

# STEM Outreach by Young Professionals— A TechnoFashion Paradigm

Asimina Kiourti

**H**ow can we get more young people engaged in science, technology, engineering, and mathematics (STEM) while also ensuring that academia and industry of the future have a diverse workforce? The answer to this question is not straightforward and is a topic of rather extensive research. One thing is for sure: to boost student excitement in STEM, early exposure is needed. Outreach programs play a significant role in this regard, where STEM role models engage with school-age students to spark their interest and illuminate career paths that students may have not been aware of to date. Remarkably, the significance of engaging Young Professionals (YPs) in these outreach programs is twofold as the process benefits not only the student participants but also the YPs themselves. And although the benefits to student participants might be obvious and typically the focus of most outcome metrics, the benefits to YP volunteers are well worth emphasizing.


## BENEFITS OF STEM OUTREACH TO YPs

A number of research works have explored the benefits of STEM outreach to the YP volunteers who helped design learning experiences and/or worked side by side with student participants. The findings show that, following their involvement in a STEM outreach program, YP volunteers are more likely to

**EDITOR'S NOTE**

In this issue of *IEEE Antennas and Propagation Magazine*, we have an interesting and insightful contribution to the “Young Professionals” column from Prof. Asimina Kiourti of The Ohio State University on the benefits of science, technology, engineering, and mathematics outreach by Young Professionals (YPs) via a TechnoFashion paradigm, which has benefitted not only middle school girls but also YPs themselves.

We have exciting articles planned for this column in future issues, and if you would like to contribute to it or have any suggestions on the topics of interest, please contact me at [cjreddy@ieee.org](mailto:cjreddy@ieee.org). For the latest updates, follow us on LinkedIn at <https://www.linkedin.com/company/ieee-aps-yp>.



**CJ Reddy**

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persist in higher education, enhance their employability skills, and improve their social and personal responsibility [1]–[3]. In turn, social and personal responsibility are known “to be inextricably linked and encompass the dimensions of striving for excellence; acting on a sense of personal and academic integrity; contributing to a larger community both educational and beyond; taking seriously the perspectives of

others; and developing competence in ethical and moral reasoning” [4], [5].

In 2015, a study carried out in the United States showed that YPs engaged in STEM outreach improved their communication skills, attitudes and perceptions toward teamwork, and teaching skills [6]. The outreach program also helped YPs shape their own future career plans [6]. In 2017, a European study confirmed that YP volunteers were able to improve their public communication skills and perceived level of skills [7]. Along similar lines, a 2017 study conducted in Australia showed that YP volunteers improved their overall motivation, understanding of the teaching and learning processes, and science communication skills, such as communicating complex concepts in

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layperson's terms to appeal to a broad audience [5].

### A TECHNOFASHION PARADIGM

Supported by the IEEE Antennas and Propagation Society (AP-S) Educational Initiative [8], our research group at The Ohio State ElectroScience Laboratory designed, offered, and helped grow a TechnoFashion STEM outreach program, aiming to 1) ignite the passion of middle school girls in STEM and 2) engage YPs in diverse roles, from concept to implementation of the program. The following chronological view of TechnoFashion is provided to inspire the involvement of YPs in similar efforts:

- *Identify the need:* When it comes to STEM outreach programs, there is no single design that fits all. A need should first be identified and understood so that efforts can be aligned accordingly. In the case of TechnoFashion, we relied on the Girls' Index [9], a large-scale (>10,000 participants) survey in the United States that was released in late 2017 to provide a deep understanding of girls' thoughts, experiences, and perceptions as they pertain to STEM. The Girls' Index shows that "girls actually have significant interest in STEM careers, however, lack overall confidence in themselves and their abilities." Although 73% of girls believe they are good at math/science, one in three girls with a grade-point average above four do not think they are smart enough for their dream career. In fifth grade, 23% of girls do not feel they are smart enough for their dream career; by high school, this number doubles to 46%. With these thoughts in mind, we aimed to boost the confidence of middle school girls in STEM. ("I can do this.")
- *Find the right partner:* To brainstorm the overall design of TechnoFashion and to recruit girls for the program, we partnered with CoolTechGirls [10], a local nonprofit with the vision to create a supportive and collaborative environment for school-age girls to ignite their passion in STEM. Through workshops and partner-

ships with role models, CoolTechGirls aim to motivate, mentor, and provide opportunities for school-age girls to pursue their passions. In reaching out to CoolTechGirls, we pitched the idea of merging "technology" and "fashion" as empowered by conductive textiles used to realize antennas, circuits, and sensors [10]. Their response was enthusiastically positive, and together, we ran to the drawing board.

- *Design the program:* In designing TechnoFashion with CoolTechGirls, we involved three AP-S YPs, all of whom were Ph.D. students. The YPs took the lead in brainstorming activities for the program in terms of content, materials needed, timeline, and format. A closed-loop design approach was then pursued for the program, where iterative feedback from the team helped finalize TechnoFashion. In its first iteration in

2019, we designed a 3-hr program for a total of 18 middle school girls in the format described in Table 1. Our proposal for the very first TechnoFashion offering was submitted to and supported by the IEEE AP-S Educational Initiative.

- *Offer the program:* TechnoFashion was first offered in April 2019 at the facilities of the ElectroScience Laboratory in the format outlined in Table 1 (see Figure 1). One of the YPs pictured in Figure 1 led preparation efforts and mentored a high school student in acquiring and organizing the necessary supplies. The same YP also prepared and presented a significant portion of the slide decks, which helped participants navigate through the phases listed in Table 1. All three YPs mentored the participants throughout the event, shared their personal journeys during phase 1, and provided hands-on

**TABLE 1. AN OVERVIEW OF TECHNOFASHION 2019, HELD AT THE ELECTROSCIENCE LABORATORY.**

<b>Phase 1</b>	Introduction to the ElectroScience Laboratory and its history; a tour of the facility	~30 min
<b>Phase 2</b>	Teams of three build Play-doh circuits to light up an LED	~45 min
<b>Break</b>		~15 min
<b>Phase 3</b>	Teams of three create a light-up stuffed animal with a conductive thread	~90 min
<b>Phase 4</b>	Postworkshop feedback	Online



**FIGURE 1.** The first TechnoFashion offering at the ElectroScience Laboratory in April 2019.

support with the activities of phases 2 and 3. When the feedback was collected, several girls noted that they enjoyed the phase 1 lab tour, others indicated it was their first time working with conductive threads, and some noted that they built their very first circuit on that day.

■ **Grow the program:** Building on such promising foundations, we are set to further grow the program and address a bottleneck raised by the girls and their parents: the lack of continuity in STEM outreach programs. Together with CoolTechGirls, we envision a year-long TechnoFashion program that includes a set of eight workshops with homework assigned in between, culminating in a design challenge. The role of YPs is now significantly expanded such that they can design any of the aforementioned activities, deliver them, mentor other YPs and student volunteers in the process, provide hands-on support to girls throughout the year, and brainstorm with them. Indeed, several YPs participated in the first pilot of our year-long TechnoFashion version, including Ph.D. students, lecturers, professors of practice, tenure-track faculty, and industry experts. We are currently building on the feedback received to improve the program and expand numerically and geographically.

## CONCLUSIONS

STEM outreach enabled by YP volunteers is known to offer numerous ben-

efits, not just to student participants, but also to YPs themselves. From designing and delivering activities, to mentoring other volunteers and student participants, YPs can build invaluable personal, social, and communication skills. A TechnoFashion paradigm was provided, which relied strongly on the efforts of YPs for its success, from concept to implementation and growth. Involvement in STEM outreach may not fulfill any formal degree requirements, but it certainly does augment training for YPs, which can prove valuable in their current and future careers.

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## AUTHOR INFORMATION

**Asimina Kiourti** (kiourti.1@osu.edu) is an assistant professor of electrical and computer engineering at The Ohio State University, Columbus, Ohio, 43212, USA. She is a 2021 *Columbus Business First's* 40 Under 40 recipient, an NSF CAREER awardee, and serves in several elected and appointed roles within IEEE and the U.S. National Committee for the

International Union of Radio Science. She is a Senior Member of IEEE.

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## TURNSTILE (continued from page 132)

being used for 5G, is still needed. The U.S. Court of Appeals for the District of Columbia Circuit noted in a recent ruling that while "it takes no position in the scientific debate over the health and environmental effects of RF radiation," [5] the Federal Communications Commission needs "to explain why its current guidelines [dating to 1996] adequately protect against the harmful consequences of exposure to radio-

frequency (RF) radiation unrelated to cancer" [5].

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