly with the State Office for Patents and Trademarks (OSIM).
- Application under the Patent Cooperation Treaty 1970 (PCT) indicating Romania as a designated state. Starting 15 October 2019, OSIM acts as a receiving office and accepts the electronic registration of international applications filed according to the PCT, by accessing ePCT (*ow.ly/OYls50wLC6N*).
- Application for a European patent and its subsequent validation in Romania.

Under Romanian law, a patent is granted if the invention:

- Is new.
- Presents an inventive step.
- Has industrial application.

All granted patents give their owner the exclusive right to use the invention as claimed for a period of 20 years.
The concept of copyright and intellectual property rights is included the school curriculum of Romania through the domain of social & civic education, ICT, also STEAM lessons were students could learn about references to authors, content creators and sources.

5. Are trademarks implemented in STEAM? If yes, how and in which subjects?

Trademarks are protected for ten years from the registration date. Protection can be renewed indefinitely for subsequent ten-year periods, subject to submission of a request and payment of renewal fees. Renewal fees must be paid every ten years. The request for renewal can be filed three months prior the expiration date of the trade mark.
Under the conditions provided by law, a trade mark can be revoked, cancelled, or declared invalid.
A trade mark can be revoked at the written request of an interested person filed with the Bucharest Tribunal. Trade secrets are protected in Romania, especially by Law No. 11/1991 on combating unfair competition.

Trademarks are not included in the standard curriculum of STEMA education in Romania. Indirectly it may be introduced in extra-curriculum educational events, through thematic projects related to STEAM subjects or in entrepreneurship.

6. **Are patents implemented in STEAM? If yes, how and in which subjects?**

OSIM's website is available in Romanian and English (*https://osim.ro*). It provides:

- An applicant's guide.
- Information on fees, time limits and procedures.

OSIM publishes all patents online. Before filing an application with OSIM, a party can search publicly available data on whether the patent sought is new or already registered (*http://pub.osim.ro/publication-server/main.jsp?lg=en*).
OSIM also publishes all patent applications in the *Official Intellectual Property Gazette* (BOPI). The BOPI is a monthly publication that is also available online (*https://osim.ro/en/publications*). The publication is structured in three parts: patents, trademarks and designs.
The applicant can also review OSIM's publicly available database (Ro-Mark) to check if the sign or a similar sign has already been registered (*http://api.osim.ro:8083/TMreg*).
International trade mark registrations can be verified via access to the TM View database (*www.tmdn.org/tmview/welcome*). EU trade marks can be viewed online on the European Union Intellectual Property Office database, but extended information requires registration and the setting up of an account.
To maintain the registration and protection of a patent, the owner must pay the annual maintenance fees and use the patented invention sufficiently in Romania. A compulsory license can be sought after three years of non-use starting from the grant of a patent or after four years of non-use starting from the registration date, depending on which of these periods ends the latest.
Similar to trademarks, the concept and the importance of patents are not covered in the standard curriculum of education in Romania; patents can be indirectly introduced in school education through thematic STEMA projects.

7. **Is design implemented in STEAM? If yes, how and in which subjects?**

The subject of design, specifically product design is not included in standard curriculum education in Romania, through thematic projects in STEAM only in extra curriculum activities and educational contests.

3. Conclusions

STEM education in Romania is an innovative approach, ensuring competency in mathematics and science, and knowledges integrated with technology and engineering. The issue of integrated STEM curriculum design and evaluation requires a more consistent understanding and clarity among STEM educators.
STEAM subjects in Romanian curriculum are implemented with support of STEM communities, giving students and teachers tools they need to create more inclusive STEM resources. Build an alliance across academia, government, industry, and nonprofit sectors STEM teachers will give students access to a broader, more comprehensive support network, including them in the work of building equitable communities.

Integrated STEM curriculum requires in-depth knowledge of engineering and use of technological tools. To facilitate teaching of integrated STEM, teachers need to be trained to teach in teams.
The STEM curriculum also fosters the development of the critical and creative thinking general capability as learners imagine, generate, develop and critically evaluate ideas. Cooperative learning builds students' collaborative skills and teamwork—important skills in the 21st century, as they are essential for addressing the complexity of present and future socio-economic challenges. Students need to learn STEMA concepts and ideas, consider alternatives and solve problems. Critical and creative thinking are integral to activities that require learners to use imagination and innovation in all learning areas at school and in their lives beyond school.
Romanian Educational approaches based on real-world contexts help students to see the relevance of science into their daily lives and enhance their interest in addressing the real-life situations around them. Regarding the application of laws in the field of Intellectual Property, it seems that Romanian educational system is organised to help users the mechanism of security.
It is important to include IP in the school curricula. In the STEAM class teachers have to make references to concepts useful as copyright, trademark, design and patents because are new entrance, aren't well elaborated in Romanian education field, used only in extra curriculum activities.
The Ministry of Education has the copyright of the materials provided in the school education, either for the teachers or students and parents. Though other materials, which are created by the several teachers are not protected under any Intellectual property certificate.
There is an urgent need of teachers to produce more qualitative materials, to introduce STEAM subjects in the field of education, "learning by doing" through lessons based on real life that allow experimentation, enabling students to make mistakes and learn from them.

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