

MindHive: a community science platform for human brain & behavior science inquiry

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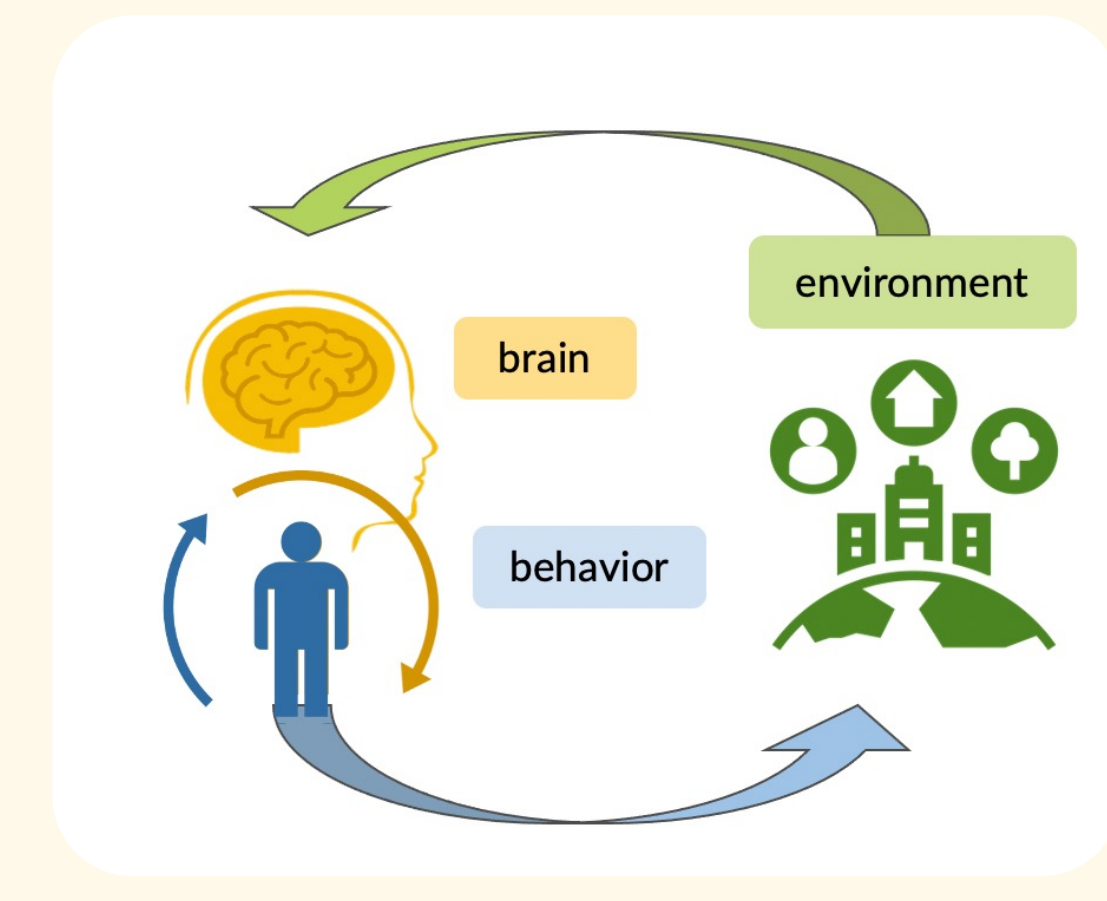


MindHive is a web-based community science platform that supports authentic human brain and behavior research experiences for students, teachers, scientists, and communities.

- RQ1:** How can we best support teachers in the process of engaging their students in authentic research?
- RQ2:** How can we best support collaborations between students, teachers, and scientists through online platforms?
- RQ3:** What is the impact of this process on students' understanding of scientific inquiry and attitudes toward STEM?

Why human brain & behavioral science?

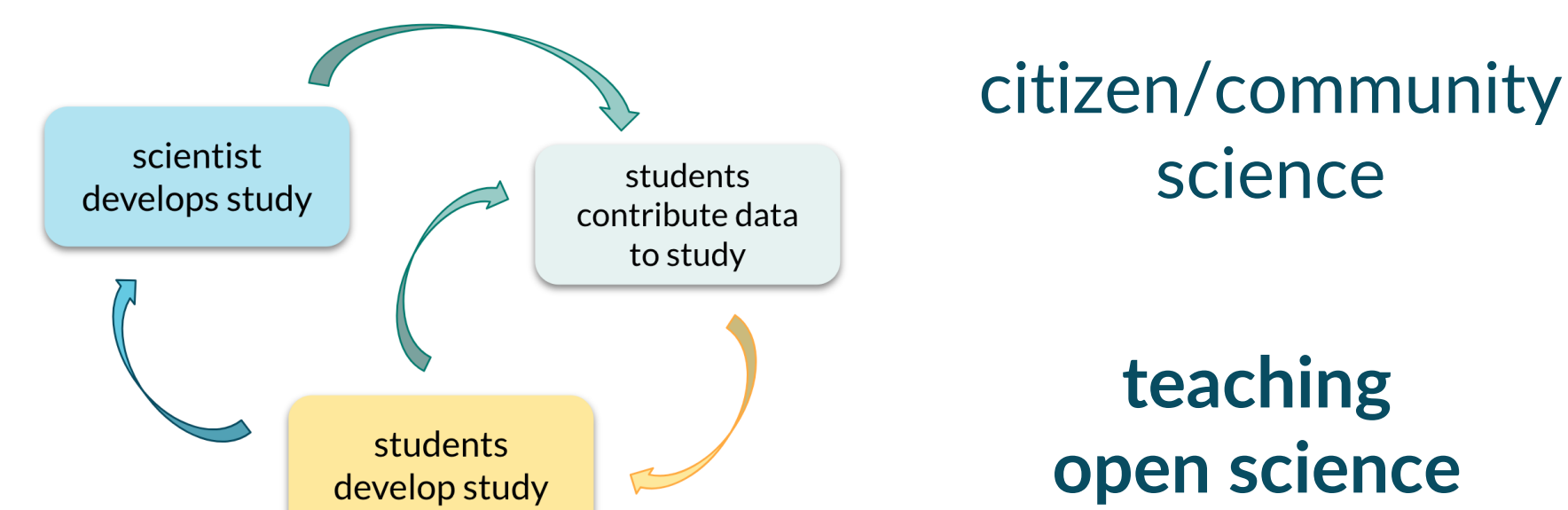
- Human brain & behavior science is recognized for its potential to address issues in public health, climate change, poverty, crisis resilience, political polarization, among other issues.
- A community science approach to human brain & behavior inquiry can empower the public to identify and address issues that are both personally and socially meaningful.



A Collaborative Inquiry Environment

- Open Science philosophy & curriculum
- Collaborative study design environment
 - study builder
 - a database of validated tasks and surveys
 - a public-facing study page
- Peer review center - students can engage with and reflect on studies designed by peers across the country
- GDPR-compliant data collection and management

MindHive uses a participatory science learning approach to engage learners in the full spectrum of scientific inquiry with the aim of significantly extending the reach and impact of student-teacher-scientist partnerships and citizen science.



MINDHIVE CURRICULUM

Student as Learner

Students engage in MindHive lessons designed to introduce concepts and skills relating to citizen science, human brain and behavior research, and the process of conducting scientific research

MINDHIVE STUDIES

Student as Participant

Students use the MindHive platform to participate and reflect on studies designed by professional cognitive and social neuroscientists, community organizers, and students across the country

MINDHIVE TOOLS

Student as Scientist

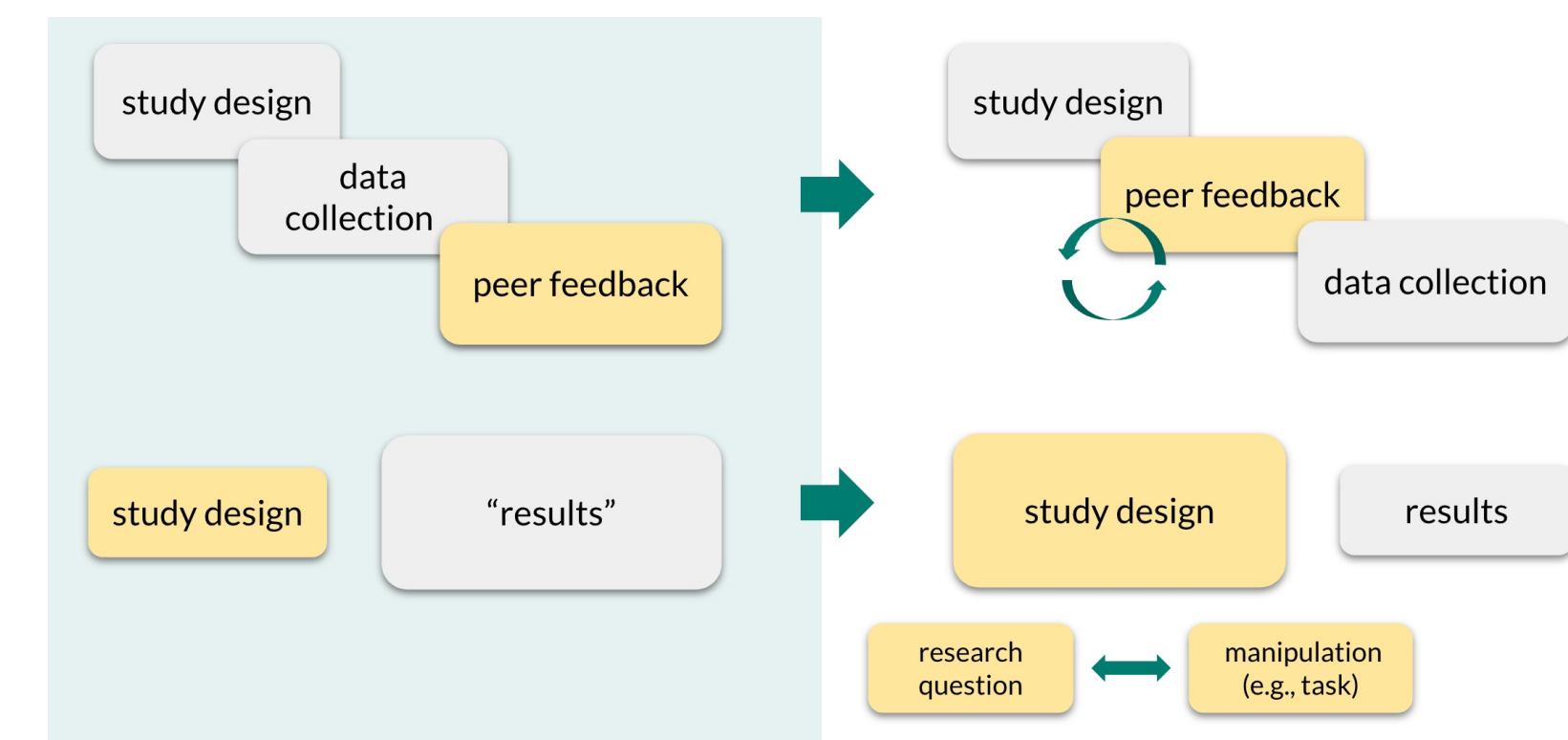
Students design their own studies, review and participate in studies designed by students from a network of schools across the country, collect and analyze research data, and generate research reports

Participating in Studies

Building Studies

Generating Research Proposals

'preregistered' study review model



study design center peer review center

Challenges in authentic scientific inquiry in the high school classroom & questions for future research

Authentic inquiry

- How can we support students in identifying questions that are both person interesting, and relevant to science more broadly?
- How can we design a platform that invites meaningful participation from both scientists and students?
- What opportunities and challenges do teachers and mentors experience in implementing and guiding students' behavioral science inquiry context?

Data engagement

- How can we design/leverage data engagement tools to better support students' abilities to design, interpret, and evaluate behavioral science research?
- How does engaging with data in the context of behavioral science impact students' dispositions, attitudes & interests re behavioral science inquiry & data?

Research & Implementation - Spring 2020 > Spring 2023

Spring 2020 (Pilot)

- 1 independent NYC high school
- 17 students
- 1 group study

Fall 2020 (semester-long implementation)

- 2 NYC public schools
- 2 teachers
- 5 implementations
- Brain & Behavior PBAT
- Environmental Science
- ~130 students

Spring 2021 (semester-long implementation)

- 4 schools across the USA (NY, MD, TN)
- 5 teachers
- 7 implementations
- Molecular Biology
- Biological
- Environmental Science
- Brain & Behavior PBAT
- ~150 students
- ~30 studies

2021-2022 (year-long implementation)

- 4 high schools in NYC
- 2 NYC-DOE schools
- 2 Independent schools
- 5 teachers
- 6 implementations
- Neuroscience
- Environmental Science
- Brain & Behavior PBAT
- ~100 students
- ~70 studies

peer review center
proposal board
task/survey bank

2022-2023 (year-long implementation)

- 10 high schools across NYC
- 8 NYC DOE schools
- 4 Consortium Schools
- 4 Regents Schools
- 2 independent schools
- 11 teachers
- 20 implementations
- Brain & Behavior PBAT
- Neuroscience PBAT
- Neuroscience elective
- Environmental Science
- Biology
- ~450 students
- ~240 student-led studies
- independent projects
- group projects

Total (2020-2023):

- ~40 implementations across 3 states
- ~900 students
- ~350 studies
- ~7,500 users nationwide

MindHive is a hybrid program to support geographically diverse participation

students design studies relevant to their daily lives

- learning
- mental health
- climate change
- polarization

Does taking different types of breaks affect students' ability to retain material?

Does geographical location affect one's willingness to respond to climate news and live sustainably?

online PD & teacher meetings

remote mentorship

Data Collection - pre/post surveys, artifacts, student-teacher-mentor interviews

Research Findings - Summary

- Students showed an increase in fascination with science, and their sense of agency as citizen scientists.
- Students improved in justifying the importance of research foci but continued to struggle with aligning methods to research questions.
- Students came to value the importance of feedback for improving study designs but struggled with aspects of peer review, including giving concrete suggestions for improvement.

Selected Publications

Matuk, C., Martin, R., Vasudevan, V., Burgas, K., Chaloner, K., Davidesco, I., Sadhukha, S., Shevchenko, Y., Bumbacher, E. and Dikker, S., 2021. Students Learning About Science by Investigating an Unfolding Pandemic. *Aera Open*, 7, p.23328584211054850.

Dikker, S., Shevchenko, Y., Burgas, K., Chaloner, K., Sole, M., Yetman-Michaelson, L., Davidesco, I., Martin, R. and Matuk, C., 2022. MindHive: An Online Citizen Science Tool and Curriculum for Human Brain and Behavior Research. *Connected Science Learning*, 4(2).

Matuk, C., Yetman-Michaelson, L., Martin, R., Vasudevan, V., Burgas, K., Davidesco, I., Shevchenko, Y., & Dikker, S. (in revision). Open science in the classroom: Students' designing and peer reviewing studies in human brain and behavior research. Submitted to *Instructional Science*.