FIGURE IT OUT!

Developing data literacy skills through use of interactive multimedia learning objects (MMLO) to evaluate figures and tables

Steven Nagel and Ross Tamburro
ABOUT YOUR PRESENTERS

Steven Nagel, MS
Associate Instructional Designer

I work with faculty to design online courses with a particular interest in multimedia innovation.

Ross Tamburro
Associate Educational Technologist

I work with all ID's to bring multimedia innovation into our courses.
1. **Recognize** the engagement value using an interactive MMLO provides to students.

2. **Assess** the possibilities of adapting an interactive MMLO in their classes to teach data literacy skills.

3. **Explain** the full development process of an MMLO for use in an online and/or face-to-face course.
PROBLEM

General data literacy issues and needs in STEM education, and course background and overall project description
Data literacy issues in STEM education

*What does the literature say?*

1. Undergrads focus on raw/untransformed data and don't perceive trends *(Angra & Gardener, 2017).*

2. Students need to master visual literacy to communicate visual representations of phenomena *(Offerdahl, Arneson, & Byrne, 2017).*

3. Students need to possess quantitative reasoning skills and apply those skills to developing and interpreting graphs *(AAAS, 2011).*

4. Online modules can be utilized to introduce quantitative skills *(Thompson et al., 2010)* and enhance development of scientific processing skills *(Kramer, Olson, & Walker, 2018).*
Data literacy issues in STEM education (continued)

What do instructors say?

Students don't know where to begin with...

1. **Reading** and **interpreting** graphs and tables
2. **Identifying** appropriate visual means to display data
3. **Constructing** effective visual means to display data
BMI 7810: Design and Methodological Approaches in Biomedical Informatics

- **Main Objective:** Compose the main components of the NIH F(31) research grant.

- **Type of students:**
  - BMI Graduate Students
  - Public Health Graduate Students
How did we **plan** to tackle this problem?
Where did we begin and what **route** did we decide to take?
What’s our **angle**?

1. How did we begin?
   - Course development kickoff meeting.
   - ID “big rocks” and main objectives.

2. Why this route?
   - EEOB: Graphing Detective Exercise.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Questions About the Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Looking only at the axes and data, what do you know about how the study was done?</td>
</tr>
<tr>
<td>2</td>
<td>Looking now at the entire graph, including the figure caption, what else do you know about how the study was done?</td>
</tr>
<tr>
<td>3</td>
<td>What can’t you tell about how this study was done?</td>
</tr>
<tr>
<td>4</td>
<td>What specific question is being addressed in the portion of the study represented by this graph?</td>
</tr>
<tr>
<td>5</td>
<td>Why would anyone want to ask the question referred to in Step 4?</td>
</tr>
<tr>
<td>6</td>
<td>What is the most important result shown by the graph?</td>
</tr>
</tbody>
</table>
Where to begin?

- Utilize Graphing Detective (Pechenik & Tashiro, 1992)
- Locate "bad/notorious figure" - "Gun Deaths in Florida"
Setting up the project roles
Overall project *workflow*, from storyboarding, version history, usability/accessibility testing and templating for further activities
Initial project **structure**

- Based on the Graphing Detective exercise, began to brainstorm project layout with three initial parts:
  - Part 1: Evaluating the Study
    - Figure only
    - Figure + caption
    - Figure + caption + text
  - Part 2: Evaluating the Visual
  - Part 3: Your Responses
• Brought back the "Gun deaths in Florida" figure to place it into our initial project outline.
• Following our storyboard template to organize and hammer out project details.
Building a **prototype**

- Storyboard material was copied into Articulate Storyline (tool of delivery).
- Continued partnership between ID and instructors to take in and incorporate project setup ideas.
Additions during design

• Adding voiceover alternatives for section intros and instructor feedback.

• Outline on each slide with a "You are here" indicator.

• Took out the "Your Responses" section and added an "Overall Improvements" section.

• Ability to view/download figure/table.
Added...

- Voiceover
- Ability to view/download a larger figure/table
- Alt text on images
- Simpler navigation
- Better indicators of where a user was in the project (outline, section indicator, etc.)
- Alternative document with all the same content listed out
Using the **prototype as the template**

- As prototype was being built, additional figures were being gathered.
  - One learning object → Three figures
  - One learning object → Three tables
- Project layout was completely finalized and tested before copying the style for the other five activities.
LEARNING OBJECT
DEMONSTRATION

Running through the final product
Evaluating the efficacy of both learning objects and the module which contained them
Assessing Efficacy of MMLO

1. **Content:** Larger Module on Data Literacy

2. **Scalability:** Approaching Key Partners
   - The Center for Life Sciences Education
   - Arts and Sciences Technology Services

3. **Research Study**
   - IRB Approval: 2018B0279
   - Courses: BMI 7810 & undergraduate biology course
   - Student use of validated rubric to score graph quality (*Duesbery et al., 2017*)
How can you apply what you heard today?
Major takeaways

1. Agile project management in course design
   • Building up a partnership with regular flows of communication
   • Encouraging a collaborative environment

2. Research-based course design
   • Starting with a published intervention
   • Utilizing the literature to guide the overall design process

3. Establishing assessment procedures for multimedia course components
Questions?
References


THANK YOU!

Steven Nagel
- nagel.101@osu.edu
- @StevenTNagel
- steven-nagel

Ross Tamburro
- tamburro.5@osu.edu
- @ratamburroOSU
- ross-tamburro