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IO4 – SYNTHESIS OF POLICY RECOMMENDATIONS

National Focus Group Implementation and Policy Recommendations

STEAM itUP

Lancaster & Morecambe College

Fundación Siglo 22

fip Future In Perspective

DOUKAS SCHOOL 1917

CARDET

university of groningen

EXECUTIVE SUMMARY

The report synthesizes the findings of the focus groups that took place in the 6 partner-countries. These are organized around the main five driving questions: a) project examples and relevant experiences; b) views of STEAM and its value; c) challenges related to STEAM approaches; d) required support for implementing STEAM approaches; and, e) policy recommendations. Overall, the findings across the 6 focus groups, despite the contextual particularities and cultural differences are consistent and can be summarized as follows. In terms of examples of projects and experiences, all participants were able to share specific projects and shared experiences with STEAM projects mostly at higher levels of education than earlier levels of education, such as primary and secondary school. Collectively, all participants shared positive views and were able to discuss about the value of an integrated approach to science teaching that brings together not only STEM disciplines but also Arts. Based on the shared experiences, it is apparent that the Arts typically serve a supporting role in STEM teaching. In terms of challenges related to STEAM approaches, two stood out across the focus groups: a) the need for teachers' professional development especially in developing the skills and knowledge needed to use contemporary technology applications (e.g., robotics, virtual reality); b) access

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to resources both in terms of curricular as well as technology equipment and tools. These challenges are intertwined with the desired support for implementing STEAM approaches, as across the focus groups the participants shared the need for access to readily available curricular materials as well as technology tools. In terms of policy recommendations four main themes emerged: a) promoting out-of-school STEAM practices and collaborations with school; b) budget availability for STEAM approaches to teaching; c) advocating for the value of an integrated and interdisciplinary approach; and, d) promoting partnerships between public education and the industry sectors.

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INTERNATIONAL REPORT SYNTHESIZING THE OUTCOMES OF THE FOCUS GROUPS ACROSS THE 6 PARTNER COUNTRIES

1. Project examples and relevant experience

In terms of examples of projects and experiences, all participants were able to share specific projects and shared experiences with STEAM projects mostly at higher levels of education than earlier levels of education, such as primary and secondary school. For this report, we choose to highlight an example from Cyprus, which serves as a representative project that implements effectively an integrated and interdisciplinary approach to science teaching.

STEM summer school for girls. It was a 4 days program in which 20 girls participated in interactive activities with an emphasis on understanding the role of women in science, developing STEM skills and entrepreneurial skills. The combination of practices and the team of people who worked together to set it up thus tight this up into an interdisciplinary project.

The IN2STEAM project aims to enhance, encourage and foster innovative educational approach that integrates STE(A)M learning (applying art and design principles to science education) in primary education through gender-inclusive methods and resources to promote a positive change of attitudes towards non–stereotyping choices in education in order to attract more girls into STEM fields. In the context of the project, partners developed a MOOC course for the teachers that included both theoretical and practical knowledge. Currently, teachers are in the process of organizing STEAM labs with students."

"The students worked at stations with the Pro – Bot in order to program various missions. The students worked using the programming software A. L. E. X. to fulfill the missions. Finally, students work on the computer, using the website www. code. org, to program their hero to go through all the stages.

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2. Views of STEAM and its value

The consensus overall was that many focus group participants as well as the many of the students they have previously worked with value STEAM for a variety of different reasons. One recurring benefit being mentioned was the multidisciplinary approach of STEAM and the real and practical benefits this has for some students. This multidisciplinary allows for a wider range of employment possibilities according to the experience of some focus group participants. Furthermore, one of the most often mentioned benefit of a STEAM education is how broad ranging it is, how diverse the information learned is, and the interdisciplinary approach makes it easier for students to relate the subjects with each other and have a better overall understanding of each field of study. There were also some additional comments made by a few participants, such as the economic value STEAM could have if future generations were STEAM-educated, as well as how this could also affect the innovation and technology in a country in the long-term. There are indeed many different and unexpected ways in which STEAM is valuable for different people. Looking towards the future, many employment opportunities will require interdisciplinary work, and having a STEAM education sets one up for this much more so than a traditional education which is less diverse and wide-ranging. Many of the focus group participants looked at STEAM education as something that would be commonplace in the future, and saw many sectors (economic, technological)

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3. Challenges for STEAM

This part of the focus group was the most deeply contested and discussed, with many of the participants having some thoughts to share, more so than any other section of the focus groups. There are a few main categories to divide the types of challenges that are facing STEAM education and the successful implementation of STEAM projects. These can mainly be divided into availability of resources, lack of expertise and knowledge and lack of support from their local environments. These issues can further be divided, however let us take some examples here to exemplify the types of challenges. STEAM is multidisciplinary and requires a broad range of information to be able to properly explain to students, therefore without specific knowledge or prior training it will be difficult for a teacher to fully expand on the STEAM subject matter or project. This can be attributed to a lack of knowledge on the part of the teacher, but also on the lack of supporting materials for the teacher.

Many STEAM projects utilize newer technologies such as robotics kits or computer programming, which not many teachers may be knowledgeable about or even familiar with. For this reason, such teaching materials are not utilized to their fullest because of a lack of familiarity on the teachers' part. This point was brought up multiple times during the focus groups, and many participants suggested giving teachers some time before a project to play around with new technologies and familiarize themselves with it, so they may be able to properly explain to students how to best utilize the materials and make more

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efficient use of their time. This not only helps students feel less lost in a new project, but also gives the teacher confidence to teach their students, which was another challenge that was brought up. A lack of knowledge utilizing new technologies leading to a lack of confidence in teachers which do not specialize in science teaching STEAM. Overall, teacher training was one of the most ubiquitously discussed topics throughout the multiple focus groups as one of the main challenges facing STEAM projects.

Further expanding on lack of resources, this can relate to anything from not having up-to-date textbooks and computers which can run certain programs to not having a budget for visiting local science exhibitions or museums. One participant mentioned that although there are numerous science exhibitions and museums in the local surroundings, it is very difficult to visit these destinations as the financial burden would be placed solely on the teacher, as there is no appointed budget specifically for these sorts of trips. Furthermore, compared to sports or arts, STEAM subjects do not have an after-school equivalent. You can practice soccer or do sketching in a specific location after school closes, but there is no such place for STEAM yet, making it more difficult to be as involved with STEAM, adding a further barrier for successful implementation of STEAM projects or education. This point relates to a lack of a STEAM-oriented space or platform, which restricts the reach that STEAM can have outside of school as well as how much it is discussed and thought about.

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4. What support is required for STEAM implementation to be successful

The support recommended by many of the focus group participants directly related to the previous section and therefore many of them relate to the most common issues brought up by the different focus groups. The lack of materials such as textbooks, robotics kits and expensive software can be dealt with quite directly. That is, by increasing the funding available for these materials or the funding accessible to STEAM projects, so that a budget is already attributed to STEAM projects. Specially allocated budgets for specific STEAM-related areas would be of great help to many teachers trying to implement STEAM projects. For instance, having a dedicated budget would allow teachers to visit more of their local destinations – such as workshops, museums and exhibitions - all of which can contribute towards a students' understanding of STEAM and therefore the potential successful implementation of it. Given that STEAM encompasses more than 5 broad subjects, having access to more resources to better understand the practical and interdisciplinary aspects of STEAM education can be very beneficial to students and the future of STEAM education. Having the support of the school management is something that was also mentioned multiple times during the focus groups, as this is a specific type of support for teachers which has many more implications. By having the support of management, there are many roadblocks which are removed, such as issues related to space, budget or location issues. This could also help with another very pertinent point – namely the training and education of teachers prior to a STEAM project. With the support of school management and teachers, training sessions can be scheduled, rooms can be set aside for practice and time

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can be allocated to allow teachers the time and space to familiarize themselves with either new technologies, tools and kits or new knowledge and information which is needed to understand and explain the interdisciplinary and practical nature of STEAM to students which are not familiar with it. One must not forget that some teachers as well as students find STEAM overwhelming at first due to it involving new technology or information from fields one has never studied before. Due to this, allowing students to become more confident and proficient in these topics beforehand will enable them to pass down this information and knowledge confidently to the students, allowing them to hopefully avoid some mistakes and misunderstandings ahead of time, and further stoking curiosity for STEAM projects and education.

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5. Recommendations for Policy that would help STEAM

Policy addressing extra-curricular STEAM

This type of policy is needed to encourage students which have an interest in STEAM and draw in those who may have an interest. Having a space where one can go to find information, speak to other similar-minded students or even a space to practice some of the STEAM-related topics such as certain computer programs or interdisciplinary papers are sorely lacking. Without a stage for STEAM outside of schools, the interest and involvement in STEAM from the side of the community will not change. Rather, by implementing such spaces and reaching out to local communities, more people will become aware of STEAM, extending its area of influence which could prove beneficial in future implementation and adoption of STEAM-oriented educational policies.

Policy addressing centralized STEAM budget and the development of a database

There are many schools, institutions and workshops throughout different countries which have tried to or successfully implemented STEAM projects in the past, and there is no place to access the information gained from all those projects. Mentioned in the focus groups was a need for centralizing this information to make it accessible to everyone else, so that they can learn from those past STEAM projects when looking to implement projects in the future. By understanding the approach one tool and why it failed or succeeded, this makes future projects a lot easier to work around and can ensure certain mistakes will not

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be repeated. Currently (within the Netherlands at least) there is no way for these institutions to share information as there is no place information is being stored related to STEAM projects or education, therefore the creation of such a platform was of paramount importance according to the focus group. Sharing information to better understand the faults of the past to avoid, and the successes of the past to replicate would help tremendously according to the focus group participants.

Policy partnering education, NGOs, and industry:

A synthesis of the findings across the focus groups showcases the need for having a practical basis to the information and knowledge presented to students will help prepare them for the workforce and ground their information in reality. This can be achieved through partnerships between education providers, NGOs and the industry sector as a way of providing tools, mechanisms, and strategies for broad collaborations between schools and different actors of society.

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