Intellectual Output 1

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REFERENCED DOCUMENTS

ID	Reference		Title
1	2020-1-UK01-KA201-078934		IPinSTEAM Proposal
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APPLICABLE DOCUMENTS

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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.

Main findings

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

For the target age group of this project – namely young people of 12 and under along with their teachers – in Scotland, choosing which subjects they study is not generally commonplace. Primary school ordinarily runs from age 5 to age 11, and is covered by the "broad general education" phase of Scottish learning (this runs until midway through secondary school, at which a student ordinarily transitions to "senior phase"). Subject choice does not take place until this senior phase and as such to answer this question, it is necessary to focus on both guidance to and feedback from teachers in Scotland, rather than on elective preferences by students themselves.

Although guidance for the curriculum at these age groups is that teaching should ideally be interdisciplinary, it is possible to tease out certain trends in STEAM subject teaching. Firstly, reports on STEAM teaching[1] and on education at this level more generally note an existing focus on literacy and numeracy, sometimes to the partial exclusion of other, broader subjects. This presumably means that there is a considerable focus on mathematics over the other subjects, concurrent with this apparent focus on developing numeracy. For the purposes of this age group in this context, the topics that are expected to be learned are estimation and rounding; number and number processes; multiples, factors and primes; powers and roots; fractions, decimal fractions and percentages; money; time; measurement; mathematics – its impact on the world, past, present and future; patterns and relationships; expressions and equations; properties of 2D shapes and 3D objects; angle, symmetry and transformation; data and analysis; and ideas of chance and uncertainty[11].

Conversely, reports also note that teachers report feeling underconfident when teaching engineering and technology, meaning presumably that it is often focused on less than other STEAM subjects[4]. It is notable that reports praise in particular, however, the enthusiasm and effectiveness of those specialists that do exist when it comes to the fields of technology and engineering[1]. In terms of topics covered, technology at the relevant educational level is made up of 13 key concepts to be understood and studied, including awareness of technological developments (past, present and future), including

how they work; impact, contribution, and relationship of technologies on business, the economy, politics, and the environment; using digital products and services in a variety of contexts to achieve a purposeful outcome; searching, processing and managing information responsibly; cyber resilience and internet safety; understanding the world through computational thinking; understanding and analysing computing technology; designing, building and testing computing solutions; food and textile technologies; designing & constructing models/products; exploring uses of materials; representing ideas, concepts and products through a variety of graphic media; and application of engineering[10].

Science at this broad general education phase does seem, as the name suggests, to be kept broad and general. Content areas and topics grouped under the "Sciences" heading are Planet Earth, Forces, Electricity and Waves, Biological Systems, Materials, and Topical Science[9]. Skills that children should develop in the course of studies like this include broad knowledge and understanding, curiosity and inquiry, safety, scientific language and formulae, ethical reasoning, and other such skills. Some indications suggest that sciences do not always get as much time in primary school as they perhaps should, although this apparently changes as young people age into secondary. Breakdowns within science are a little more difficult to ascertain as primary school curricula do not make clear distinctions between differing sciences, though they do seem to include broad aspects from across these.

Finally, the Arts also have a number of sub-categories that students within this age range are expected to have learned by the end of the broad, general phase. These include art and design, dance, drama, and music[12]. In terms of how much teaching time the Arts get, this is a little more difficult to determine in comparison to the other subjects more traditionally included under STEM, as the reports referenced above from which we are able to make assumptions about subject popularity do not generally include the arts.

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

One of the main issues (referenced above) that is apparent from multiple sources is that at a primary level in particular, teachers are not always comfortable teaching engineering and technology, and sometimes even science. This seems to be due in large part to a lack of familiarity or up-to-date knowledge of the subjects in question on the part of teachers, suggesting that experience and professional development are in particular demand for STEM subjects[4]. Elsewhere, it is suggested that digital skills in particular have been of great importance in teaching STEM[2].

On a slightly different note, some reports note the success of collaborative efforts in teaching STEM subjects – of teachers sharing ideas and approaches. This is noted to have helped them gain new and effective ways of teaching, but also to give them a clearer ability to self-evaluate and recognize their strengths and areas for improvement in general[3].

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

Intellectual property in Scotland is, as it is in many other countries, a key part of life in STEM areas and beyond. Scottish Government results in a brief Google search appear to indicate that intellectual property is mainly a priority for business, in order to protect their products, logo, branding, or other areas[6].

Other search results return almost entirely legally-related results, either law firms advertising their intellectual property expertise, or else universities offering law courses on it. There appeared to be very little information available on intellectual property awareness in STEM specifically, only one or two largely anecdotal profile pieces on STEM practitioners who became lawyers.

Even the Intellectual Property Awareness Network yielded few results, with only two surveys available of higher and further education students on intellectual property issues generally[8]. Indications are mixed, but awareness of intellectual property did seem to be quite high, and most did manage correct identification of at least some of the key concepts. With that being said, a significant majority reported learning about it at their higher or further education institution, and a still greater proportion reported that they did not learn about it from STEM classes. This does somewhat limit the broader utility of this report in identifying the level of awareness in Scotland generally (as an additional point, this survey was UK-wide and referenced English qualifications as distinct from Scottish ones). With that being said, it does seem that most people who have been to college or university might reasonably be expected to be aware of intellectual property issues.

The business-centred view of intellectual property is supported by a UK government survey on awareness of it, which is targeted entirely at business firms[7]. Despite the apparent importance of intellectual property to the economy, many businesses remain seemingly unaware of some of its key concepts, according to this survey. By way of example, although nearly all respondents thought that it was important to understand how to protect their intellectual property, the vast majority were unaware that telling someone else about an invention before applying for a patent could lead to that patent being unsuccessful. This indicates (and is to a large degree corroborated by other results from that same survey) that although awareness of the importance of intellectual property may be high in general terms, businesses remain in some ways in the dark about some of the finer details.

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

There is little indication that copyright specifically is taught in STEAM subjects at a primary or lower secondary school level in Scotland. Plagiarism is included in the relevant technology curriculum, towards the end of this age range in the context of digital literacy and managing information. One EU study from 2015 does indicate that intellectual property-related ideas are taught within this age group in Scotland, but only in the Arts and IT classes (from which the report specifically distinguishes STEM subjects) and furthermore whether or not this includes copyright is not specified[13]. Furthermore, this report notes that concepts of “ownership”, which is presumably the heading copyright might fall under, is not taught in Scotland at all. This is backed up the report’s Scotland-specific section, which appears to suggest that copyright is not included at all. That being said, innovation, citizenship, creativity, and new technologies are noted elsewhere as being taught, and between them may have some relationship to copyright ideas.

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

Similar to the above, there are indications that intellectual property concepts that may include trademarks is taught in certain contexts in Scottish education, but little that makes it possibly to confidently say that trademarks specifically are taught in a given subject or at a given level. In any case, the EU report mentioned above notes that intellectual property concepts are included exclusively in arts, IT, or entrepreneurship subjects and not in STEM[13]. It is also worth noting that again the report’s Scotland-specific section indicates that trademarks are not specifically taught in any given subject.

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

Similarly to the two previous questions, the Scotland-specific section of the EU report suggests that patents are not specifically included in any area of the Scottish curriculum, though there may be adjacent or related concepts that are taught more broadly[13]. Indeed, this report and others note that this is the case, so it may well be that while patents are not discussed explicitly, related themes are included in subjects such as arts, IT, and entrepreneurship.

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

Similarly to the two previous questions, the Scotland-specific section of the EU report suggests that design is not specifically included in any area of the Scottish curriculum, though there may be adjacent or related concepts that are taught more broadly[13]. Indeed, this report and others note that this is the case, so it may well be that while design is not discussed explicitly, related themes are included in subjects such as arts, IT, and entrepreneurship.

3. Conclusions

Through a broad examination of STEM subjects, awareness of intellectual property, and the degree to which various intellectual property concepts are taught in Scotland, this report can come to a number of conclusions. There are three main caveats that should be noted, however, about this report and its conclusions. Firstly, it is important to note that the remit of this report has been children aged up to 12 only (in line with the target group of the report). At this stage of education, the curriculum remains quite broad and general, making certain points and facts more difficult to draw out. But it also means that there may be some teaching of intellectual property concepts, or other relevant conclusions to draw that fall outside the purview of this document.

The second caveat to bear in mind is that this report is largely focusing on Scotland and not the entire UK. While this does narrow the focus of the study significantly, that narrower focus is unfortunately necessary – the four nations of the UK (the other three being Wales, England, and Northern Ireland) each have their own separate system of education and curricula, making it difficult to generalize about the state of intellectual property education across all of them. As such, where possible, Scotland – the country in which CIVIC is based – is the focus of this report, and information on any of the other three nations, where it exists in this document, is largely treated as incidental.

Finally, it has been quite difficult to pin down a definition in relevant sources of subjects that is exactly analogous to the STEAM subjects on which this report has chosen to focus. In some sources, science, technology, engineering, arts, and maths were all treated as individual subjects; in others, technology and engineering were largely merged; in still others they were referenced as the more traditional “STEM” but with the arts being treated as separate; and sometimes there were even mentions of STEM, but with IT being treated as outwith that category. As such, this report has attempted, where this is was an issue, to make the most obvious and logical possible assumption about the subjects that were relevant in a given source.

With those caveats clearly noted, it is clear that the state of intellectual property in STEAM subjects is somewhat mixed. On the one hand, there are clear signs that these subjects are taught in Scottish

schools at this age group, and in sufficient depth to broach some aspects of intellectual property. However it is also clear that the ways in which intellectual property is taught is often integrated quite fully into the subject under which it is being taught, and as such references can be indirect, not always as detailed as might be ideal, and that not every important intellectual property concept (for the purposes of this report, patents, copyright, trademarks, and design) is specifically covered. It does therefore seem that there could be an opportunity here to introduce such concepts more directly in the curriculum in the relevant subjects, it this is felt to be beneficial.

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