

Science Communication Through STEAM: Professional Development and Flipped Classrooms in the Digital Age

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Abstract

STEAM is the term given to a growing field of research and practice that integrates arts into traditional science, technology, engineering, and mathematics subjects. It is also the name of a science communication summer school that has evolved from a conventional in-person professional development opportunity to a blended informal science learning space with a flipped classroom approach. This article charts that development and includes perspectives from several science communicators who participated in in-person and online versions of the STEAM schools. The future of professional development in science communication is considered in light of the changes caused by the COVID-19 global pandemic.

Keywords

STEAM, professional development, flipped classroom, public engagement, science, society

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Professional Development and STEAM in Science Communication

STEAM—with its inclusion of the arts alongside the more commonly grouped subjects of science, technology, engineering, and mathematics (STEM)—is not only an emerging field of research and practice but also a contested concept (Colucci-Gray et al., 2019). There are plenty of arguments as to why the economically driven motivations for STEM learning (the precursor to STEAM) are already complicating the fields of education and communication (Herschbach, 2011; Roche et al., 2016; Sanders, 2008). The rich possibilities for transdisciplinary learning, however, have been demonstrated across a range of seminal STEAM programs (Bevan et al., 2020; Costantino, 2018). Since STEAM first emerged as an initiative of the Rhode Island School of Design in 2008 as a reaction to the defunding of the arts caused by a global financial downturn (Allina, 2018), it has steadily evolved to become a field with the potential for transformative learning, especially when the arts is given equal status among the STEM subjects (Mejias et al., 2021). Such equal status boosts the likelihood of STEAM programs succeeding in engaging new audiences in transdisciplinary learning (Guyotte et al., 2015; Liao, 2016; Patton & Knochel, 2017; Sochacka et al., 2016).

The landscape of European science communication is in a state of transition due to the global pandemic (Massarani et al., 2020; Priest & Myrick, 2020). While tools and resources have been created to help science communication professionals cope with the challenges caused by the pandemic (Mannino et al., 2021; Olesk et al., 2021), there remains an enduring divide between research and practice (Davies et al., 2021). Other than the professional learning that occurs at conferences (Roche et al., 2018), professional development opportunities in science communication generally take place at workshops, short courses, or summer schools (Miller et al., 2009) and can sometimes be limited in scope and duration (McCartney et al., 2018; Tran et al., 2019). The STEAM summer school represents a unique professional development opportunity in the field of science communication. It provides a flipped classroom approach (Bergmann & Sams, 2014), underpinning science communication theory and incorporating elements of theater, drama, and comedy (Figure 1), which are themselves understudied topics in science communication (Cacciatore et al., 2020; McGillion & McKinnon, 2014; Roche et al., 2020).

The STEAM Summer School's Flipped Classroom Approach

The STEAM summer school was established in 2016 by Dr. Edward Duca through funding from an Erasmus+ Strategic Partnerships project. Partners included Rhine-Waal University, Haaga-Helia University, University of



Figure 1. Participants work in groups in a theatrical setting to develop creative science communication skills (STEAM Summer School 2017, 2019, and STEAM Digital School 2021).

Edinburgh, Science View, and EUSJA and was led by the University of Malta. Erasmus+ is the European Commission's program for supporting researcher and student mobility to boost personal and professional development, European integration, and educational opportunities (Dabasi-Halász et al., 2019). The Strategic Partnerships strand allows organizations across Europe to "cooperate for innovation and exchange of good practice" (European Commission, 2015, p. 3). The focus of the initial Erasmus+ STEAM project was to harness the expertise of science communication academics to develop unique curricula and a summer school that would cover science communication research and practice along with opportunities to engage public audiences with science through the arts. The emphasis on transdisciplinarity allowed the school to bring together participants of various ages, spanning four continents and all with different research backgrounds and professions to explore new ways to improve science communication. The project implemented an experimental model, trialing the summer school in Germany (2016), Greece (2017), and Malta (2018) to determine a suitable host location for the school beyond the project's scope. As the original Erasmus+ project drew to a close, the organizers of the STEAM summer school ensured the long-term sustainability of the project by establishing it as a social enterprise and moving it to its permanent home in Malta for the 2019 iteration, which saw the enrollment of 12 self-funded participants.

Throughout the 3-year Erasmus+ STEAM project, the summer school was continually evaluated and amended based on feedback from the participants and organizers. This consisted of daily evaluation with participants and end-of-program focus groups with all involved. These evaluations highlighted that the most significant benefits of the intensive school were receiving individually tailored support from experts based on practical assignments as well as the opportunity to collaborate with other students to deliver



Figure 2. Participants put on a STEAM performance at the end of the program (STEAM Summer School 2016, 2017, and 2019).

hands-on science communication events. To maximize the benefits of this opportunity, a multimedia online course was developed by Amanda Mathieson for participants to complete prior to attending the summer school. This flipped classroom approach meant that participants could prepare for the school by working through the online course at their own pace in advance, learning about the science communication concepts and theories underpinning the practical components of the summer school, before putting that knowledge into action over the 10 days spent in an immersive peer-learning environment in Malta. The online course covers general theories of science communication, writing and presentation skills, traditional and social media, marketing and branding, along with evaluation and planning. After testing the flipped classroom approach at the 2019 iteration of the summer school—which culminated in the participants creating and staging a science communication event in a local theater (Figure 2)—the COVID-19 global pandemic resulted in the need for the summer school to once again evolve, this time becoming an online event. To replicate the intensity of the in-person experience, a 5-day practice-oriented online school was hosted on Zoom for 14 participants. This was followed by a 2-week window where participants were encouraged—with intentionally limited support from the organizers—to develop, market, and deliver an online science communication event.

Participant Perspectives

Despite the obvious differences between the in-person and the online versions of the STEAM schools, the reflections of four participants (two who took part in the STEAM digital school in 2021 and two who took part in the most recent in-person version of the school in 2019 in Malta) show how similar peer

learning and professional development opportunities in science communication can be fostered regardless of the environment or modality of engagement.

Fiona (attended the STEAM digital school in 2021):

I attended the STEAM digital school because I thought it would be a fantastic way to complement the Masters in science and health communication which I am currently doing. I was excited to learn more about how to merge theory with practice as we developed our very own Sci-com event. Given the current travel restrictions the digital school was an incredible opportunity to connect with people from around the world; learning new skills from both the experts and the other attendees. The most rewarding aspect of the school for me was being introduced to the innovation which can be achieved with digital tools; there being no one size fits all approach to science communication was a huge take-home message for me. The most challenging aspect of the school was putting presentation skills into practice; however, knowing I was in good company made embracing the spotlight that bit easier!

Ian (attended the STEAM digital school in 2021):

The STEAM digital school presented me with an opportunity to refine my science communication skills, especially as we were given the creative freedom to develop, market, and deliver a unique science communication event tailored to an online audience. Although we had to wrestle with the common issues that arise when science communication events go virtual, like overcoming screen fatigue, we found that those challenges can be overcome when the focus of the group is on collaborating and learning together. One of the most impactful elements for me was seeing how improvisation and comedy can be used to frame science communication in new ways. Being able to experiment, mess-up, and laugh about our comedic delivery, not only made the content we were communicating more accessible and engaging for our audience, but it made the event more enjoyable and memorable for us too.

Frida (attended the STEAM summer school in Malta in 2019):

I attended the STEAM summer school because I realized that the tasks I enjoyed the most were communication-related and decided to learn more about science communication. The summer school was a fantastic experience for a newbie like me because the organizers were great at guiding us through the tasks and the attendees were mostly experienced science communicators. The most rewarding aspect was getting to know people, spending time together, and learning from each other. The most challenging part was having to improvise because I like to prepare and organize things in advance. I believe the experience helped me to deal better with unexpected situations and let the creativity flow.

Joseph (attended the STEAM summer school in Malta in 2019):

I signed up for the STEAM summer school because I was intrigued by the flipped classroom approach. The online course provided us with solid foundations and having the material covered in advance meant that during the 10-day summer school we could focus on working together as a motley crew of science communication practitioners. The dovetailing of research and practice really helped me to feel more confident about how I communicate. I think the location of the summer school in Malta provided a perfect creative and supportive space for us to challenge ourselves and to learn from each other.

Future Challenges and Opportunities

Professional development opportunities in the field of science communication are needed now more than ever with the COVID-19 global pandemic raising new challenges for the community to consider, such as, how science is communicated in times of crisis (Goldstein et al., 2020; Kim et al., 2020) and the implication of the digital divide for public engagement (Roche et al., 2021). The STEAM summer school remains unique in its offering of a flipped classroom approach encompassing an online multimedia course and an immersive and collaborative practice-focused school in either virtual or in-person formats. Feedback from participants has highlighted impacts, such as gaining new knowledge and skills, professional experience, career opportunities, and building a community of practice. While uncertainty hangs over all international travel, the STEAM summer school has demonstrated that even the most practical and hands-on science communication initiatives can survive and even thrive in digital environments, creating a welcome dilemma for supporting virtual, in-person, or hybrid events for future iterations of the school. The STEAM summer school will be open for future applications via its website: steamsummerschool.eu.

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