Innovating Environmental Health: Building Peace through Collaborative Engineering and Education for Clean Air

Kathmandu Nepal

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The possibility of large-scale deaths and disparity in distribution of resources caused by air pollution is a threat to national security and global peace. Korea and Japan's claims of dangerous chemicals and particles drifting from China have led to strained diplomatic relationships while public tolerance of lax environmental-safety and high pollution levels are falling and boiling into riots ("The Adelphi Papers, 38(319), 11–16" n.d.). With limitations to healthcare resources, air pollution exacerbates the gap between who is able to access medical care and who is left behind. Indoor air pollution is also correlated with decreased test scores, attendance, participation, and attention in the classroom (Gilraine 2020). Thus, clean air is becoming a desired yet scarce commodity to students. The inequality in healthcare access and education quality undermines the principles of human rights and is a basis for conflict.

Though air pollution is described as an outdoor phenomenon, pollutants from the outdoors can move into and accumulate in indoor spaces such as classrooms. Children spend ⅓ of their days in the classroom. Thus, it is a "natural location to reduce children's pollution exposure (Gilraine 2020). In addition, Kathmandu's role in the Nepali economy, in tandem with its geography makes it especially prone to amassing air pollution. Hence, we propose to design and implement a low-cost air filtration device in Nepali secondary schools and to deliver an educational curriculum focused on design thinking, sustainability, and engineering to foster the next generation of climate leaders. By providing clean air to children, we hope to narrow the inequalities in health and education posed by air pollution, especially in low-income communities. In other words, we hope to address a source of climate disparity that has the potential to result in conflict and large-scale deaths.

Our project provides a collaborative platform where students from two nations work together towards the common goal of clean air. By setting a foundation for understanding between and within nations, we strive towards the goal of global peace through communication and compassion. In both designing an air filtration device and teaching an educational curriculum, we place a large focus on human-centered design -- empathizing with users and understanding their perspectives in the problem-solving process. This approach instills precious lessons of empathy, understanding, and cooperation, values that make a more peaceful world. As a part of the education program, we will be working closely with young Nepali students with the promise of supporting their innovations beyond our time in Nepal. Additionally, in the long term, we hope to expand to other countries, creating networks across nations to collaborate and innovate on environmental health challenges. Fostering intercultural cooperation, especially in a time of division, facilitates mitigation of conflict and the pursuit towards a more peaceful future.

We are a group of undergraduate students at Wellesley and Babson College with a goal of alleviating the burden of air pollution in Nepal. We are from Kathmandu, Nepal and Shanghai, China and have seen firsthand the adversities caused by air pollution. We were especially inspired to take initiative after hearing about parents protesting for air filters and learning that there are no air filtration devices specifically designed for schools. Thus, we initiated our engineering project in January of 2020 and are remotely teaching our education curriculum Eco-Ed in January of 2021. Among the three of us, we study Chemistry, Sociology, Chinese, Business, and Biochemistry. We have experiences ranging from engineering air filters for surgical systems to designing civic engagement programs in Nepal. Thus, we hope to leverage our broad scope of knowledge and expertise be it in engineering,

business, or the humanities to tackle the interdisciplinary challenges of planetary health.

Over the past year, we have been able to analyze the existing air filtration market and gather data on indoor air quality as a team. It has given us invaluable insight on technical speculations as well as core components of the air filter device design. We have received feedback from Professor N. Bastakoti at Kathmandu University, Professor S. Hersey at Olin College, and M. Levine at Moodys who validated the need for such a technology and helped mold our device to suit the classroom environment. By being immersed in Kathmandu over the summer, we hope to physically observe how air pollution impacts student experiences and what the perceived challenges are in the eyes of the local community. We will interview users, stakeholders, and experts and use their insight to further the design of our device.

The Association of Mechanical Engineers at Kathmandu University has generously partnered with us to collaboratively build prototypes of the low-cost air filtration device throughout the Spring and over the Summer. With AMES, we hope to make use of local resources and create a design that is appropriate in our target environment. By the end of the summer, we wish to launch our pilot test by implementing 10 air filtration devices at our partner schools, Aazad Secondary School, Shree Ganesh Secondary School, and Panchkhal Jhorpati Secondary School. Furthermore, we will be measuring levels of pollutants using standard indoor air quality devices over the course of 6 months in fall of 2021 to collect and analyze data on the efficacy of these devices.

Over January of 2021, we have remotely delivered the Eco-Ed curriculum to the Elite's Co-ed School and the Galaxy Public School. This curriculum uses a self-constructible air filtration toolkit designed by our team. By piecing together a "mini air filter" with cardboard and circuit toolkit, students explore skills in electrical engineering, recycling, and sustainability. Students also learn about the design thinking process and initiate a climate project of their own with the hope of creating a sustainable impact in the communities we work in. Our remote sessions have given us insight into intercultural communication and aspects of the curriculum we can improve upon.

Over the summer, we will deliver our Eco-Ed education curriculum to 150 students to a broader region of Nepal. By working in person, we will not be limited by the lack of access to technology and internet connection in some of our target schools. Throughout our time in Nepal, we will be working closely with Karkhana. Their commitment towards a hands-on approach to STEM learning is well aligned with the goals of our education program. As such, they have helped us with formulating the curriculum we had delivered in January and have agreed to support us in delivering these sessions at low-resourced schools in the Kathmandu and Dhulikhel area in the summer. Specifically, Kharkhana has offered to help facilitate travel within Nepal, connect us to relevant schools and administrators, and provide us with work spaces for both our education project and air-filter project.

We would love to be able to implement our project over the summer of 2021 through Davis Project for Peace. While in Kathmandu, we will prototype and test air filtration devices as well as deliver Eco-Ed in-person to Nepali secondary schools. We believe that immersing and interacting with the Kathmandu community as well as incorporating local expertise at every step of the process is crucial to shifting the power to the community we work with. After the summer, we want to maintain strong partnerships with our student's collaborators in Nepal by communicating remotely and incorporating their feedback. In addition, we hope to share our experience with climate enthusiasts around the world, with the goal of creating a network of environmental health innovations. Air pollution is a largely overlooked health emergency for children around the world (Rees and UNICEF 2016). By providing clean air, we hope to make a difference in alleviating the health and educational cost of air pollution and to build a language of empathy and collaboration. We hope to begin to narrow the inequalities induced by climate change and the threat that it poses to world peace.

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