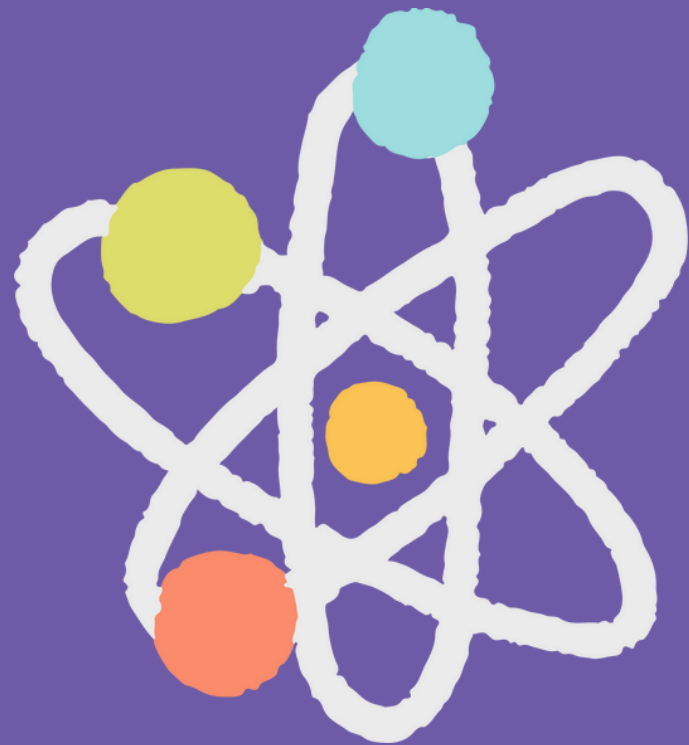# Research 101

ILLINOIS SCIENCE &
TECHNOLOGY COALITION

EDUCATION

Overview

- Research question and hypothesis creation
- What are the primary sections of research?
- Literature review tips and tricks
- Quantitative vs Qualitative methods
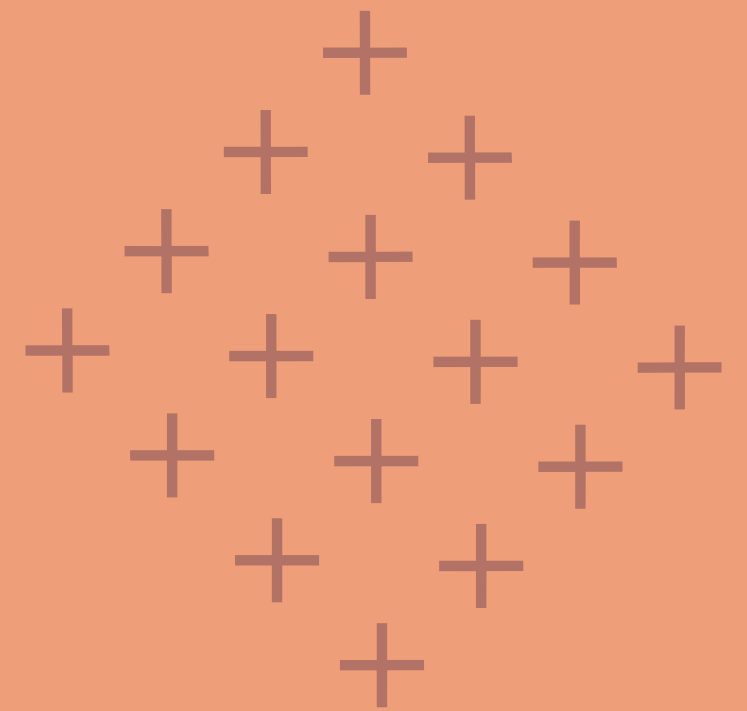- How to write and present research

My Background

Julianna Grandinetti, M. S.Ed
BA in Neuroscience and Psychology

Previous Mentor on the platform

Research Experience
- Child Development and Child Psychopathology
- Behavioral Science
- Education
- Neuroscience
- Drug
- Community Healthcare
- Museum Studies
- Policy

What is a Research Question?

- An inquiry that leads to a response by finding out information and/or solution

- Three Categories
  - Descriptive
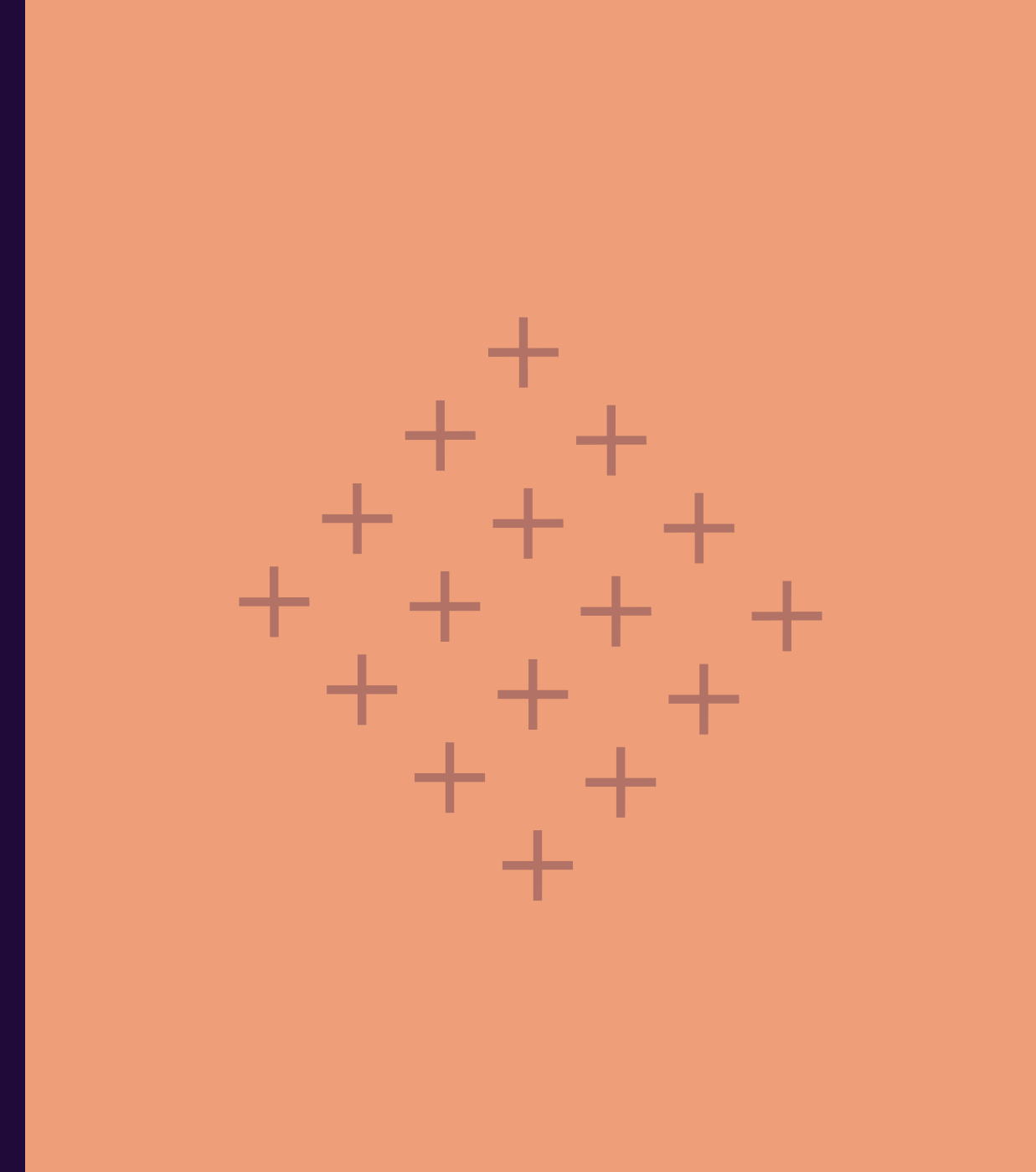 - Relational
  - Causal

- Think broad!
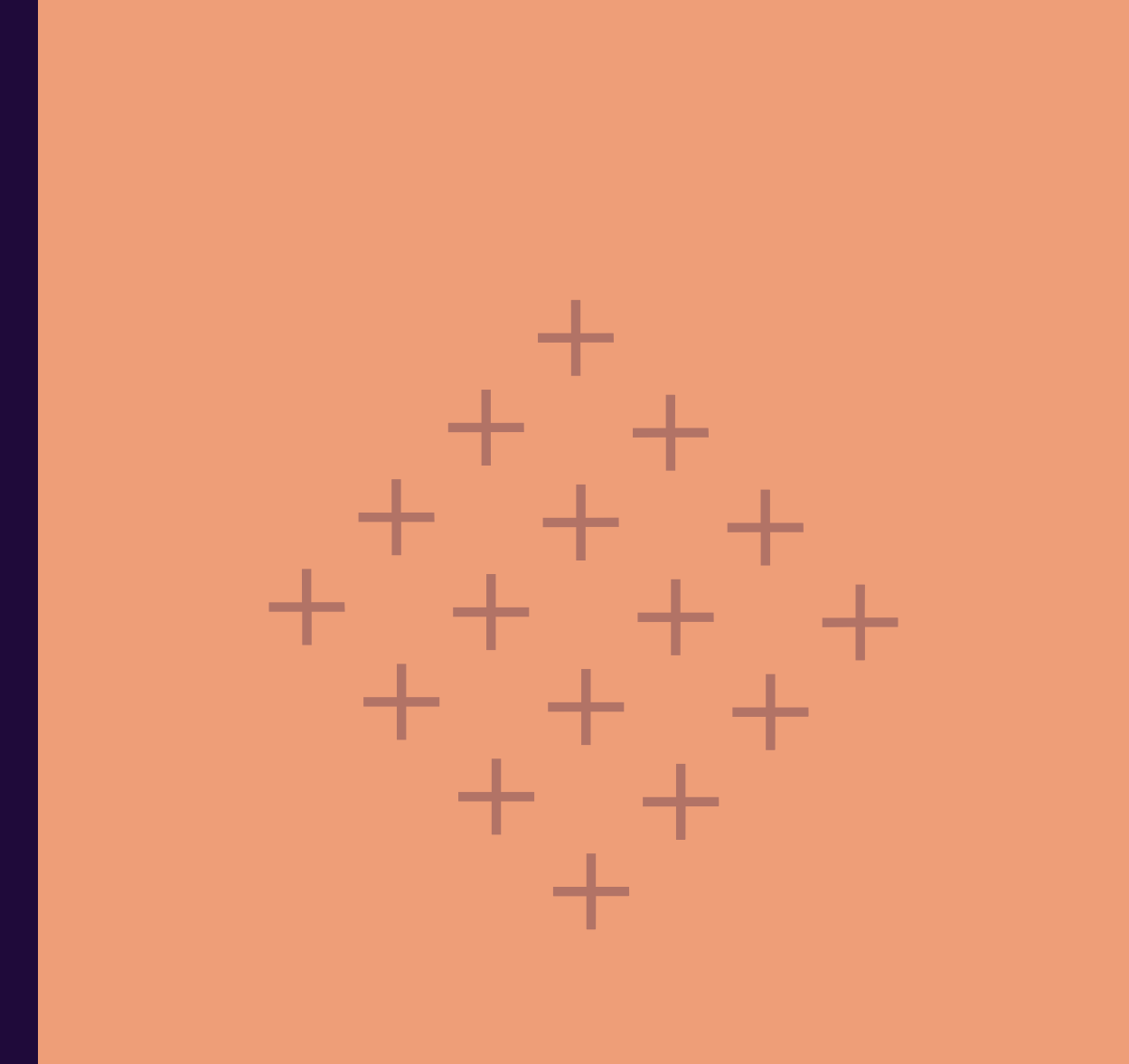
How do I start?

- Questions to ponder:
  - What field or things am I interested in?
  - How can I add or change what already exists?
  - What am I eager to learn?
  - Am I addressing a real world problem?
  - How can I create change?
  - What inspires me?
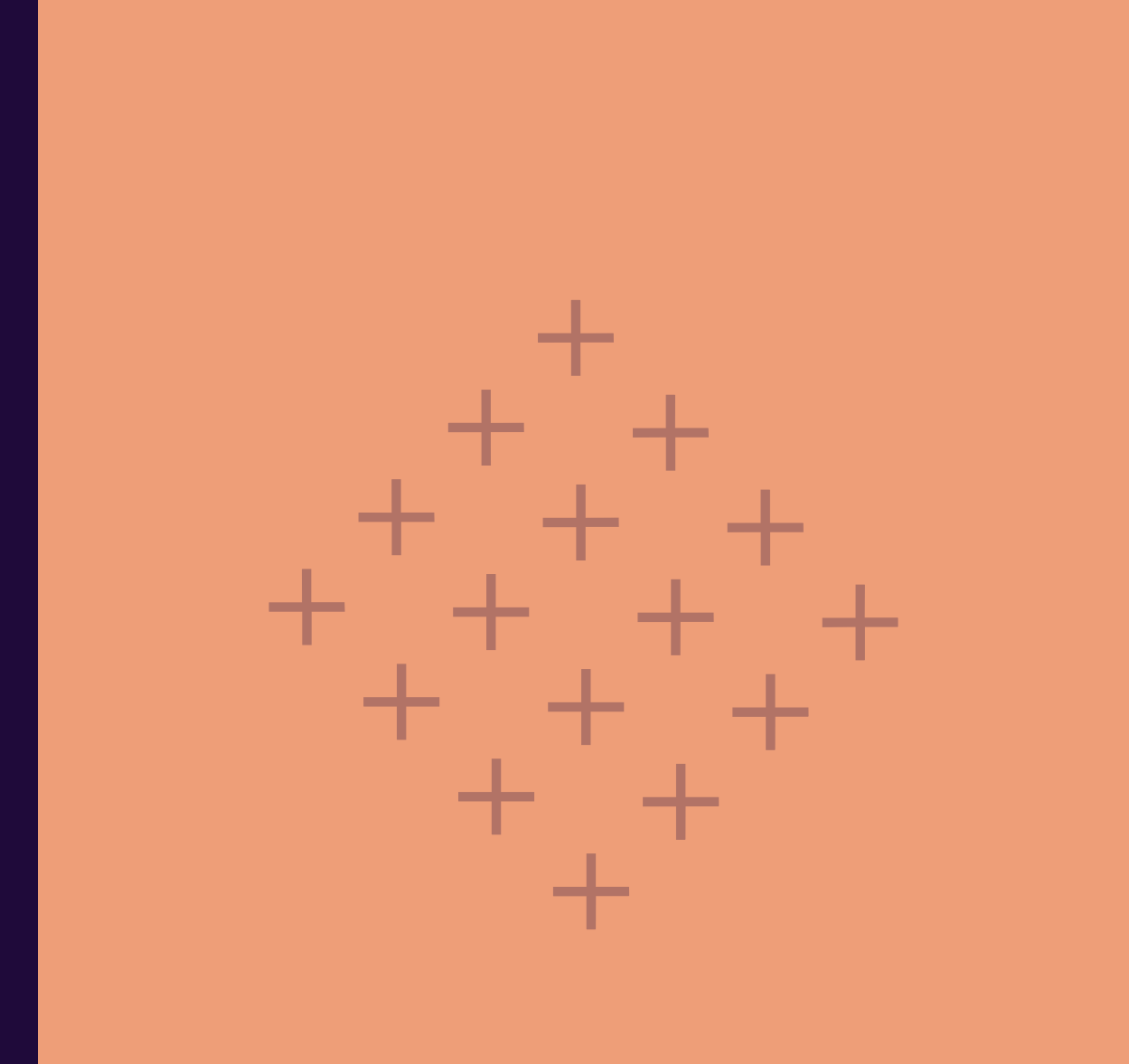
How Do You Create a Hypothesis?

- Think "If, Then"

    ○ is there a prediction of the relationship and outcome?

    ○ is it simple and concise?

    ○ can observable and testable results occur from the

      question?

- Relevant and specific to your research question

    ○

Try It Out from Last Year's Projects!

1. Descriptive
2. Relational
3. Causal

The correlation between childhood trauma and negative mental health

To what extent do the toys kids and parents play with affect the perception of success of careers and the future

What is the benefit of mindfulness meditation to students with learning disabilities

Is synesthesia real?

What Are the Main Sections of General Research?

- Introduction
  - State the problem, why it matters, what is the impact, what you plan on doing
- Literature Review
  - What does the data say? Is there contradictory data? History?
- Methods
  - What did you do to test your hypothesis? How?
   - Someone should be able to read your methods and replicate it exactly
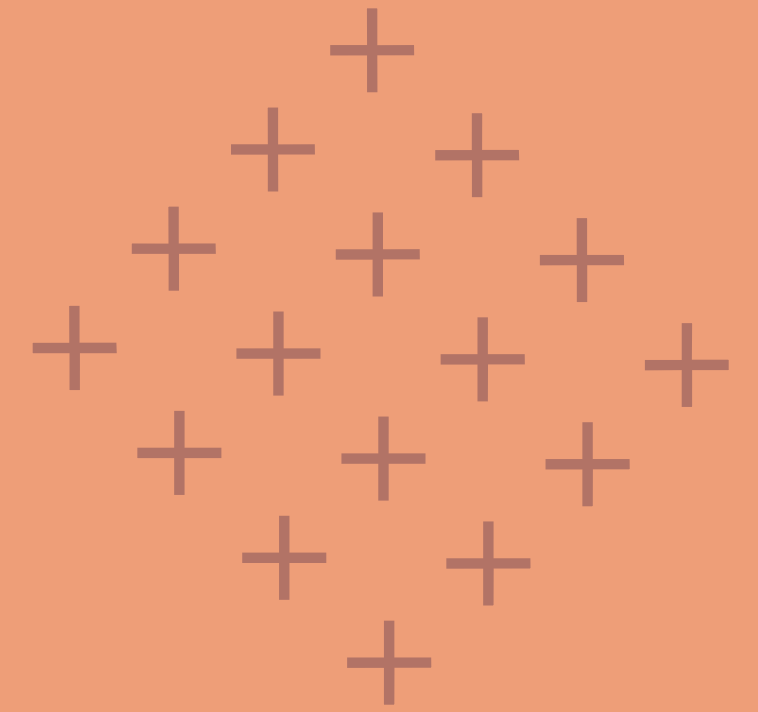
What Are the Main Sections of General Research?

- Results

  - What are the tables and graphs from the methods?

    - Results do not describe data, it just reports

- Discussion

  - Interpreting the data, addresses gaps and implications, what would you do differently

- Conclusion

 - Summary of project, why did this all matter?
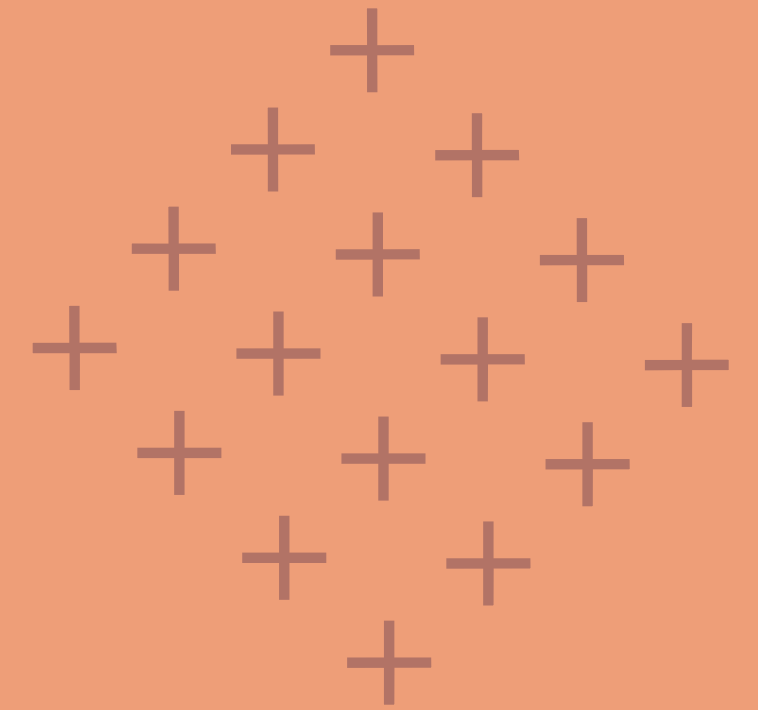
What Are the Main Sections of Prototype Research?

- Define the vision

  - What problem does it solve? Is there something like it? What

    problem does it solve or complement?

- Focus on key features

  - It doesn't need to be identical to the end result!

  - Focus on 1-2 aspects

- Build, test, revise. Build, test, revise.

- Present

  -
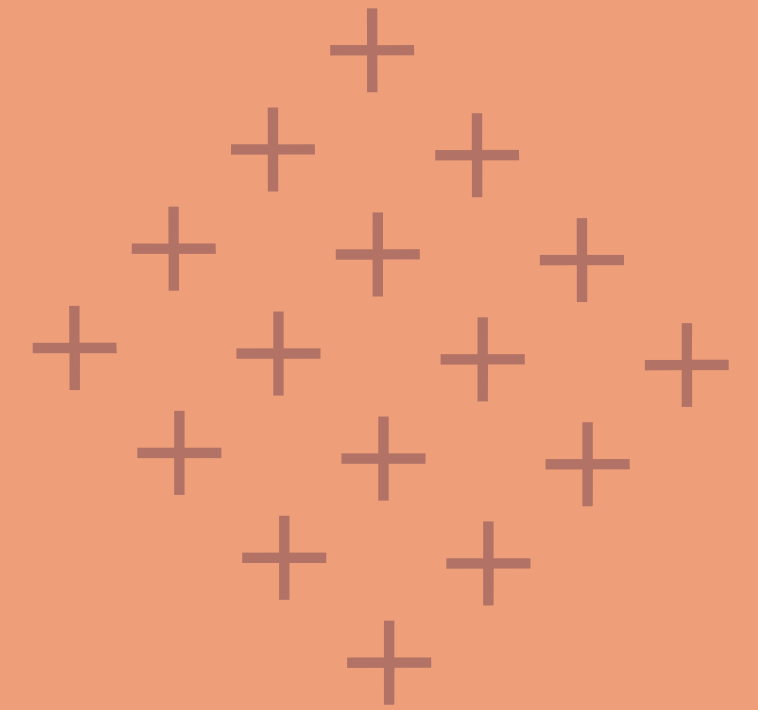
Literature Review

- Primary vs Secondary Source

    - How removed are you from the direct source?

    - Both are needed!

- Databases VS Google Scholar

    - Databases have only peer reviewed journals, but you need

      granted access (like school library)

    - Google Scholar: scholarly, but not always peer reviewed

- Ask your mentor!
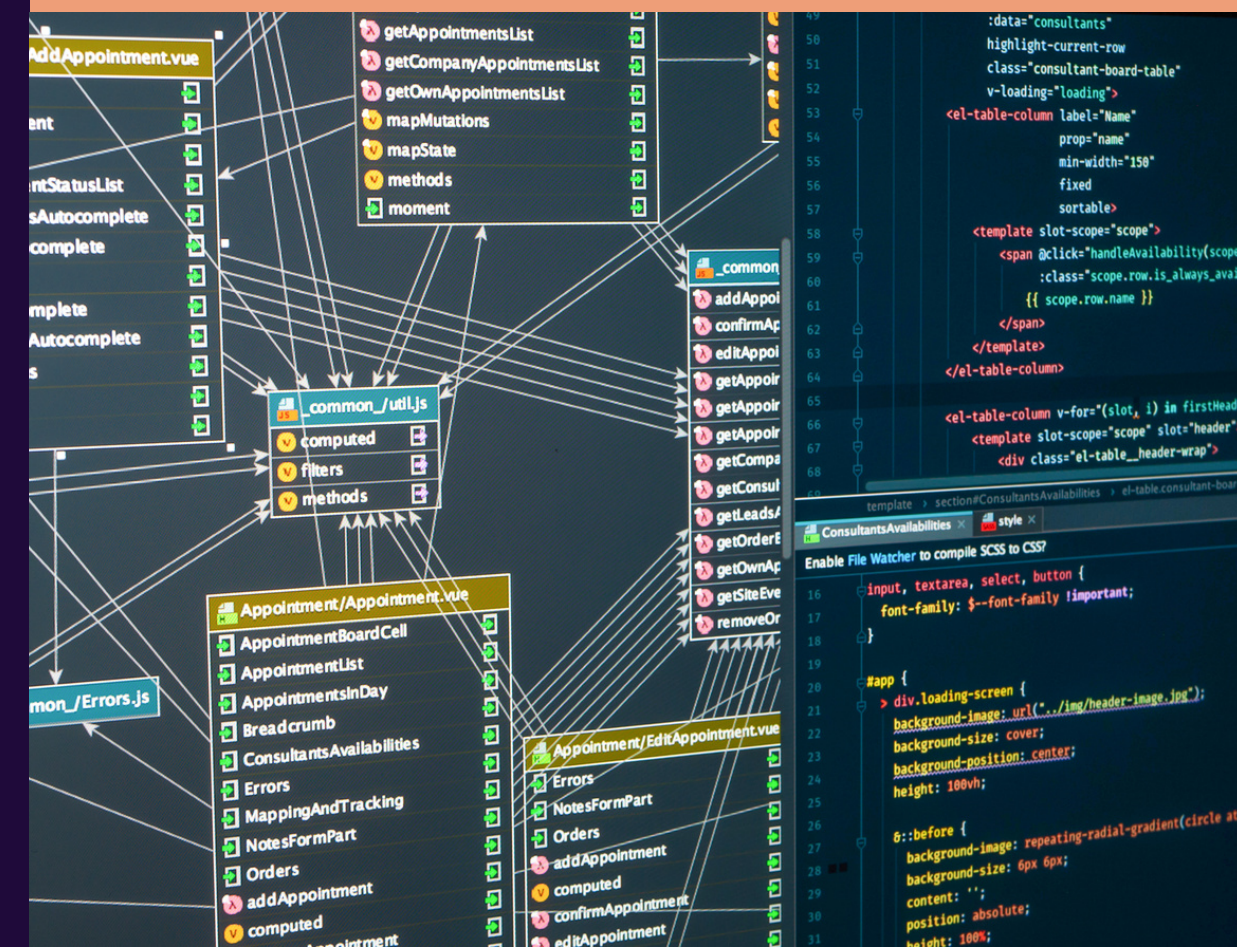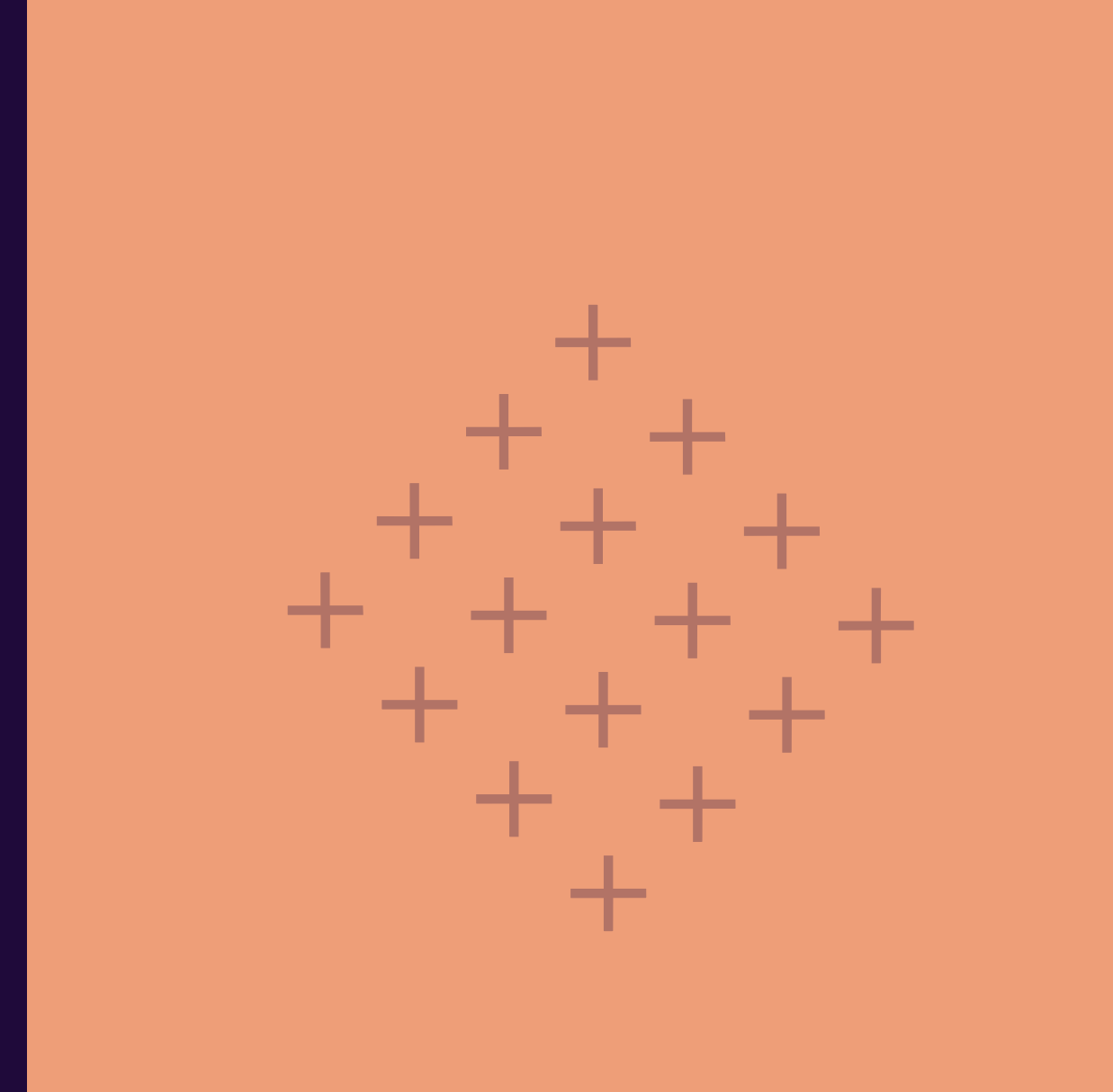
Tips and Tricks for Finding Literature

- Boolean Searches

  - Quotation marks

  - "and", "or", "not"

- Unless historical, stick with the last five years

- Reference sections of existing research

- Question your research: SIFT!

  - Stop and reflect on the source

  - Investigate the source

  - Find better coverage

  - Trace claims back to original source
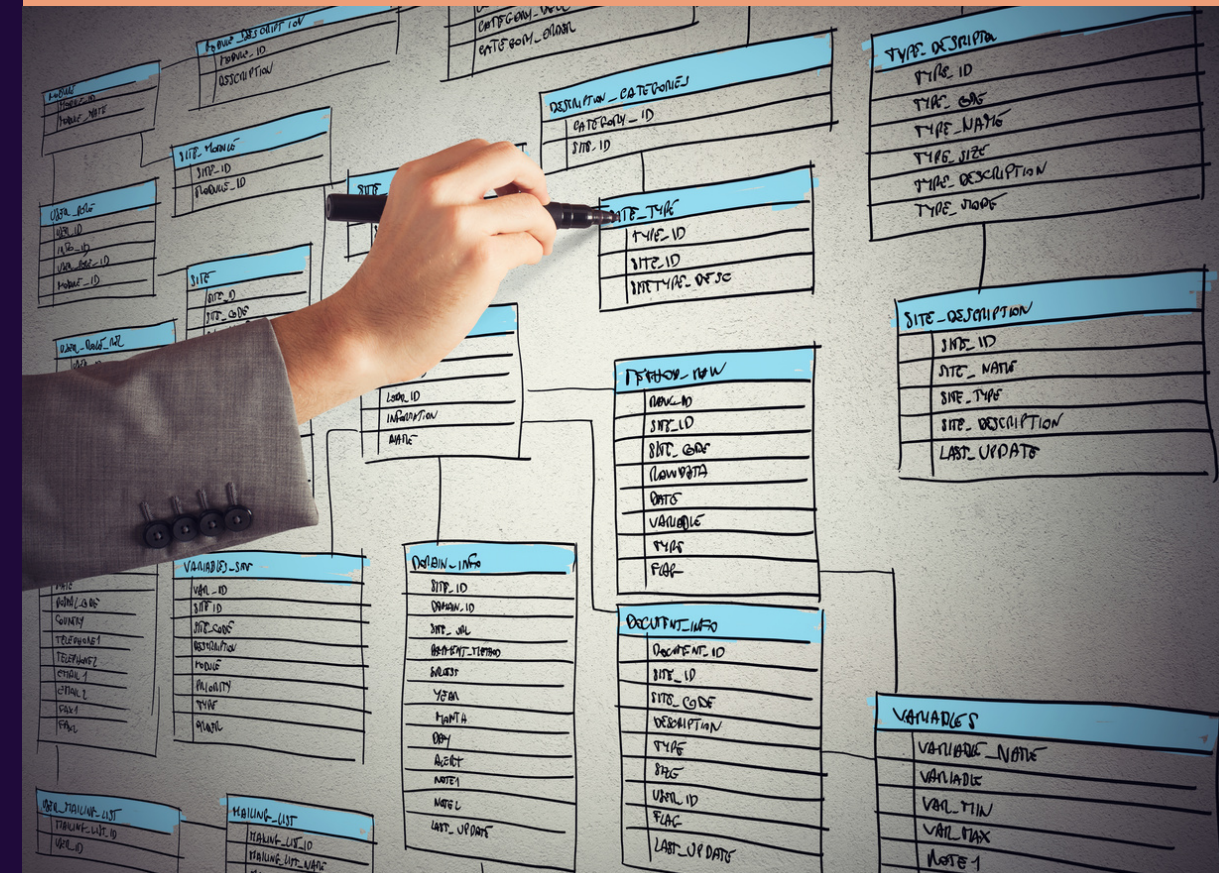
Research Methods

- Qualitative: using descriptive methods to conduct research

  - Interviews, observations, open-ended surveys

  - Typically about a phenomena in society

  - Can derive numbers from worded data

- Quantiative: ONLY numerical data

  - Understands the cause and strength of the variables

  - Coding, hard-STEM experiments, numerical survey

- Mixed Methods: uses both

  - Most social science research is mixed methods

- Prototype

  - test concepts that respond to theoretical research
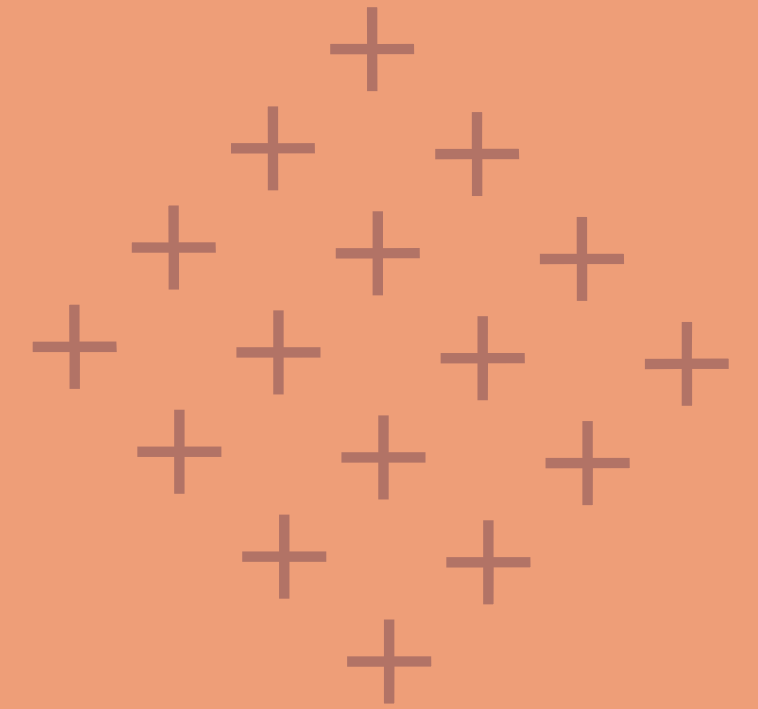
Try It Out from Last Year's Projects!

1.) Qualitative

2.) Quantitative

3.) Mixed Methods

4.) Prototype

Being interviewed about your experience having divorced parents
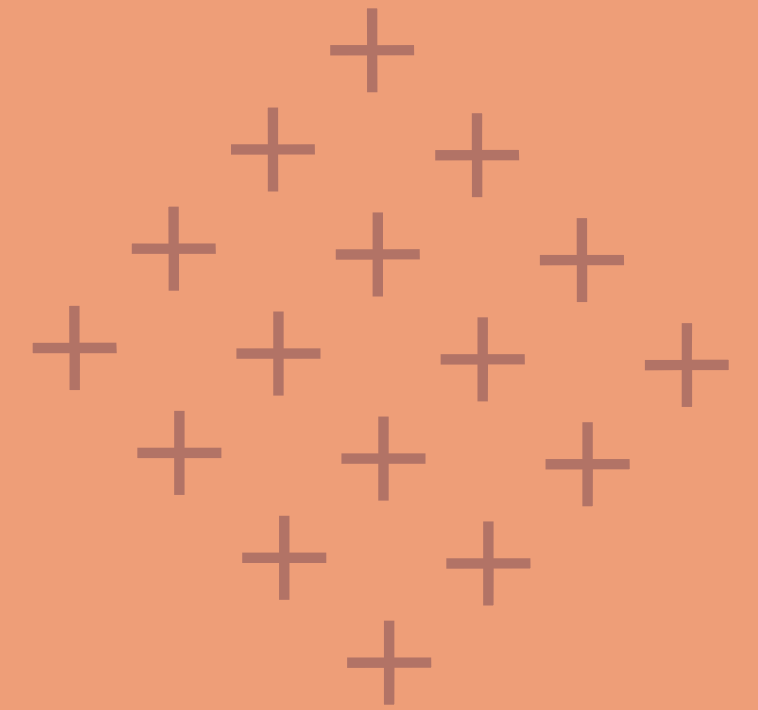
Building a wheel to stop grocery carts from being stolen

Answering a Likert scale (least-most likely) in a survey

Collecting heart rate after exercise

Creating an app to calculate your final grade

Data Analysis

- Mentors should take lead on supporting!

- What does statistical significance mean?

- For engineers/nanotech: does it accomplish what you sought to do?

Data Analysis

- It's okay if students do not reach statistical significance in their research

  project!

- In the discussion

    - Confounding variables

    - New hypothesis

    - How would you replicate the experiment?

    -
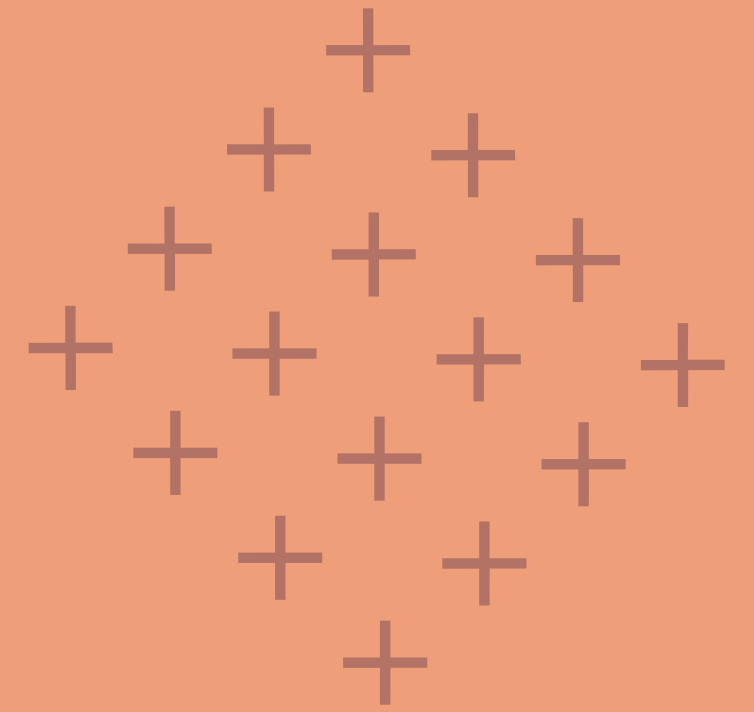
How to Write a Paper
## From Purdue OWL

- APA 7th

  - One Author: Author (Year) or (Author, Year)

  - Two Authors: Author & Author (Year) or (Author & Author, Year)

  - Three or more Authors: Author et al., (Year) or (Author et al., Year)

- Main subheadings: Abstract, Introduction, Literature Review, Methods, Results, Discussion, Conclusion

- Graphs

  - Title Graph (Number) on top, one sentence description on bottom

- Tables

  - Title Table (letter) on top, one sentence description on bottom

What's the Deal with Headings?
From Purdue OWL

- Abstract is on own page, centered with NO BOLD OR ITALICS

- All other headings (Introduction, Literature Review, Methods, Results, Discussion, Conclusion) are CENTERED AND BOLD

- Subheadings of each section, such as "history" of literature review are LEFT HANGING AND BOLD

- Subcategories can be further divided into left hanging and italics but usually not needed for starter scientific research

  - Example: language analysis paper had "Analysis" as a main heading, "Nonverbal Communication" as a subheading with "Gestures" as another subcategory.
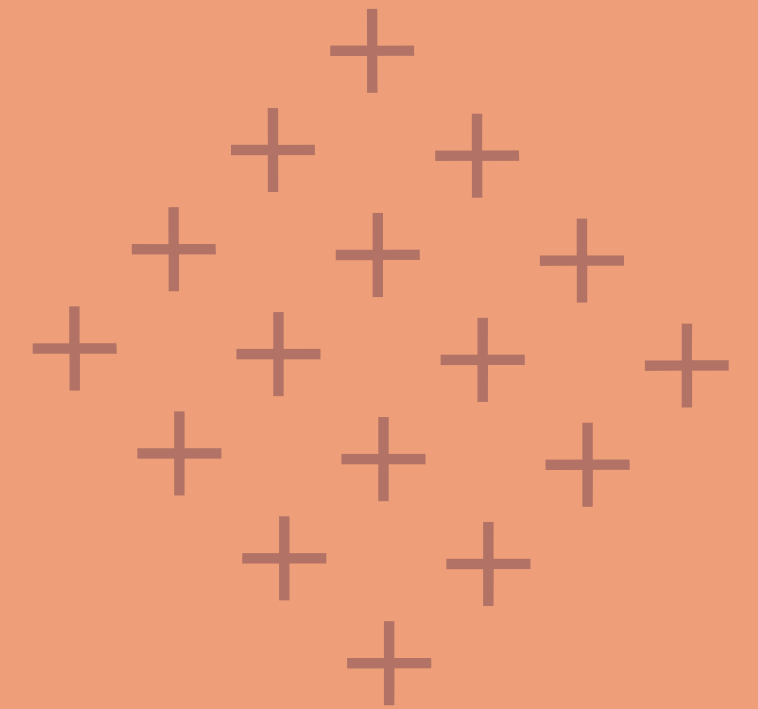
Other Research Outcomes

- Science Fair

  - Explain title and purpose of project

  - Elevator Pitch with a physical source (poster presentation, prototype, deck)

  -
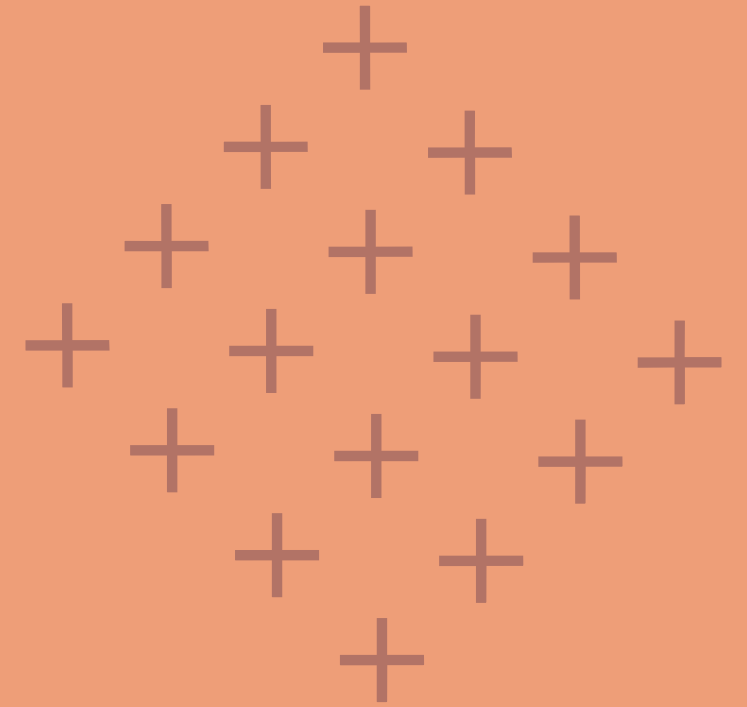
How to Present Research

- Start with elevator pitch of entire research project

- Practice elevator pitch of Introduction/Literature Review, Methods, Results, and Discussion/Conclusion

- Move on to talking about each section for an equal amount of time

- Piece it all together!

- Practice, practice, practice

  - Fun game: give random topic to do an elevator pitch about, if they stumble, start over and give new topic until they can talk for 1-2 minutes straight
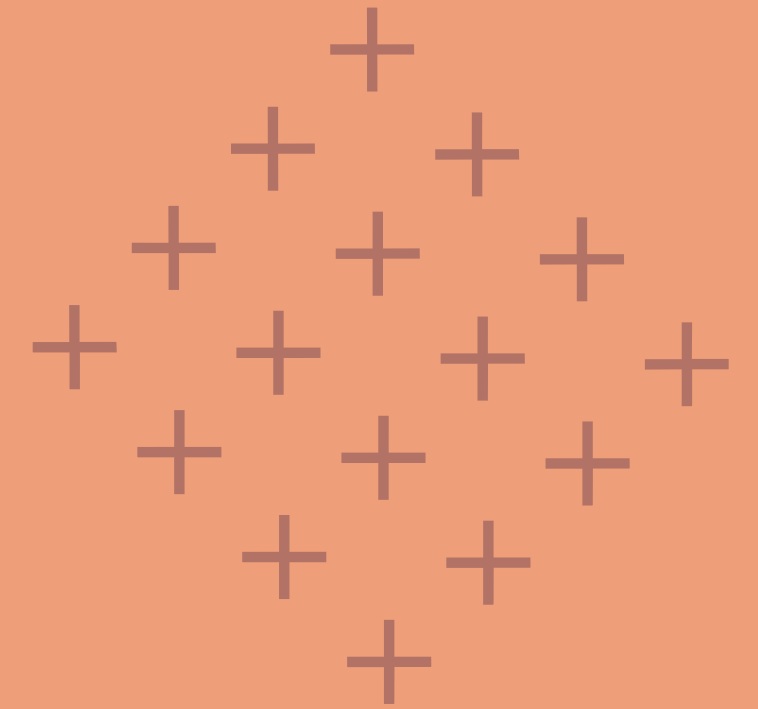
BUT... How Do I Know the Research Project "Worked"?

- Not receiving statistical significance, not having a successful prototype, not being able to answer your research question is the beauty of science!

- Failure is not only normal, it is welcomed and encouraged

  - Scientific Method

- The best scientists are not the ones who have all the answers or everything memorized, the best ones are the ones who go about science with humility and never lose sight of their passions and eagerness to learn.
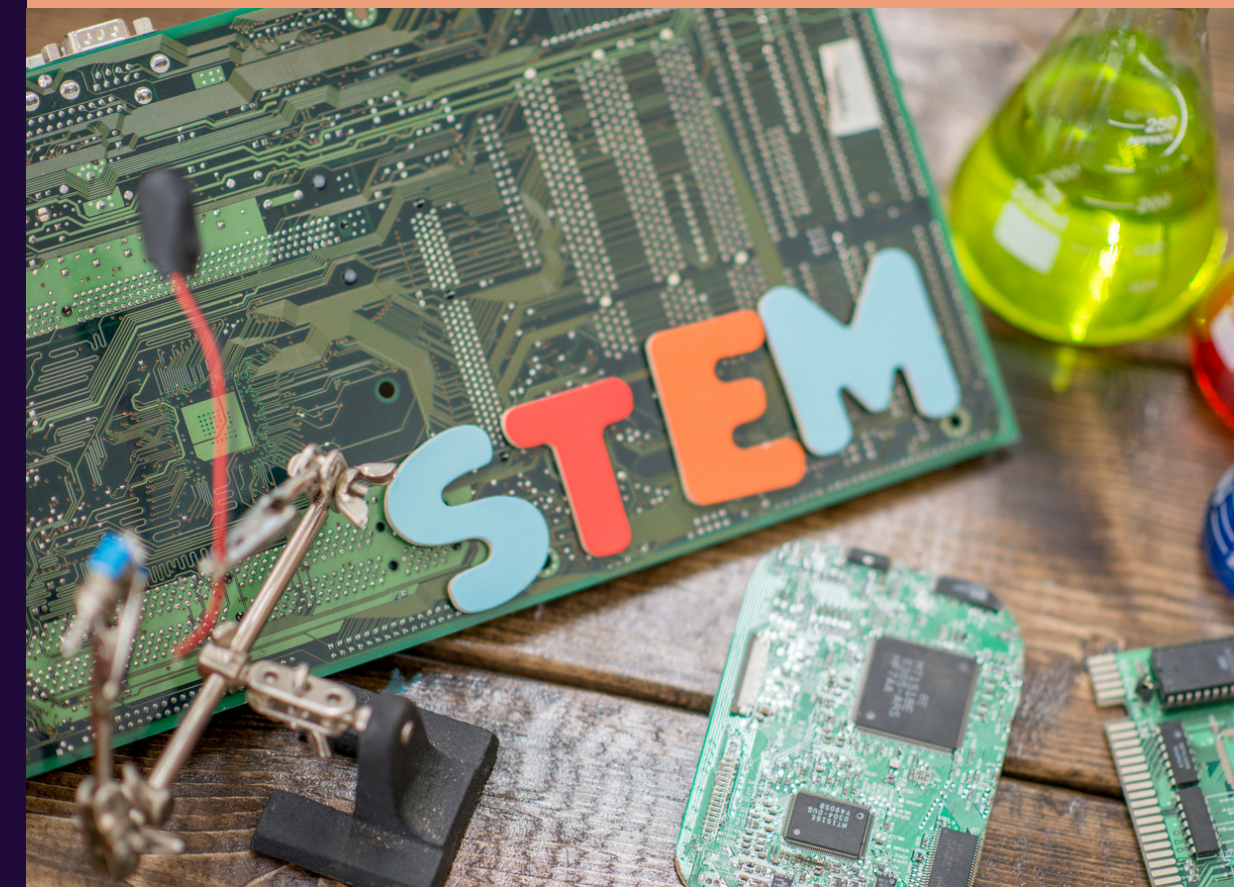
Kahoot Review!

Thank You...
...and Welcome to MME!

We are so excited to start the year with you all!