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# REBOOTING STEM: NEW ERA, NEW CURRICULUM

CONFERENCE REPORT

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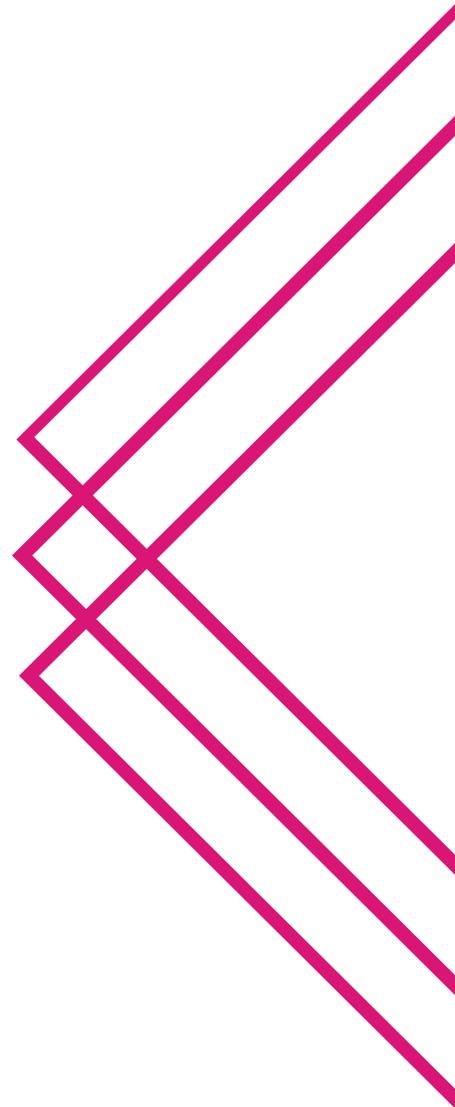
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# INTRODUCTION

On 2nd June 2021, Professors Without Borders in association with Lecturers without Borders held the online conference, **Rebooting STEM: New Era, New Curriculum**. The conference was composed of two panels: 'Improving Soft Skills in STEM', and 'Ethics and Credibility in STEM'.

## PANEL 1. Improving Soft Skills in STEM

Panel One, 'Improving Soft Skills in STEM' was moderated by Dr. Eugenia Covernton. Dr. Covernton is the researcher coordinator of Lecturers Without Borders. She studied Biotechnology then Science Management before earning her PhD in Virology. She is a freelance educator and trains university students in science communication. She also promotes students to become active participants in their education. The panel included Prof. Meenakshi Narain from Brown University in the US, Nikolena Christofi, PhD student from IR Saint Exupéry in France, Dr. Pankaj Jain, co-founder of Seed2Sapling Education in India and Tram Ahn Nguyen, co-founder of the Centre for Finance, Technology and Entrepreneurship in the UK.

## PANEL 1. Open Discussion

Professor Narain began by presenting her research interests in the structure and composition of matter and forces. Narain's research investigates the first moments of the universe following the Big Bang. She has also been involved in large scale projects at CERN, including the Large Hadron Collider project and The CMS Experiment.

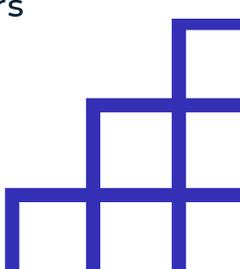
The CMS Experiment is a collaboration between roughly three thousand scientists from over fifty countries, as the costly and complex nature of particle physics detectors necessitates collaboration. Professor Narain stressed that soft skills are particularly important for these large scale collaborations to be effective. She explained that these projects require creativity, time management and the ability to adapt across different cultures, peoples and mindsets. Professionals can only realize their full potential when they have developed these personal competencies.

Professor Narain also stressed the importance of training at all levels whether as a student or senior scientist, soft skills must be part of the curriculum. Lastly, she suggested that academic skills can be assessed in ways that also enhance soft skills by setting learning goals that promote **flexibility, strategy and communication.**

Next, Nikolena Christofi maintained that teamwork is the key to future education and curriculum content from early education to the university level. Christofi recalled her time at the European Space Agency, where she participated in the launch of a space robotics project. This venture was aimed to raise the level of engagement in STEM subjects. To continue her goal of promoting STEM subjects, Christofi developed a learner-centric and peer learning approach based on the IB physics curriculum. While a student, Christofi drafted a report on behalf of the Board of European Students of Technology which aimed to consider new ways of teaching STEM to improve the quality of education at technical European universities.

Learning from first-hand experience coaching and mentoring, Christofi attested to the extraordinary difference that soft skills make in collaborative work. Christofi opined that no greatness has ever been achieved by one person alone. **“Leaders and visionaries are always facilitated by a group of people. Thus, an ideal employee is not someone who has developed technical skills individually but a person who is a good team player.”**

The next panelist, Dr. Pankaj Jain, prepared an interactive presentation in the style of teaching he promotes with Seed2Sapling. He began with an exercise in free association, using the image of a running tap. The other panellists were prompted to form questions about what they could see in the picture. Is the water drinkable? Is the water being wasted? In this example, Dr. Jain asked: Why does a running stream of water become narrower the further away from the tap it is? Panellists were asked to consider the challenge of investigating this question from a child's perspective. Next, Dr. Jain used a different example of why condensation forms on a glass of cold water. He shared some of his student's hypotheses regarding this. Most students believed condensation formed from water inside the glass. Regardless of whether they were correct, students are encouraged to think of an experimental design for their hypothesis. Dr. Jain's students **debate ideas, critique their assumptions and respect plausible theories.** In this way, Dr. Jain approaches the process of learning by encouraging active participation which fosters the development of soft skills.



Tram Ahn Nguyen described the success of her organization, the Centre for Finance, Technology and Entrepreneurship (CFTE) in training over 100,000 learners from different countries and professional backgrounds. The CFTE works to upskill finance professionals, tech workers and entrepreneurs to prepare them for technological disruptions to their industry.

Nguyen created the CFTE to address the shortage of technology skills and knowledge in the finance sector. Nguyen believes the world of finance needs to increase the diversity of its stakeholders, particularly to be more inclusive of all genders, and those without finance backgrounds. Nguyen explained that not only should new people be brought into finance, but the existing labour force should not be left behind. **The coming technological changes to finance should be made accessible to working professionals through retraining.** Retraining would eliminate the need to leave employment to undertake further university education. Through her interviews with hundreds of CEOs of technology start-ups, Nguyen has itemised the skills needed to accommodate future changes. In this regard, COVID-19 has increased the digitalization of business at a record pace. This trend only highlights the importance of professionals having the skills and knowledge to be ready for further changes. Nguyen stressed this trend applies not only to finance, but to all sectors.

## PANEL 1. Q&A

**Q: What soft skills are relevant to each of your fields?**

Professor. Narain explained that graduate and postdoctoral students need **creativity, communication and strategic skills**. She believes these are important for the large-scale collaborations she is involved with. Further into a career, **leadership** skills are necessary.

Christofi emphasized that the term “soft skills” is difficult to define and covers a broad umbrella of skills. According to Christofi, hard skills are technical and easy to define. Due to their tangible nature, education focuses on the development of hard skills.

Dr. Jain considered that the most important soft skill in his work is the ability to **understand people and form connections**. **When teaching children, the desire to relay hard skills can hinder the goal of inspiring children to learn for themselves.** Dr. Jain sees COVID-19 and the subsequent shift to remote learning as a challenging environment for student engagement.

**Q (To Tram Ahn Nguyen):** How do we convince working professionals that they lack certain skills and make them open to the idea they can be helped?

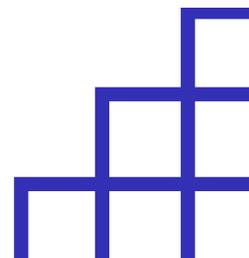
Ms Nguyen replied that professionals initially seek training to learn hard skills, as graduates usually possess hard skills for finance or technology but not both. **She admitted that professionals who have worked for decades as industry experts become used to a particular framework and fail to update their skills.** COVID-19 forced the finance industry to create new digital-focused jobs. According to her surveys, employers are seeking highly analytical, focused and digitally enhanced individuals. Currently, it is important to be able to work with people from other areas in your company, be adaptable to change, communicate effectively in a business context and be customer-centric. **In the near future, adaptability to change, capacity for innovation and creativity, data and analytic skills will all be important.** Ms Nguyen wants to encourage an entrepreneur mindset, which she defines as the ability to **test, learn and accept failure.**

**Q (To Nikolena Christofi):** How can students be convinced that soft skills are relevant to a future occupation?

Ms Christofi explained that volunteers she has worked with have an international mindset, they want to travel, meet other people and are open to new ideas. Their openness facilitates learning and accepting differences between people improves communication. Christofi believes soft skills can be taught at a younger age, as children have the creativity and confidence to make mistakes. In comparison, university students are very competitive and prefer individual work. In her opinion, undergraduates should be forced to **work together in groups and learn from those in fields other than their own.**

**Q (To Professor Narain):** Can you talk about the relationship between creativity, art and science?

Professor Narain responded by making an equivalence between abstract elements of artistic representation and experimental design. She agreed with the notion that blending art with science can help imagination and creativity, as with the case of Dr. Jain's work. In her experience, mandatory art courses are becoming more prevalent at university for STEM students, and lab assessments are becoming more inquiry-based and less instructional.



Professor Narain's students work collaboratively through a process of “set up, solve, and reflect”. She believes there are many students who have the capacity to innovate, but lack the skills to project or share their ideas. This becomes a problem later in their career when they need to compete for grants. Professor Narain admitted that scientists sometimes have difficulty finding their human side, further illustrating why skills that fall under the term emotional intelligence are particularly needed.

**Q (To Dr. Jain):** How do you think your way of teaching might help children develop soft skills?

Dr. Jain believes his method of education is focused on the process of education and not teaching particular subjects. He explained that the name Seed2sapling reflects a philosophy that all students hold potential and they need to be nurtured into whatever form that takes. Dr. Jain agreed that the freedom to make mistakes is important. He determined that a focus on the joy of the learning process and creating an enriching environment solves many other problems.

Dr. Eugenia Covernton concluded that one should look within oneself first to help others develop soft skills. She pointed out that adapting to COVID-19 provides students with the reminder that they will need to adapt in later life also.

## **PANEL 2. Ethics and Credibility in STEM**

Panel Two, ‘Ethics and Credibility in STEM’ was moderated by Victor Warlop, engineering student studying nanomaterials at Stanford University. The panel included Oliver Geffen from the UK, epidemiologist and co-lead of Imperial College’s online COVID-19 course, Dr. Peter James, postdoctoral research fellow with a background in Pharmacology and Public Health at Southern Cross University in Australia, Dr. Raj Kumar, material science engineer lecturing at Stanford University in the US and Dr. Melissa Sterry, transdisciplinary design scientist based in the UK.

## **PANEL 2. Q&A**

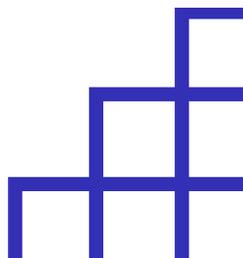
**Q (To Mr Geffen and Dr. James):** Over the last year, you must have experienced a big loss of public trust in scientists, what can you tell us about the experience? What can be done to restore that trust?

Mr Oliver Geffen began his reply by remarking that before the pandemic most people didn't know what an epidemiologist was. He **identified two aspects to the crisis of trust – technical and institutional**. The underlying technical problem is due to the underfunding of public health and health surveillance systems. He continued, poor funding routinely leads to analysis that is prone to error and delayed. In his opinion, without timely studies, **policymakers tend to disregard scientific advice and prefer to trust their judgment**. Geffen acknowledged that from a public perspective, initial evidence was slow and inconsistent given the emergency context.

Geffen proposed that an investment in health data infrastructure would restore trust between scientists and the governments they work for as well as the public. He criticized a prevailing notion that science speaks with one coherent voice, and stressed that **disagreements are a healthy and natural part of scientific discourse**. The idea that science holds a singular view creates an indisputable quality where there is none. The methodology and analysis of scientists should be open to criticism. This indisputable quality has interfered with the scientific process of refining theory. According to Geffen, it has also allowed politicians a level of unprecedented authority and power. Geffen allowed that while this may have been done in good faith, it removes an important mechanism of accountability.

Dr. Peter James agreed and expanded on Oliver's remarks, saying that, during the COVID-19 pandemic, scientists saw an opportunity to showcase their personal brilliance. This created a problem for the integrity of research, of which the public became aware. Dr. James explained that scientists are trained to employ technical terms that condense complex information without explanation. **The public requested answers to questions about which scientists were not ready to form conclusions**. This absence of digestible scientific information created a vacuum for public demand. In response, the public sought alternative sources while fear and misinformation spread. **Dr. James called on scientists to conduct due diligence and suppress the desire to be the first to publish findings**.

Q (to Dr. Kumar): There is a huge pressure in the scientific community to do well, such that it has gotten a name – 'Publish or Perish'. What do you believe are the advantages or disadvantages of such a mentality and what can be done about this within education?



Dr. Kumar agreed that the Publish or Perish mentality creates a level of competition that challenges scientists to produce better work. Scientists work on similar questions, in the rush to be the first, scientists are challenged to produce their most effective and tangible arguments. Dr. Kumar warned, however, that the pace often neglects a broad communication of science to general audiences or even those from different scientific backgrounds. **Dr. Kumar suggested that scientists and educators need to be critical and careful in how science is explained, to ensure a very broad audience can understand scientific research.** Dr. Kumar conceded this may mean relinquishing being the first to publish. However, Dr. Kumar pointed out that often later articles that build off earlier work become the most ground-breaking. With time, attention and hard work, research that explains itself to a larger audience can become more well-rounded and established

**Q: Can you tell us about your experience of honesty in scientific research? What ethics do you follow in your work?**

Dr. Sterry answered the latter of these questions first, by stating she has a rigorous ethical code that requires her to decline contracts from companies involved with fossil fuels, plastics, and tobacco. She explains that this is for both personal satisfaction and leadership reasons. **By passing up such opportunities she is in a better position to convince audiences to make sacrifices to combat these problems.**

Responding to the first question, Dr. Sterry characterized science as a gated community in the process of becoming more open to the public. Dr. Sterry praised the example of open access publications but gave a balanced consideration that some of these have no peer review or standards fall woefully short. From Dr. Sterry's perspective, the user experience of accessing online journals is expensive, frustrating and of poor quality. She points to one of the upsides to the COVID-19 pandemic as academic institutions have been forced to consider digital platforms and their possibilities as a serious medium.

Dr. Sterry also discussed the need for scientists to accept their limitations, and to reach out and form collaborations with designers and digital experts to **collaborate on scientific posters.** This would enable a natural exchange of learning and **upskill the scientific community** while allowing the design community to tell new and interesting stories.

**Q: How can communication between scientists and the general public be improved?**

Mr Geffen surmised that the problem does not lie with the public. Geffen continued to say that, for governments and policymakers, science has no equivalent to public prosecution. The creation of such a body that informs and challenges governments on the strength of their scientific justifications could prove interesting.

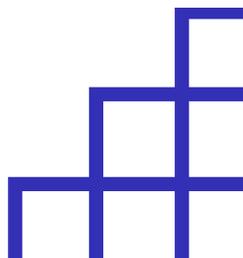
Dr. Peter James called for more participation-based research that involves stakeholders at every level of design. This would include beneficiaries of the intended research including industry representatives and policymakers. Dr. James anticipated that the public will be more willing to accept policies and decisions when including this wider circle of society. **His second recommendation is that scientists need to make themselves more available to the public to explain their research.** Dr. James concluded that scientists should undergo **media training** to facilitate an existing trend of science moving into the mainstream of platforms of television, internet, and radio.

Dr. Sterry recommended that networking events should be hosted for scientists to gather together and interact with others from different spheres. She pointed out that no progress can be made if generalizations are made about audiences. **She advised that for communication to be successful, one must understand how an individual interprets information and what motivates them to act.**

**Q: Is there an ethical grey zone in interpreting scientific results?**

Dr. Kumar answered yes. He characterized ethical decision-making as a series of small decisions that lead to ethical behaviour. According to Kumar, one ethically ambiguous practice is to only publish the best result of an experiment. While the result may be truthfully obtained, cherry-picking the data and leaving out weaker results gives a false impression of what can be expected. This creates a problem for researchers that want to replicate the study and is further compounded by poor methodology sections. **Dr. Kumar reckoned only one out of ten studies contain well-explained methodology sections.**

Dr. James agreed with Dr. Kumar's assessment and emphasized the importance of explaining study limitations. **With the omission of weak results and failure to discuss influencing factors, studies cannot be replicated and the strength of findings cannot be confirmed.**



# CONCLUSION

The conference ended with remarks by Dr. Caroline Varin, the CEO of Professors Without Borders (Prowibo). She remarked on the large amount of work that needed to be done to promote soft skills, communication, and ethics in STEM. She spoke enthusiastically about sharing the findings of the conference with Prowibo's global audience of educators.

Professors Without Borders would like to thank Lecturers Without Borders as well as all panellists for their time and contributions to this event.

