

How to Give a Poster or Oral Presentation in STEM

Dr. Mindy Capaldi
Associate Dean
Math & Stat Professor
James Madison University

Dr. Kristi Bugajski
Biology Professor
Valparaiso University

Workshop Goals

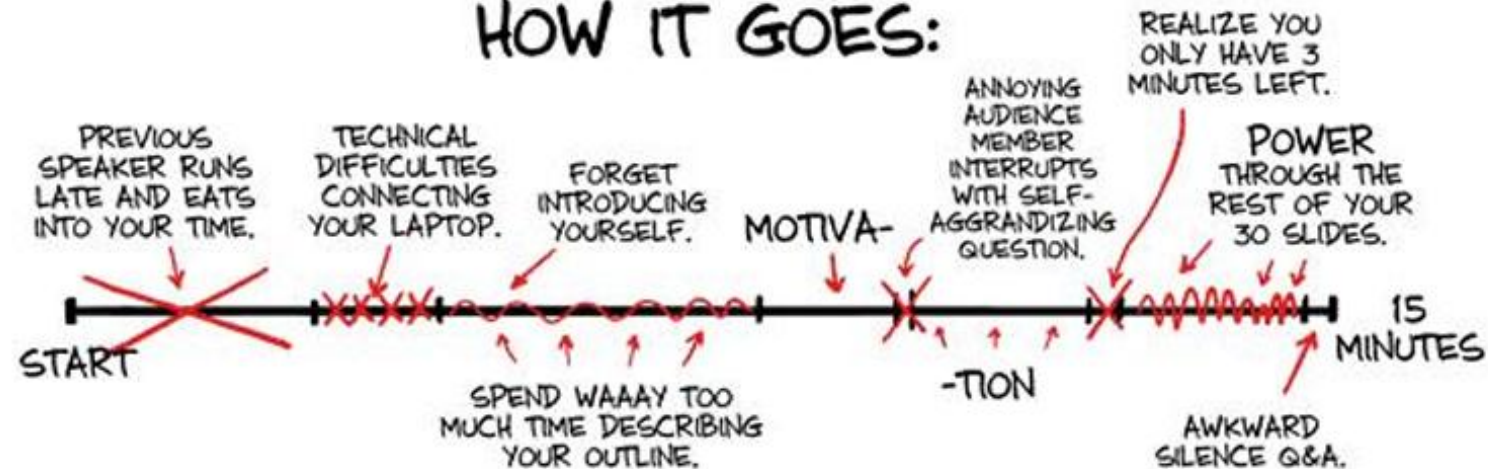
- Identify important elements of an effective research talk and poster.
- Practice strategies for clear, engaging delivery.
- Receive peer feedback on a short “micro-presentation.”
- Learn about other resources for preparing STEM presentations.

YOUR CONFERENCE PRESENTATION

HOW YOU PLANNED IT:



HOW IT GOES:



Conference Speed Networking Activity

- Pair up with someone.
- Introduce yourselves and take 1 minute each to explain your research or a class project or pretty much anything you find interesting.
- Give your partner 1 piece of feedback, such as
 - *"I liked when you..."*
 - *"I was curious about...."*
- With your partner, come up with a question you have about giving presentations that you hope is addressed in this workshop.

What makes an Effective Talk or Poster?

1. Know your Audience
2. Structure & Design
3. Delivery & Engagement

These are important for both oral and poster presentations.

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Take a minute to think of the “best” and “worst” things you’ve seen in talks and posters.

Know Your Audience

1. Will everyone be from your discipline/field?
(You can ask)
2. Can you make the first third or half of the talk/poster broadly accessible?
3. What visual aids can be included to help?

Recommendations:

- Explain definitions and concepts using simple examples and/or non-examples
- Avoid complicated definitions or notations if you can get the point across without them
- Summarize in plain language
- For poster: if you ask about background knowledge, you can adjust what you say accordingly

Structure & Design

Structure:

1. Title
2. Introduction
3. Methods
4. Results
5. Conclusion (and future directions)
6. References & Acknowledgements

Design Recommendations:

- Minimal text. Bullet points help.
- Visual Aids- physical or on slides/poster
 - Graphs: label your axes/variables
 - Tables: okay to use, but keep simple
 - Photos/Diagrams: clear, not blurry
- Segment your talk in case you run out of time. For a poster, have clear sections with headings.

Structure & Design

Accessibility Recommendations:

- Use contrasting colors that also work in grayscale for those who are color blind
- Use large enough font- Arial, Times New Roman are more accessible than some others
- For oral presentations, make sure main points are on the slide for deaf and hard of hearing folks.

Delivery & Audience Engagement

Preparing to Present

1. Practice! Multiple times.
2. Check timing. Leave room for Q&A.
3. Think about what simple, clear language you can use to explain complex ideas.
4. Prepare summaries of key points
5. Anticipate questions.

Engagement Ideas:

- Make eye contact. Talk loudly and slowly.
- Avoid reading directly from the poster or your slides (or notecards).
- Let the audience practice/participate.
- Move around, don't stand in one spot.

Structure & Design

Introduction

L_∞ algebras and symmetric braces are a relatively new area of study within the field of algebraic topology. These concepts are related to closed field string theory in physics, although the applications have not been thoroughly explored. L_∞ algebras are a generalization (of sorts) of Lie Algebras (which is the $n = 3$ case). Also, they are the symmetric version of A_∞ algebras, which give associativity to a graded vector space up to homotopy. Symmetric braces clarify the goal and process of proofs involving these algebraic structures, allowing one to avoid many of the complications of recursively defined maps, unshuffles, and degree issues which arise.

L_∞ Algebra Definition

An L_∞ algebra structure on a graded vector space V is a collection of skew symmetric linear maps $l_n : V^{\otimes n} \rightarrow V$ of degree $n - 2$ that satisfy the relations

$$\sum_{i+j=n+1} \chi(\sigma) (-1)^{j(i-1)} l_j(l_i(v_{\sigma(1)}, \dots, v_{\sigma(i)}), v_{\sigma(i+1)}, \dots, v_{\sigma(n)}) = 0$$

where $\chi(\sigma)$ is the antisymmetric Koszul sign and σ is taken over all $(i, n-i)$ unshuffles.

What do these terms mean?

- A graded vector space means that V can be split up into different subspaces, each with distinct degrees.
- The antisymmetric Koszul sign means that you can switch the order of elements as long as a sign change occurs. So, $(v_1 \otimes v_2) = -(v_2 \otimes v_1)$.
- Skew symmetric is another sign change for when the maps are permuted.
- $V^{\otimes n}$ is similar to $\mathbb{R}^n$, or $\mathbb{C}^n$. Degree $n - 2$ means that n number of elements (v_i) are mapped to just 2.
- $(i, n-i)$ unshuffles is actually like unshuffling a deck of cards into stacks of i and $n-i$ number of cards. We have to account for all of the possible ways to do this (all possible permutations σ).

Examples of L_n Structures

$n = 2$ case:

$$(-1)^{2(1-1)} l_1(l_2(v_1, v_2)) + (-1)^{1(2-1)} l_2(l_1(v_1), v_2) - (l_1(v_2), v_1) = 0$$

or

$$l_1(l_2(v_1, v_2)) - l_2(l_1(v_1), v_2) - (l_1(v_2), v_1) = 0$$

$n = 3$ case (Lie Algebra Jacobi Identity):

$$(-1)^{3(1-1)} l_3(l_3(v_1, v_2, v_3)) + (-1)^{2(2-1)} l_2(l_2(v_1, v_2, v_3) - (l_2(v_1, v_3), v_2) + (l_2(v_2, v_3), v_1)) \\ + (-1)^{1(3-1)} l_3(l_1(v_1), v_2, v_3) - (l_1(v_2), v_1, v_3) + (l_1(v_3), v_1, v_2) = 0$$

or

$$l_3(l_3(v_1, v_2, v_3)) + l_2(l_2(v_1, v_2, v_3) - (l_2(v_1, v_3), v_2) + (l_2(v_2, v_3), v_1)) \\ + l_3(l_1(v_1), v_2, v_3) - (l_1(v_2), v_1, v_3) + (l_1(v_3), v_1, v_2) = 0$$

When using this definition we really have to consider that n can range from 1 to infinity. Hence the name L_∞ .

Main Theorem

Assume that the collection $\{l_i\} \in B_{-1}(V)$ is an L_∞ algebra structure and therefore $l(l) = 0$. Suppose there exists a collection $\{f_i\} \in B_0(V)$ such that

$$\sum_{i=1}^n f_i(l_{n-i+1}) = \sum_{j=1}^n \sum_{\substack{i_1^1, \dots, i_{i_1-1}^1 < i_1^2, \dots, i_{i_1-1}^2 < i_1^3, \dots, i_{i_1-1}^3 < i_1^4, \dots, i_{i_1-1}^4 < i_1^5, \dots, i_{i_1-1}^5 < i_1^6, \dots, i_{i_1-1}^6 < i_1^7, \dots, i_{i_1-1}^7 < i_1^8, \dots, i_{i_1-1}^8 < i_1^9, \dots, i_{i_1-1}^9 < i_1^{10}, \dots, i_{i_1-1}^{10} < i_1^{11}, \dots, i_{i_1-1}^{11} < i_1^{12}, \dots, i_{i_1-1}^{12} < i_1^{13}, \dots, i_{i_1-1}^{13} < i_1^{14}, \dots, i_{i_1-1}^{14} < i_1^{15}, \dots, i_{i_1-1}^{15} < i_1^{16}, \dots, i_{i_1-1}^{16} < i_1^{17}, \dots, i_{i_1-1}^{17} < i_1^{18}, \dots, i_{i_1-1}^{18} < i_1^{19}, \dots, i_{i_1-1}^{19} < i_1^{20}, \dots, i_{i_1-1}^{20} < i_1^{21}, \dots, i_{i_1-1}^{21} < i_1^{22}, \dots, i_{i_1-1}^{22} < i_1^{23}, \dots, i_{i_1-1}^{23} < i_1^{24}, \dots, i_{i_1-1}^{24} < i_1^{25}, \dots, i_{i_1-1}^{25} < i_1^{26}, \dots, i_{i_1-1}^{26} < i_1^{27}, \dots, i_{i_1-1}^{27} < i_1^{28}, \dots, i_{i_1-1}^{28} < i_1^{29}, \dots, i_{i_1-1}^{29} < i_1^{30}, \dots, i_{i_1-1}^{30} < i_1^{31}, \dots, i_{i_1-1}^{31} < i_1^{32}, \dots, i_{i_1-1}^{32} < i_1^{33}, \dots, i_{i_1-1}^{33} < i_1^{34}, \dots, i_{i_1-1}^{34} < i_1^{35}, \dots, i_{i_1-1}^{35} < i_1^{36}, \dots, i_{i_1-1}^{36} < i_1^{37}, \dots, i_{i_1-1}^{37} < i_1^{38}, \dots, i_{i_1-1}^{38} < i_1^{39}, \dots, i_{i_1-1}^{39} < i_1^{40}, \dots, i_{i_1-1}^{40} < i_1^{41}, \dots, i_{i_1-1}^{41} < i_1^{42}, \dots, i_{i_1-1}^{42} < i_1^{43}, \dots, i_{i_1-1}^{43} < i_1^{44}, \dots, i_{i_1-1}^{44} < i_1^{45}, \dots, i_{i_1-1}^{45} < i_1^{46}, \dots, i_{i_1-1}^{46} < i_1^{47}, \dots, i_{i_1-1}^{47} < i_1^{48}, \dots, i_{i_1-1}^{48} < i_1^{49}, \dots, i_{i_1-1}^{49} < i_1^{50}, \dots, i_{i_1-1}^{50} < i_1^{51}, \dots, i_{i_1-1}^{51} < i_1^{52}, \dots, i_{i_1-1}^{52} < i_1^{53}, \dots, i_{i_1-1}^{53} < i_1^{54}, \dots, i_{i_1-1}^{54} < i_1^{55}, \dots, i_{i_1-1}^{55} < i_1^{56}, \dots, i_{i_1-1}^{56} < i_1^{57}, \dots, i_{i_1-1}^{57} < i_1^{58}, \dots, i_{i_1-1}^{58} < i_1^{59}, 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J(stu)MU: Supporting Science, Mathematics, and Statistics Majors for University Success and Beyond

Project Team:
Mindy Capaldi (PI)
Jason Sterlace, Isaiah Sumner, Brian Walton, Steve Whitmeyer, Louie Wurch, LouAnn Lovin (former PI)

Overview

The J(stu)MU project is aimed to recruit and support 22 science/math majors in two cohorts.

Cohort 1:

5 Biology, 2 Chemistry, 1 Biophysical Chemistry, 1 Geology, 1 Math, 1 Physics

Retention: 1 withdrew early, 1 switched to a non-eligible major, and 3-4 lost financial eligibility (1 temp). Two additional students recruited in year 2.

Cohort 2:

8 Biology, 1 Chemistry, 1 Math, 2 Physics

Retention: 1 academically suspended

We will likely need to recruit 2-3 replacement scholars due to Pell-status changes.



Multidisciplinary cohorts- Cohort-building was accomplished through early arrival, a residential learning community, and seminar enrollment.



Residential Learning Community- Beneficial for cohort-building and allows students to live on the side of campus with science facilities.

Lessons:

- have non-cohort roommates in case there are difficult living situations
- make clear to students that this is 1st year only

Transition week- Students appreciate coming early, meeting each other, seeing campus.

Lessons:

- work more closely with student employment to plan for student hiring/stipends
- don't have an overfull schedule

Peer Mentoring- Students are matched up with peer mentors in their majors and Counseling graduate students for mental health & wellbeing sessions, meeting monthly.

Lessons:

- Reach out to student orgs (e.g., Tribeta) to find peer mentors for scholars
- discontinue mental health & wellbeing sessions due to lack of interest and overfull schedules

Continuing Supports:

- Summer Research (after 1st year)
- Tutoring & Peer Mentoring (2nd year)
- Faculty Mentoring (all years)
- Seminars (all years)
- Scholarships (all years)

Early Evaluation Results

Focus groups have guided formative evaluation.

Seminars- Overall good in concept and good prep for research. Could benefit from clearer goals/expectations. Scheduling conflicts also caused issues. We are moving to a study group format for scholars' 3rd and 4th years.

Summer Research- "Rewarding and inspiring."

Overall good experience. However, there were problems with logistics. Changes after the 1st year:

- Split the summer payment into smaller sums so that funds can be disbursed earlier.
- Instead of meal vouchers, flexible funds added to their university cards.
- Provided more assistance in finding a research mentor/project and facilitated a group mentor meeting before the summer.
- Added field trip to DC and events with other research students.

Continued challenge: 4 weeks likely too short for a productive research experience.

Communications- Need more! Students wanted more and clearer information about housing logistics, program requirements, etc. A J(stu)MU Handbook was revised for clarity and to provide more info. The PI communicates and meets with scholars frequently, including through more program-wide social gatherings.

Acknowledgements

This project is supported by the NSF under Award No. 2221277. We also thank James Madison University and the College of Science and Mathematics.



Talk Examples

1. [Delivery Example](#)
2. [Visual Aid Example](#)

Navigating Q&A/Poster sessions

- Know your material in advance. Have your “elevator pitch” or summary ready.
- Anticipate common questions
- Rehearse your responses
- If you don't know the answer, it is okay to say so and offer to follow up
- Be open to feedback and critique

Practice Time

1. Take 4-5 minutes to develop an “elevator pitch” for the topic or project of your choice. If you need an idea, you can use your favorite show/movie/book.
2. Practice your pitch with a partner/group, taking turns.

Practice Time

Now adjust your elevator pitch for a different audience:

- Experts in your field
- STEM general audience
- Community/ non-STEM

If topic is a show/movie/book, use audiences:

- Super fan
- Someone who has seen it
- Someone who has not seen it or doesn't like that genre

Q&A



Final Tips and Other Resources

- Have multiple ways to access slides (i.e., not just through your email)
- Dress appropriately
- Arrive early. Check out space ahead of time, if possible.
- Be flexible!
- “[Technically Speaking](#)” NSF-funded project that has a series of video vignettes demonstrating the good, bad, and ugly of giving STEM talks.
- S-STEM Scholars Workshop: “[Mastering Engaging and Impactful Poster Presentations](#)”
- AAAS Webinar: “[How to Prepare an Excellent STEM Research Oral/Poster Presentation Abstract](#)”
- “[How to Give a Fabulous Academic Presentation](#)” blog
- Poster examples and templates: <https://guides.lib.purdue.edu/posters>

Provide Your Feedback on:

Your Conference Presentation: how to give a poster or oral presentation in STEM

Survey Link:

<https://airtable.com/appMqgBJxZT21jAQH/pagkELJacMIub9bgz/form>

