



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

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What is Building Insights through Observation?

A four-year design-based research process to iteratively develop, test, and refine a cross-disciplinary instructional framework and professional development model with middle school science teachers ...

...using their classrooms to examine how these practices support students' data literacy and reasoning skills, and to explore specific areas in which the approach shows greatest promise.

Based on:

1. Visual Thinking Strategies

Learner-centered facilitation method creating inclusive and thoughtful group discussions.

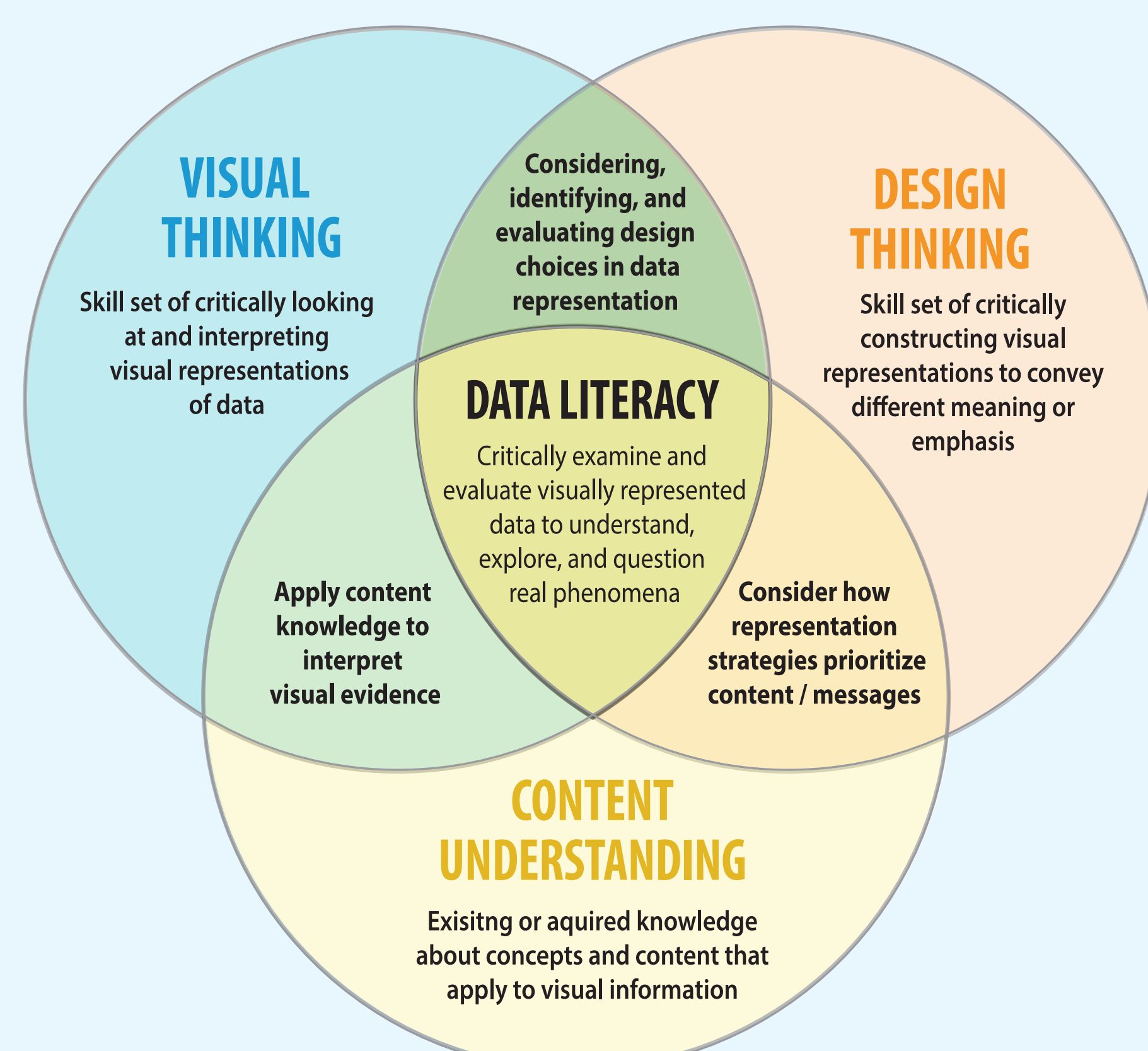
2. Design Thinking Process

Solution-based approach to solving problems with 5 stages: Empathize, Define, Ideate, Prototype, Test.

Set the Environment

- This is a safe place for reflection and all voices are welcome
- Everyone's observations are equally important
- Step up, step back
- Be respectful and considerate when others are speaking
- You will be doing most of the work in groups
- It is critical to pay attention (listen!) and work together
- Be open to new experiences and approaches and have patience when you don't understand

Underlying Theoretical Framework



Overview of the Building Insights through Observation Framework:

BUILDING INSIGHTS THROUGH OBSERVATION

Resources:
SOSx <https://sos.noaa.gov/catalog/datasets/>
NOAA View Global Data Explorer
NASA Earth Observatory
BIO Art Image Library

1 VISUAL THINKING STRATEGIES > as a class
open, inclusive environment 40 min.
- artwork related to science topic
- mapped data related to science topic
• silent reflection
- optional jotting down of ideas
• guided discussion
"What's going on in this picture?"
"What do you see that makes you say that?"
"What more can we find?"
• thank you and wrap-up VTS
• pair share - questions to parking
listen carefully, accept each comment neutrally, paraphrase, do not change meaning, point to the image, add vocabulary, link student's answers to prior knowledge

2 BRIDGING APPROACH > individually & as a class
fun, creative environment 30 min.
Fence Post Activity
Making Local to Global Data Connections
- handouts: design tools sheet, topic-based questions
- strips of cardstock
- drawing tools
- string/clothes pins
• as a class decide what symbols to represent answers
• students respond to questions creatively
• class responses are lined up
• silent reflection and guided discussion

3 DATA SKETCHING CREATIVE PROCESS > groups of 3
supportive, collaborative environment 50 min. (2)
- handouts: design tools sheet, map template, student worksheet
- drawing tools: tracing and scrap paper
- mapped data piece used in VTS session
- 2 - 4 additional related mapped data
UNDERSTAND • review design tools
• silent reflection of maps
• group planning
CREATE • observe and sketch
RESPOND • answer worksheet / discuss
"I see..."
"I wonder..."
"This data is interesting because..."
LAYER and DISCUSS
• layer maps
• discuss patterns and connections, summarize
• present findings to class

4 WHAT QUESTIONS DO WE STILL HAVE? HOW DO WE FIND THE ANSWERS?

QUESTIONS PARKING

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Methods

Approach

- 2 Cohorts of 5 middle school science teachers from across the country
- Professional development workshops each summer, followed by teacher-led implementation in classrooms
- Reflections, evaluation, and feedback help refine the approach
- Iterative, adaptive

Critical Components

- Independent looking /silent observation time supports different types of learners and slows the pace.
- Group discussions reinforce learning within the community by hearing others' insights.
- Use of both art and SOS data, with art first. Using art first helps with empathy, confidence.
- Group environment is set as a safe space for open discussion where everyone feels their perspective matters.

Outcomes

- ▶ An adaptive toolbox that can be used by educators of STEM disciplines for teaching data visualizations from maps.
- ▶ Website that includes video tutorials, a framework outline, repository of example lessons, and an e-book that explains the approach.
- ▶ 10 trained middle school science teachers across the country that helped iteratively test and refine the model
- ▶ Research findings about the effectiveness of the approach in helping improve data literacy

1 Sample artwork and dataset used in (framework component #1- Visual Thinking Strategies)

Thomas Hart Benton - The Menemsha Hurricane [1954] Hurricanes 1950-2020 Cumulative

2 Global to Local Connections (framework component #2 - Fence Post Activity)

3 Sketching of mapped data (framework component #3 - Data Sketches)

Design Tools for Mapping your Data

Maps use graphic symbols to represent locations and characteristics of events spread across Earth's surface. Below are some key design elements you can use as a guide in representing your data and creating your own legend for your map. You can combine colors, patterns and symbols to make your map truly unique.

LEGEND

- Densely Urban
- Urban
- Settled
- Rural
- Ocean