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NEGLECTED SPACES IN SCIENCE COMMUNICATION

STEMroller: smashing stereotypes

Helen Bayram and Karen Ironside

Abstract

STEMroller events disrupt stereotypes surrounding STEM professionals within a neglected space in science communication; a sports hall. Roller derby inspired STEMroller, both the do-it-yourself culture and creating a space for women and genderqueer people to be themselves. Over 100 female and non-binary STEM professionals volunteered to put this event together for students aged 11–19. STEMroller includes networking with people from over 30 science, technology engineering and mathematics industries, watching roller derby and trying it out — albeit in socks not on wheels. STEMroller uses a pool of engaged volunteers to create a unique and memorable event. Feedback after the event was hugely positive.

Keywords

Community action; Public engagement with science and technology; Representations of science and technology

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Introduction

Despite the benefits of a diverse working environment being widely known (e.g. [Hoffman and Maier, 1961]), women continue to make up under 30% of the Science, Technology, Engineering and Matematics (STEM) workforce globally [UNESCO Institute for Statistics, 2019]. In the UK, where STEMroller is based, women account for is only around 20% of the STEM workforce [Wise Campaign, 2020]. This gender disparity begins at school. By the age of 15 boys are, on average, more than twice as likely as girls to expect to work as engineers, scientists or architects [OECD, 2017]. Female high school students are consistently underrepresented in STEM subjects [OECD, 2006; OECD, 2017]. Traditionally, scientists are viewed as men. When children have been asked to draw a scientist, of 4,807 drawings only 28 were female [Chambers, 1983]. Nearly 40 years on, these stereotypes still exist and impact young women when making future career decisions [Makarova, Aeschlimann and Herzog, 2019]. Gender stereotypes even have a negative impact on the academic self-concept of female students with good grades in STEM [Ertl, Luttenberger and Paechter, 2017]. Access to role models and positive experiences of diverse people in

STEM professions can disrupt these stereotypes. STEMroller aims to tackle this gender disparity by organising networking events, centred on sport, which offer a different view of people working in STEM.

> *"Sport has the power to change the world. It has the power to inspire. It has the power to unite people in a way that little else does. It speaks to youth in a language they understand. Sport can create hope where once there was only despair."*
> *Nelson Mandela*

Sport is regularly used as a tool to empower women and girls [British Council, 2017; Mlambo-Ngcuka, 2019]. Within the first year alone, Sport England started a "This Girl Can" campaign in 2015 to inspired 2.8 million women to exercise [Sport England, 2016]. Women's rugby has recently experienced unprecedented growth worldwide, with a 28% increase in registered players since 2017 [World Rugby, 2020]. Roller derby, a full contact sport that has been compared to rugby on roller skates, has seen huge growth since the amateur revival of the sport in 2001. The sport has a DIY mentality, driven by the mantra 'by the skaters, for the skaters', a culture with roots in the punk aesthetic and a strong feminist ethic. Contact sports, such as rugby and roller derby, are not traditionally played by women. Similarly, STEM roles are traditionally male dominated. In our experience, many roller derby players also work in STEM, breaking stereotypes in their professional and personal lives.

The philosophy of roller derby inspired STEMroller, both the do-it-yourself culture and creating a space for women and genderqueer people to play a full contact sport that would not traditionally be seen as "appropriate". Female and non-binary STEM professionals will often be working in male dominated spaces, or can be students with only male lecturers, and as such are highly aware of this lack of gender diversity within the STEM disciplines.

What is STEMroller?

STEMroller is an outreach and networking event that engages young female and non-binary students with STEM career options in an environment that is deliberately very different to traditional images of STEM subjects. Inviting a diverse range of volunteers to support the events increases the chance that students will speak to someone they can relate to. STEMroller aims to communicate the same messages that traditional STEM engagement events do, such as the need for greater gender diversity in STEM industries, after breaking down barriers. These barriers are broken down by involving students in sporting activities that on the surface have nothing to do with STEM. The whole event is designed to help young people feel relaxed and able to engage with our volunteer professionals in as normal a way as possible. We brief our volunteers to communicate informally and try to prevent any sense of forced communication.

STEMroller events

Students (female/non-binary aged 11–19) are recruited through a variety of means: Facebook posts in community groups; schools; outreach organisations, corporate sponsors; and the roller derby community). Each event is aimed at 60–80 young people (and their parents) and us supported by a team of c100 volunteers.

Students on arrival are immersed in the roller derby community. Before the event begins, volunteers sit with the students and speak informally to them, creating a relaxed and open environment. Our adult volunteers share their nervousness about the event, if they felt that STEM wasn't for them, and if they are proud of their roller derby or STEM achievements.

All volunteers wear a sports top with their job title on the back in place of their roller derby name. Roller derby names are a rather unique aspect of the sport's culture, but can act as another ice breaker (our own roller derby names are Bumram and Kermit Killer). Displaying job titles on shirts and in the day's information booklets reinforces the diversity of STEM careers available. The booklets also include professional contact details, creating a network of professionals the students can call upon if required.

The event includes three components (Figure 1); sock derby, roller derby and speed networking. Sock derby is simply roller derby without the skates. This allows the students to move about and introduces how the sport is played. Students also watch a game of roller derby. The teams — Space Jammers and Beta Blockers — are introduced to the students throughout the event so that they can pick a team to support and cheer for. Although unusual, the sporting elements of the day are key. Young female and non-binary students in particular are often told, either explicitly or indirectly, that being strong and demonstrating controlled aggression is not appropriate. Many are not given the confidence to take a fall and get right back up (both actually and metaphorically).

Students watch our female and non-binary professionals physically force their way through walls of players, fall and get right back up, celebrate each other's achievements, and see officials making split second decisions and ensuring that the game runs smoothly. Our volunteers smash traditional stereotypes. There is no need to tell the students this explicitly. They learn through lived experience.

The speed networking is the more traditional element of the event. Students are in small groups and speak to a group of 2–3 volunteers for 8 minutes, before moving on to another group of volunteers from a different industry. Eight minutes is enough time to ask questions, but not so long that conversation can get stilted or repetitive. There is a list of recommended questions in the information booklet, although students are invited to ask anything they would like. Although slightly more formal than the roller derby, the volunteers have name plaques including their job titles, industry and derby name — maintaining this distinction from the teachers and adults they know.

Volunteers

Around 100 volunteers are required to run a STEMroller event. Finding this number of people was not a challenge. To understand volunteer motivations, we asked previous volunteers why they took part in STEMroller. All respondents said that young people seeing a range of role models was a major motivator. Most respondents also stated changing the future workforce to be less male dominated was a motivator (Table 1). Universities and other organisations often see outreach as an important part of their employees' role. As such, many of our volunteers did

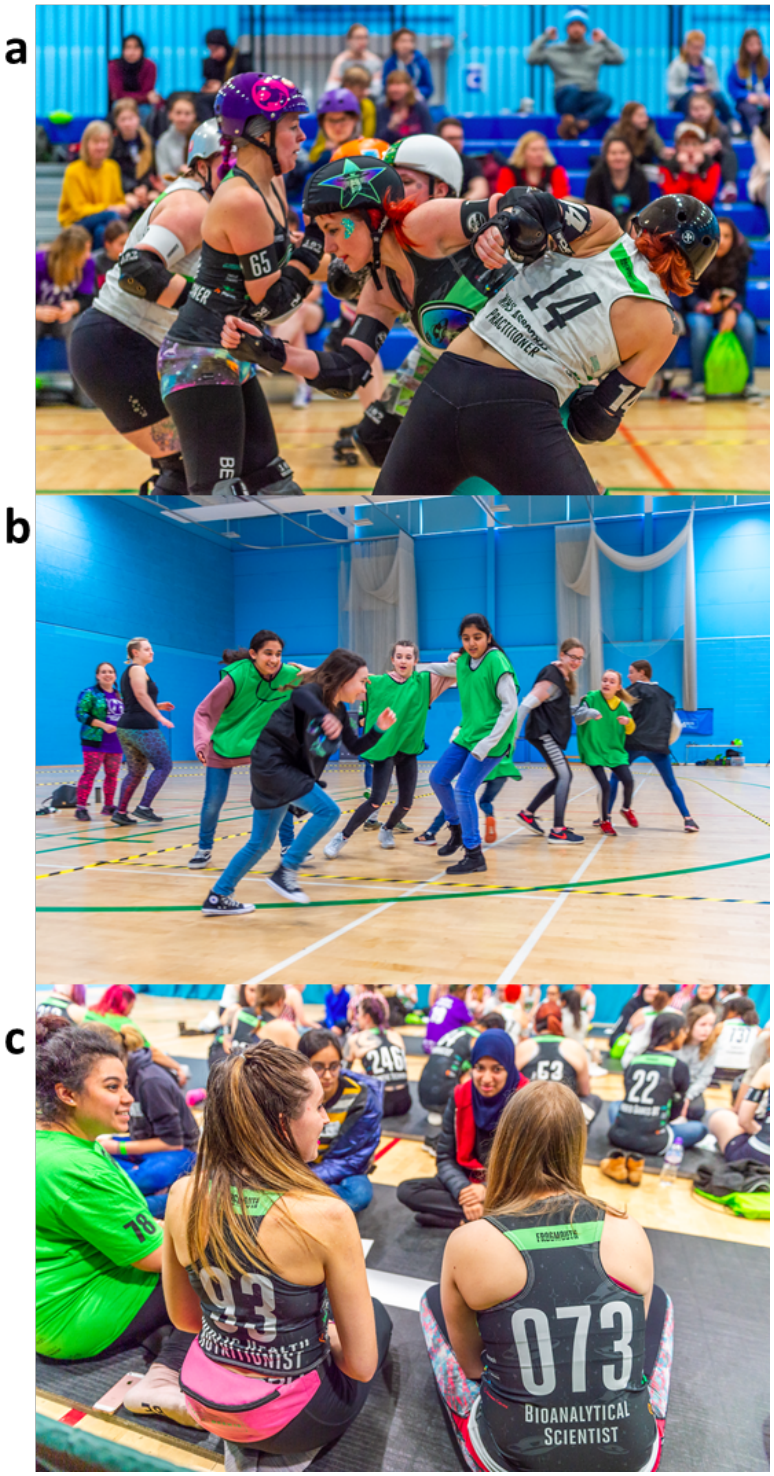

Figure 1. Images from STEMroller 2020 to show the three components of an event. (a) Roller derby, (b) sock derby, (c) speed networking. Photos reproduced with permission from Striking Places Photography (Jo Hailey).

receive travel support from their employers or research institutions. Access to this pool of motivated volunteers, from a community sport that was used to doing things themselves, enabled STEMroller to go from a spark of an idea to a successful networking event.

Table 1. Results from a survey of volunteers after the event.

Why did you sign up to be a part of STEMroller?	*Number of responses*
To play or officiate a game of roller derby	21/25
It was local and convenient for me	0/25
I am required to do outreach as part of my job and this was an interesting option	25/25
I think it's important that young people can see a range of role models	25/25
I think it's important that young people can see a range of career paths	23/25
I want the STEM workforce to be less male dominated to improve future work environments	19/25

Diversity

Representations matters when it comes to increasing diversity. STEMroller fundamentally aims to increase gender diversity in the STEM workforce. In Year 1, the recruitment of volunteers wasn't targeted. As a result, we had one volunteer of colour but about 30% of students were young people of colour (POC). This oversight was something that we needed to address as it is important for all types of people to be visibly represented. For year 2, we proactively recruited players and officials from more diverse backgrounds, which resulted in 11% representation by POC. The challenge being that both STEM industries and roller derby lack ethnic diversity. We were explicit in our promotion of the event to potential volunteers that People of Colour would get priority places. We recognise we still have some way to go, but representing a greater range of ethnicities is a hugely important consideration for us.

The very nature of roller derby being an inclusive sport for members of the LGBTQ+ community meant that our volunteers probably over-represented this community as compared to baseline UK statistics. While no one stated their sexual orientation or gender identity explicitly when interacting with young people, this representation is important for young people to see.

Data was not captured on the socio-economic background of our students or volunteers. Anecdotally, volunteers came from a range of socio-economic backgrounds and were encouraged to tell their stories, whatever that might be. Students came from many schools that also draw from lower socio-economic communities and as such we feel this will help to draw parallels between the lives of our volunteers and that of our students.

Marketing

In the first year, promotion of this novel event was inevitably challenging. By the second event, we had feedback gathered in Year 1 and images from the pro bono services of a professional photographer. Being able to show evidence of impact (qualitative and quantitative) meant that schools were far more willing to engage and promote it to their students. The free tickets therefore went much more rapidly.

We promote STEMRoller heavily on social media (primarily via our Facebook page and local Facebook groups), highlighting the diversity in our volunteers and some case studies of individuals. Our promotion was designed to help challenge stereotypes while also encouraging young people to sign up for the event.

Funding[1]

Due to the timing of the event, we secured a grant from British Science Week for the first year. While this initial grant was relatively small, it also provided credibility and promotion allowing further funding to be obtained. Increased funding in Year 2 enabled more volunteers to take part (120 instead of 65) and to increase the range of activities provided. It also enabled volunteers to have an enhanced event experience. The Frogmouth scrim tops are aspirational for most roller derby players (cost £65+) and ensured our volunteers felt valued. Volunteers travelled from all across Britain and Ireland to attend, with many travelling from over 5 hours away, so it was fundamentally important that they also had a good experience.

Impact

Student impact

Survey questions varied from Year 1 (a compulsory British Science Week survey completed by 51 participants) and Year 2 (a survey compiled by organisers completed by 63 participants). Over both years, 100% of students that attended said they enjoyed or really enjoyed the event. Prior to the events, on average 50% said they had a significant interest in STEM subjects. The majority of students reported an increased interest in STEM subjects after the event (Figure 2).

Year 2 survey results showed that 90% of students enjoyed the roller derby game and 73% indicated it had impacted on their perception of STEM professionals. Additionally, 100% of students found the event both inspiring and informative. While this question was not asked in Year 1, students had been asked to give 3 words to describe the event; informative, interesting and fun were used by the majority.

While work still needs to be done to create an impact reporting mechanism that focuses on the medium to long-term effects, it is clear that the innovative nature of this event does meet the objectives we had of challenging STEM stereotypes and engaging students in a diverse range of career options and pathways.

Qualitative feedback has also been very insightful. A student said: “Really enjoyable, roller derby is awesome! Loved the STEM aspect as well, being able to network has really helped with choosing what to do!” A further student described our volunteers as, “their motivation and determination were really inspiring, and they were really passionate about their jobs.” Whilst parents described their daughter’s experiences:

[1]Funding detailed on appendix A.

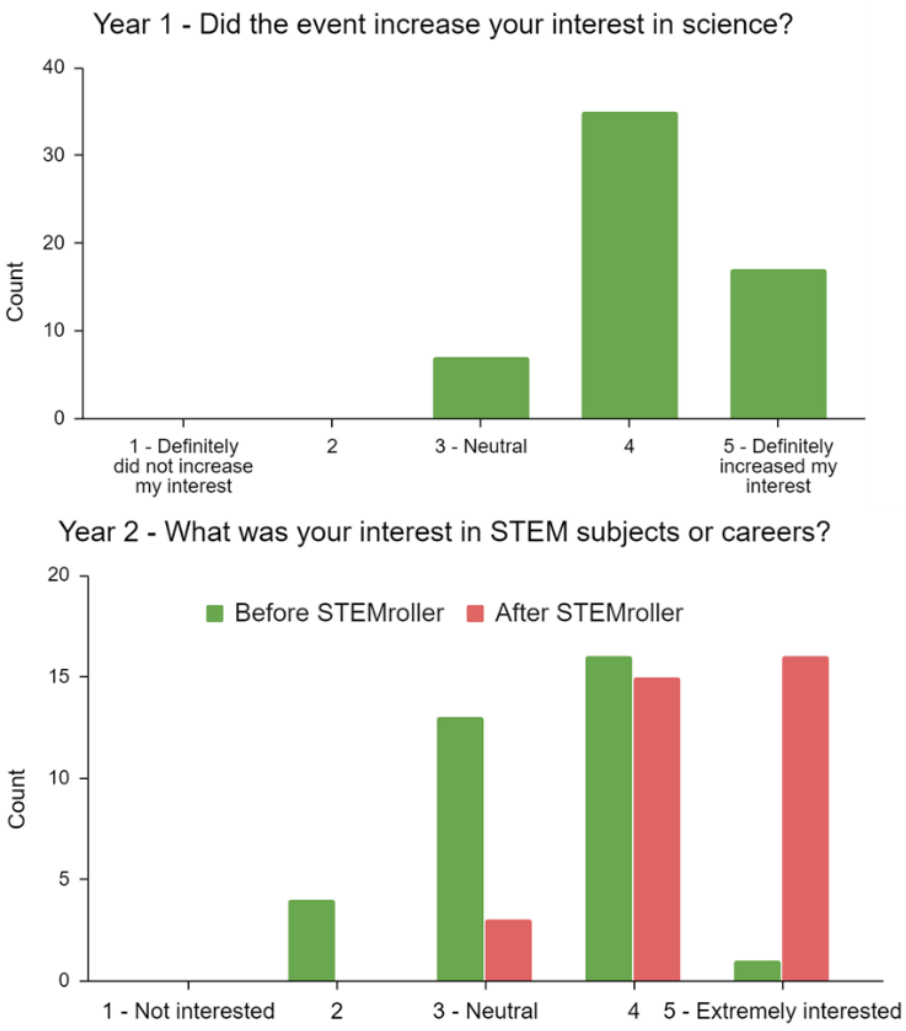

Figure 2. Results from Year 1 and 2 post event surveys of participants.

"She came home enthusiastic about pursuing a career in engineering and has spoken highly about the event both in her school and to her youth club too. The people that she met were inspirational and she loved watching the roller derby live."

"My shy daughter was given amazing support to network and engage and she came away from the event beaming and full of ideas; the honest and open discussions between the women was refreshing in that it offered a different dialogue to that which they get in school; the game was fun, fast paced and a good way to ease into the networking part."

Volunteer impact

STEMRoller was always designed as a student impacting event. It was assumed our volunteers were coming along because they wanted to do outreach and play some roller derby. The unexpected impact that STEMroller has had on our volunteers further reinforced the value of this event.

Close to 100% of volunteers who took part in Year 1 returned for Year 2. Given the logistical challenges volunteers had to consider to attend, including paying for

travel and accommodation or requesting support from their employer, it is clear that they got something more than just a game of roller derby from the event. When asked, 100% of volunteers stated that they would return for Year 3.

Of the volunteers surveyed, 88% stated that taking part in the event had had a positive impact on their lives. The reasons given included:

> "I was surprised how great I felt after meeting so many amazing, talented and intelligent fellow STEM professionals. It was inspiring!"
>
> "Even in my 30s, it's empowering to see women in STEM roles, many of which I didn't know about. It can be hard to imagine yourself in a role when you don't see representation of people 'like you'. I've worked in laboratories for 12 years and my bosses have all been men; the majority of my lecturers at university were men."

Some talked about how they felt empowered to be part of necessary change:

> "I have found becoming part of the STEMRoller community very enriching in finding out about other women's and non binary people's experiences in STEM careers and feeling like we are becoming part of the change in the way these industries look for the future."
>
> "It helped me network with other non male people in STEM. I met so many inspirational people who have very similar experiences of sexism in industry. It validates my own experience. It motivated me to change things."

What next?

Covid-19 has put a temporary halt to face-to-face STEMroller activities. We intend, when possible, to continue with STEMroller in its current venue in High Wycombe and for it to evolve into STEMroller South. We are creating a template event protocol that would enable teams to more easily take on the project management of the event, and to be able to utilise each group's learnings to help improve all future events. A group already exists to develop STEMroller Manchester, potentially centred on Manchester Science Week. A further group is considering STEMroller Scottish Borders, potentially led by a representative of STEM Learning Scotland.

The impact on volunteers however has resulted in a new evolution of STEMroller; STEMroller — The Professionals. This virtual event was first held in Autumn 2020. This event aimed to empower volunteers to inspire change in their own workplaces, and to feel more confident to lower a hand to those who are earlier on in their professional journey. STEMroller — The Professionals also includes Action Learning. Female and non-binary professionals from a range of industries shared their experiences of barriers to entering STEM industries (both real and perceived), and how to limit the leaky pipe of those that enter the profession but do not necessarily progress or leave. This was done using Rolls Royce as a case study and with their Diversity and Inclusion teams.

Conclusion

Breaking down stereotypes is key to increasing gender diversity in the STEM workplace. Sport is a potential tool to empower and engage people. STEMroller

events use sport to smash traditionally limiting stereotypes. The highly motivated roller derby volunteer community has been key to the event's success. This is a great example of utilising an existing community to support outreach and provide non-traditional role models. This type of event could be successfully replicated with other communities; e.g. rugby, art, or gaming groups. Many people that already work in STEM are passionate about creating and facilitating change. Other communities can help find these highly motivated volunteers.

Appendix A. Funding postnote

Year 1 funders

British Science Week: £500 grant
Economic Development team at the local authority (Buckinghamshire Council): £500 grant
Pro bono venue (worth c£4000/day) from a local PPI leisure centre (Wycombe Leisure Centre).
Pro bono photography (Striking Places Photography)
Below cost catering (RetroMum Catering)

Year 2 funders

Royal Society of Chemistry: £2000 grant
Troop Bywaters + Anders (lighting engineers — lit The Shard in London): £800 sponsorship
Frogmouth (world's leading supplier of roller derby clothing based in U.S.): sponsorship through provision of scrim tops worth c£6000 for cost of £800.
Economic Development team at the local authority (Buckinghamshire Council): £1000 grant
Pro bono venue (worth c£4000/day) from a local PPI leisure centre (Wycombe Leisure Centre).
Pro bono photography (Striking Places Photography)
Pro bono videography (Lee Blaise Malone)
Below cost catering (RetroMum Catering)

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