

BUILDING INSIGHTS

OBSERVATION

THROUGH

Building Insights through Observation (BIO): Researching Arts-Based Methods for Teaching and Learning with Data

BIO MODEL

Observation and Discussion: Art/Data

"VTS-inspired" observation sessions of at least two images artwork relating to the topic of the unit, and a related geospatial data visualization.





Bridging Approach: Fence Post Activity

Students represent personal data, thoughts, and opinions in a graphic form and observe and discuss gathered responses.





Data Sketches

Using a design thinking process, students draw their own representations of geospatial datasets on tracing paper, then overlap those different "data layers" to discuss patterns and correlations.



Theoretical Framework

The BIO approach activates and intertwines Visual Thinking, Design Thinking, and Content Understanding to improve Data Literacy.

The BIO model was tested and iteratively refined with 10 middle school science teachers who participated in professional development workshops and used the model in their classrooms.



This material is based upon work supported by the National Science Foundation under Grant No 2101310. Any opinions, findings, and conclusions or mendations expressed in this material are those of the author(s) and not necessarily reflect the views of the National Science Foundation

DESIGN identifying, and evaluating design choices in data THINKING Skill set of critically looking Skill set of critically representation at and interpreting constructing visual visual representations epresentations to convey **DATA LITERACY** of data different meaning or emphasis Critically examine and evaluate visually represented data to understand, explore, and question **Consider how** real phenomena knowledge to interpret visual evidence representation strategies prioritize content / messages CONTENT UNDERSTANDIN Exisitng or aquired knowledge about concepts and content that apply to visual information

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Teacher Professional Growth & Practices

Individual teachers valued the arts in more and different ways due to BIO Professional Development (PD).

I believe arts-based practices help students...

Make detailed observations

Visualize and make design choices

Access new ways to do science

Think about more or different viewpoints

Use art as an entryway to science

Demonstrate deeper understanding

Visualize processes and phenomena

Only Mentioned Pre-PD	No Change	Ne
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Data are from coded interview responses (n=10). Numbers reflect the type of change shown by each individual teacher. Yellow bars show the number of teachers for whom an idea was newly expressed post-PD.

Essential Elements of BIO Professional Development

Teachers described the most valuable or transformative attributes of the BIO PD.

"Because [PD] was so focused, and because we had lots of opportunities to practice and to try it, to reflect on it and to keep going, I think it's changed the way I look at presenting data to kids."

-Teacher Interview



Promise for Developing Student Skills

BIO students showed greater growth in their ability to make a claim and support it with evidence.



Out of three opportunities to say something about a novel data visualization, the data below represent each student's "personal best" – the highest level demonstrated of their ability o interpret from data and support it with evidence. (n=68 BIO students; n=76 Control students)





"[I used to think] the art is not as important as the data or the science knowledge behind it, but I think my perspective has kind of changed. Art is a good entryway into all the deeper science things, because there's deep science to be found in art pieces."

-Teacher Interview

BIO lessons over multiple semesters benefitted neir students alike.	9 out of 10
d the BIO PD team's reponsive and personalized edback.	8 out of 10
ed from one another, often through reviewing each Is for inspiration.	7 out of 10
to practice and roleplay the lessons as a learner added teachers.	7 out of 10
e BIO lessons were focused, purposeful, and ready to ed.	7 out of 10
	-

Data are from coded interview responses, post-PD (n=10). Numbers indicate how many teachers focused on each theme at least once in interviews after they'd experience part or all of the PD.

Control Post



"I learned that there's always more than meets the eye with some of this data. There are hidden correlations that sometimes you don't see. I did learn to open up and try to find more correlations between stuff."

-Student Interview

BIO Professional Development was effective for teachers because it offered:

Teachers found the BIO approach especially effective for:

Compared to control, BIO Students showed greater growth in geospatial data literacy and skills:

- Application of geographic knowledge
- Causal claims about why data show a given pattern, supported by evidence

- Consideration of human population relationship to other datasets (a specific data set used in most BIO classrooms)











After participating in BIO Professional **Development**, teachers:

Increased their confidence in teaching with complex data and the arts

Saw greater and broader value in how the arts benefit teaching science

 Increased their use of complex, professionallycollected data

• Lessons that were highly adaptable and useful beyond the BIO project

Respect for teachers' expertise and input to develop lessons

Materials, templates, and supply kits designed to ease logistical challenge

Broadening participation in science class

Improving ability to recognize patterns and solve problems with data

Building critical thinking about the design of data visualizations

• Frequency and diversity of visual observations

• Flexibility of interpretations





