Why Elementary and Broader Impacts?

It is clear that beginning to engage students in STEM at the undergraduate level may be “too late” for many to transition into and build a successful STEM career. This is particularly true for students from underrepresented backgrounds who often face barriers far earlier than at the undergraduate level. Research shows that late elementary and early middle school is a critical time period, where high numbers of students lose interest in and motivation to pursue STEM. This is often fueled by limited access to diverse and engaging STEM experiences and STEM role models. These issues can be mitigated through high-quality broader impacts (BI) experiences that connect university STEM faculty and their research with elementary classrooms.

BI activities connecting researchers to elementary students have proven successful. While there is much to learn from these experiences, compared to activities involving high school students, they are limited in number. This, coupled with the fact that STEM at the elementary level can often feel distant from the rigorous work done at the university level, can deter researchers new to BI from pursuing activities with elementary grades. There is a need for guidance on how to successfully engage elementary audiences in BI in order to increase the number of researchers partaking in it.

Developing Experiences

Elementary level BI experiences should focus on fostering student curiosity, interest, and motivation to continue learning about STEM.

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| K-5 teachers face time constraints for adding STEM to an already full classroom schedule. | - Align activities with the NGSS.  
- Consider integrating activities with ELA, math, and social science.  
- Utilize assessments to show the impact and value. |
| K-5 students are discovering their interests while getting exposed to potentially harmful STEM stereotypes. | - Make experiences “fun” leave students interested and motivated to learn more.  
- If possible, highlight connections or relevance to diverse STEM careers/fields.  
- Share a personal “STEM journey.” |
| K-5 students are developing their social-emotional, self-regulation, communication, and cooperation skills. | - Consider how these skills may impact activities and/or how the activity may support these skills.  
- Avoid lectures; use hands-on experiences.  
- Provide appropriate number of breaks. |
| K-5 students have a very basic level understanding of STEM; experience with, knowledge and skills in STEM may be limited. | - Focus on overarching STEM concepts relevant to the research.  
- Search online for related K-5 activities.  
- Connect with others who have successfully engaged K-5 audiences.  
- Get familiar with the K-5 NGSS. |

Example K-5th grade BI activities: summer camps, after-school programs that include lab visits, demonstrations; songs, games, physical activities, or story books modeling complex STEM concepts; researcher STEM journeys; hands-on activities and projects.

Researchers Partnering with Teachers

K-5th Grade Teacher Assets:
- Expertise in elementary pedagogy.
- Expertise in teaching multiple subjects (ELA, math, etc.).
- Access to students and families.
- Familiarity with students’ backgrounds and prior knowledge.
- Familiarity with Next Generation Science Standards (NGSS).

University Faculty Assets:
- STEM content experts.
- Connection to STEM fields and professionals.
- Ability to serve as an example of a successful STEM role model.
- Access to equipment, tools, labs, and cutting-edge research.

Case Study: BOTS

BOTS, or Building Opportunities with Teachers in Schools, is a computer science K-5th grade teacher professional (PD) development program developed and led by the USC Viterbi K-12 STEM Center.

BI and BOTS

Get familiar with faculty’s research in natural language processing, robotics, and artificial intelligence (e.g. read faculty website, attend outreach talk, and meet with faculty).

Connect faculty and 3rd-5th grade teacher to share interests, needs, challenges, and to brainstorm ideas. Review curriculum and activities already developed and available online.

Collaboratively develop new lesson(s) linking natural language processing in robots, AI, with English language arts or Math.

Teacher shares and leads the lesson during a BOTS teacher PD workshop.

BOTS teachers implement the lesson in their classrooms; provide feedback.

Faculty connects with each classroom virtually to share their STEM journey.

Call To Action

Are you interested and/or passionate about engaging elementary teachers and students in broader impacts work? Share your experiences and let’s connect! https://tinyurl.com/USCElementaryBI

References