

Teacher Guide: Conducting a Meta-Analysis Research Project for Science Day

What is a Meta-Analysis?

A meta-analysis is a scientific research method that combines the results of multiple published studies to answer a research question using statistical analysis. Rather than collecting new experimental data, students analyze existing peer-reviewed research to identify patterns, measure overall effects, and draw evidence-based conclusions.

Meta-analysis projects are appropriate for students with limited laboratory access, those interested in data science or statistics, or those investigating questions that would be difficult or unethical to study experimentally.

Is a Meta-Analysis Allowed at Science Day?

Yes. Meta-analysis projects are acceptable provided they answer a clear scientific question, use multiple credible scientific sources, follow a systematic process for selecting studies, include quantitative analysis, and reach evidence-based conclusions. A literature review alone is not sufficient.

Characteristics of a Strong Project

- Clear scientific question
- Systematic search strategy
- Inclusion and exclusion criteria
- Data collection from multiple studies
- Quantitative analysis
- Evidence-based conclusions
- Discussion of limitations

Step 1: Develop a Research Question

Choose a question that is specific, measurable, scientific, and answerable using published research.

Examples:

- Does urbanization reduce bird diversity?

- Does vitamin D reduce respiratory infections?
- Does sleep deprivation affect reaction time?

Step 2: Conduct a Literature Search

Search databases such as Google Scholar, PubMed, ERIC, NASA Technical Reports, government databases, or university libraries. Document search terms, databases, dates searched, and the number of studies identified.

Step 3: Establish Inclusion Criteria

Define which studies will be included before reviewing results. Example: include peer-reviewed experimental studies published after 2015; exclude opinion articles, case studies, duplicates, and studies without usable data.

Step 4: Screen the Studies

Record how studies were selected. Example:

120 identified → 102 after duplicates removed → 46 after abstract review → 18 included.

Step 5: Extract Data

Create a spreadsheet including study name, year, sample size, variables measured, and results.

Step 6: Analyze the Data

Perform original quantitative analysis such as averages, percentage differences, correlations, weighted averages, or effect sizes. Present findings using appropriate graphs and tables.

Step 7: Draw Conclusions

Determine whether the combined evidence supports the hypothesis, identify trends, discuss conflicting evidence, and explain practical implications.

Step 8: Discuss Limitations

Consider publication bias, differences in methodology, sample sizes, missing data, and other factors that may affect conclusions.

Judging Considerations

Judges will consider the scientific question, research design, quality of sources, originality of the analysis, interpretation of results, and the student's understanding of the project.

Frequently Asked Questions

Does this count as original research? Yes. The originality comes from the student's systematic review, quantitative analysis, and interpretation—not from collecting new experimental data.

Teacher Tips

Help students choose focused questions, rely on peer-reviewed literature, organize extracted data in spreadsheets, emphasize original analysis over article summaries, and encourage discussion of limitations and future research.