

**2020-2021 Science for All Outreach Program
Annual Report
8/18/2021**

In 2020-2021, UMN Science for All (SFA) worked with **five teachers across four Minneapolis and Saint Paul middle schools to conduct 33 virtual visits** with hands-on science experiments focused on teaching scientific-method-focused inquiry. A summary of participants and experiments conducted can be found below (**Table 1**). Broad subjects spanning fluid mechanics, simulation and programming, polymer science, genetics and chemical reactions were conveyed in 50-minute experiments to the students. The 2020-2021 year was conducted 100% virtually over Google Meets and Zoom. A few pictures from this year's program can be found below (**Figure 1**), or on our blog, sfa.cems.umn.edu/blog. Experiments incorporated a mix of online simulations and experiments with supplied kits, which were distributed in partnership with participating teachers. Graduate student mentors guided students through experiments in breakout rooms, each with a few middle school students.

The virtual nature of this past year allowed SFA to increase the number of partnering classrooms. We re-established relationships with the American Indian Magnet School and KIPP North Star Academy, both schools that we have collaborated with in previous years. This expansion **more than doubled the number of students SFA worked with from 80 to about 180**. Continued funding allowed SFA to adapt to an online mode of delivery while covering the cost of ready-to-use experiment kits and filming equipment. **We are extremely grateful for our financial and institutional support over the past few years – these visits would not have been possible without it.**

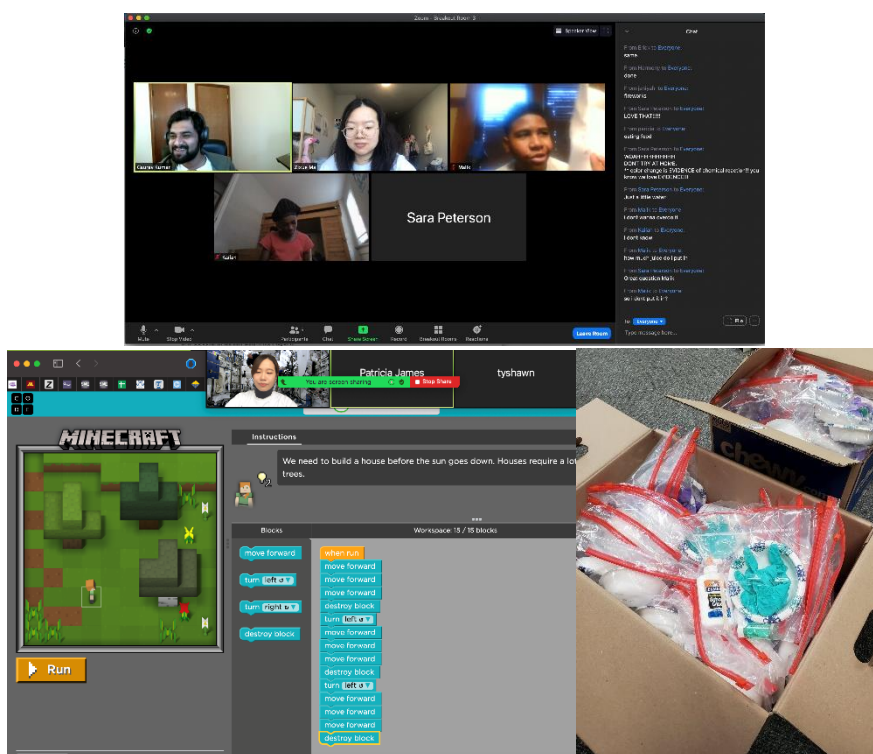


Figure 1: “Visits” looked a little different in 2020, but we still found ways to engage with students in breakout rooms, programming worlds in Minecraft and providing prepared kits for hands-on experiments.

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Table 1: 2020-2021 SFA Participants and Experiments

School	Students	Graduate Volunteers	Experiments conducted
Marcy Open School (two classes)	62	20	What is a scientist? Homemade lava lamp Floating drawings Scratch programming Surface tension on a penny
Murray Middle School (two classes)	60	16	Rockets, Rust, Rotting Rocket launch simulation Sticky Science: Slime and superglue Homemade lava lamp Floating drawings
KIPP North Star Academy (two classes)	44	19	Programming a turtle Superabsorbent diapers How did we become scientists? Invisible ink Mouse genetics Minecraft programming Building an atom Light at the nanometer
American Indian Magnet School (started mid-year)	17	10	Simulating gravity Natural selection and giraffes

SFA mentor graduate students participated from various UMN departments, including Biomedical Engineering (BME), Chemical Engineering and Materials Science (CEMS), Chemistry (CHEM), Mechanical Engineering (ME), among others. **This past year, effort was placed on recruiting graduate students from a broader range of departments.** As a result, SFA recruited several members from two additional departments: Computer Science and Electrical and Computer Engineering. In a year where experiments were delivered virtually, graduate students with experience in simulation and computational learning were instrumental in incorporating a new thread of activities. Additionally, in 2021 the number of active volunteers increased from 58 to 65 members (**Table 2**).

In 2020-2021, SFA has continued to develop testing metrics to assess learning of the scientific concepts demonstrated in experiments. **We began to consistently use pre- and post-experiment assessments with multiple choice questions to gauge the influence of experiments on understanding of key physical concepts.** After collecting over 200 survey responses, both before and after experiments, we saw notable improvement in student understanding. **Post-experiment surveys showed a ~20%** (ranging from ~6-30%) **increase in correct answers with a ~70% correct answer rate** (ranging from ~60-85%) after our approximately fifty-minute lessons. In addition to gauging learning of participating students, the survey program encourages graduate mentors to focus their learning objectives for each

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experiment. We are dedicated to self-evaluating impact and improving our reach wherever possible, aided by quantitative performance metrics when applicable.

At the end of a typical academic year, the students would visit the university campus to conduct more elaborate experiments in the organic chemistry labs, such as making elastic bouncy balls, finding the energy content in food, and building mechanical hands from household materials. This visit could not happen this year due to the COVID-19 pandemic, but we are excited to resume this critical aspect of the program in 2021-2022. We also anticipate a return to in-person visits across our four partner schools. We seek to **maintain the broad reach of our program** - expanding when appropriate across classrooms and graduate departments – and continuing to improve upon the quality of each experiment delivered to **deepen our impact**.

Best,

SFA 2020-2021 Leadership Team

Annie Brinda, *Co-President*

Nolan Concannon, *Co-President*

Ela Engen and Matthew Lawler, *Marcy Open School Team Leads*

MaryJane Been, *Murray Middle School Team Lead*

Yutong Pang, *KIPP North Star Academy Team Lead*

Elizabeth Komosa, *American Indian Magnet School Team Lead*

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Table 2: 2020-2021 SFA Members

Name	Department	Name	Department	Name	Department
Aaron Shih	CEMS	Elizabeth Komosa	BME	MaryJane Been	BME
Abby Harthorn	BME	Elizabeth Shih	BME	Matthew Lawler	BME
Aditya Banerji	CEMS	Emma Pettit	CEMS	Maya Ramamurthy	CEMS
Allison Wong	CHEM	Erin Maines	CEMS	Meghna Singh	CS
Andreas Mueller	CEMS	Euna Mehnaz Khan	CS	Nathan Sidhu	CEMS
Annie Brinda	BME	Huzefa Hussain	BME	Nicholas Van Zee	CHEM
Ben Kaiser	CEMS	Issac Mastalski	CEMS	Nolan Concannon	CEMS
Ben Yeh	CEMS	Jonathan Lemke	CSE	Parth Bhide	CEMS
Benjamin Robertson	CEMS	Jonathon Nguyen	CEMS	Peng Ge	Pharm
Brady Bresnahan	CEMS	Joseph Hassler	CEMS	Prafful Golani	ECE
Brian Bayer	CEMS	Joseph Vallin	CEMS	Priyatanu Roy	MechE
Carly Donahue	BME	Josh Punnoose	BME	Rohan Chakraborty	CEMS
Casey Kraft	BME	Karin de Langis	CS	Roopana Vuppalapati Chenchu	CS
Charlie McCutcheon	CEMS	Katherine Cummins	BME	Rui Zhou	Earth Science
ChoongSze Lee	CEMS	Kaylie Richard	CEMS	Sam Boland	BME
Clara Kirkvold	CHEM	Kevin Schmalbach	CEMS	Sam Newell	BME
Daniel Krajovic	CEMS	Koen Verrijt	CEMS	Sarah Seeger	CEMS
Demetra Adrahtas	CEMS	Kristine Loh	CEMS	Simon Willis	CEMS
Diana Zhang	CEMS	Liz Gacek	BME	Supriya Ghosh	CEMS
Dipanjan Ghosh	CEMS	Maggie House	CEMS	Yutong Pang	CEMS
Ela Engen	CEMS	Maggie Lau	CEMS	Zhichen Shi	CEMS
Elise Miller	BME	Mark Gotthelf	ME		

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