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Presenting the STEM Research Project

Introduction

An important part of conducting research for all STEM professionals is to communicate their study results. This is generally accomplished in two different ways. The first is to write a scientific paper, as outlined in Chapter 11, in order to have the paper published in a STEM or other scientific journal. The other way is to present the research to peers face-to-face at oral presentations and oral poster presentations. This chapter focuses on preparing you for the latter.

Learning Objectives

By the end of the chapter, you will be able to

1. identify the qualities of an oral presentation,
2. explain how visuals can both help and hinder a presentation,
3. describe the components of a poster, and
4. perform an oral presentation of your STEM research project.

Oral Presentations

Even if you are not presenting your research at a research symposium, you may still be expected to present your research to your classmates. Generally, that means an oral presentation—containing visuals—with a question-and-answer session at the end. The presentation may vary in length, depending on

your teacher's requirements; student presentations can run from 2 to 15 minutes. See Appendix E, "Oral Presentation Rubric," pages 209–211, for examples of what you will need to consider when preparing your presentation.

If you did your research project with a group, you will need to divide the parts of the presentation among the group members. Consider having each member responsible for his or her own portion, including any corresponding visuals. Then the group can put the parts together before the presentation. Do not have one person do all the preparation and the others do all of the talking on presentation day. Your teacher expects each group member to contribute equally to both the visual and oral parts of the presentation. It is important that each group member verbalize an understanding of the research project. As you have done during previous portions of your research project, you may choose to determine these roles and tasks ahead of time, write them down, and have each member sign the document before turning it in to your teacher.

Parts of the Oral Presentation

Introduction

Begin with one or two sentences to acquaint the audience with your topic. Although you wrote your paper using a formal, impersonal tone, your presentation can include humor, cartoons, current events, a poll of the audience, or before-and-after photos of the entities you studied. *Be creative* and try to *hook* your audience. Your visual (overhead, poster, or electronic presentation) for the introduction should not have a lot of text that your audience has to read. Keep it simple, using graphics with few words.

Hypothesis

Although you do not have to tell the audience your formal hypothesis word for word, you must clearly describe your independent variable and what measurements or correlations you were looking for in your dependent variable. It is fine to use phrases that include the first person, such as, "In my research I was looking to correlate…with…." Again, your visual should be simple, using as few words as possible.

Materials and Methods

Provide just enough detail about your methods so that your audience will understand how you collected data, what extraneous variables you kept constant, and the length of the experiment. In your visual, use photographs you took during your experiment to help tell this story. If your teacher or the symposium or fair officials allow it, bring in parts of your experiment the day of your presentation and integrate them into your explanation of how you

collected data. Visuals for the materials and methods portion of the presentation might include photographs of the experimental setup and data collection and a simple table that describes your experimental design, such as the one shown in Table 11.1 (p. 159).

Results

Display and explain your results clearly and succinctly. Carefully choose tables and figures that best highlight the results. When you discuss these graphical data during your presentation, take time to explain *what the graphic shows overall* before launching into the specific results. It takes an audience a moment to orient themselves to what they are viewing, and if you do not take time to help them, they will miss the important points you are making about the table or figure. If you add photographs of the results from the experimental and control groups, you will help your audience even more to connect with your research study.

Analysis and Conclusions

Just as you did in the last paragraph of the analysis and conclusions section in your paper, you need to summarize your conclusions regarding your research. Remind the audience of the connection you were seeking to make, and then describe how confident you are that your research design produced reliable data that either supported, or did not support, the relationship between the independent and dependent variable or a comparison between two groups. Then explain how you reached that conclusion. Be sure to talk about the limitations of the study as well as the factors that may have influenced the results and to speculate on what could have been done to eliminate those factors. Keep in mind that STEM researchers sometimes get results that do not support their original hypothesis. However, they know that they can learn as much from a "failed" experiment as from a "successful" one.

Closure

Close your presentation by making a statement regarding the relationship between the independent variable and the dependent variable. Give a quick summary of why the two are, or are not, linked. Tell your audience how confident you are (you don't have to be 100% confident!) that the results supported this final analysis. Your teacher may also want you to share with members of the audience why they should care about this research study—its importance to the global community and how the knowledge derived from the study can be used.

Asking for Questions

Once you are finished with your presentation, invite questions from your audience.

Preparing for the Oral Presentation

Several Days Ahead

Organize your visuals. Prepare the overheads, poster, or electronic presentation so that they are ready to use for practice. Then, using the visuals, start considering what you will say when each visual is presented. You have spent a lot of time on this project and therefore you should know the content. You can have an outline or note cards or use the note feature in the electronic presentation software when you make your oral presentation, but you should not read from them, only refer to them. The notes should not be written in complete sentences. Write down only the important phrases that will remind you of what you need to say. Finally, think of possible questions that your audience may ask you and figure out how you might answer those questions. Review your background research notes so that you will be prepared!

Practicing the Presentation

Putting your visuals and notes together is the first step of preparation. You should practice your presentation out loud, several times, using your visuals and your notes. Your first or second time, focus on effectively delivering the ideas. Make sure you know what you will say and be sure that the visuals are a crucial part of the presentation. Point to places on the tables and figures as you discuss them. Pick up and use parts of your experiment to make a point or to demonstrate a method you used.

Once you feel confident that you can effectively communicate information about your STEM research project, work on polishing the presentation to make sure the audience hears what you have to say. While practicing out loud, work on clear pronunciation (try not to mumble, even if you are nervous), breathing, voice fluctuation, enthusiasm, and pauses. Pauses are an important part of public speaking. But all pauses are not equally welcome. People new to public speaking often fill quiet moments with *um…, OK…, like…*, or *so….* It is better to let the silence be silence (hard as that may be) then to use verbal fillers.

Most likely you will have to stand while giving your presentation. Therefore, stand while you practice. Get comfortable with this position. Work on posture and eye contact. Practice looking at *all* parts of the audience, sweeping your eyes to both sides of the room. Figure out what to do with your hands

during the presentation. Practice how you will conclude your presentation. Find a natural and upbeat ending statement that flows from what you have been talking about—perhaps say how exciting one particular aspect of the learning process has been for you or how you look forward to your research being applied to new scientific questions. Don't end saying, "That's all I have to say" or "I guess I'm done."

The Day of the Presentation

Now that the day is here, there are several things you can do to help it go smoothly. First, be sure to dress appropriately—you are giving a formal presentation of your time-consuming and important work. Don't wear jeans and a T-shirt. Be sure all your materials are ready for the presentation. Have your visuals well protected and packed for easy transport. If you have electronic visuals, save them in several locations to ensure you can gain access to them at presentation time. Consider saving them by e-mailing the file to yourself, posting it to your personal server space at school, and saving it externally so that it can be directly connected to a computer and ready to use. If your teacher doesn't mind, bring a water bottle to have available during your presentation, in case your mouth is dry. (Also, taking a sip of water will help you fill in a pause.) Although you might like to chew gum during the presentation to calm yourself or prevent dry mouth, *don't.* It is distracting to the people in the audience and they are less likely to take you seriously.

Once you are in front of the room and begin to talk, go for it—just as you practiced. If something goes wrong—perhaps your experiment falls on the floor or you have trouble accessing your presentation on the computer—do not overreact. Breathe deeply, fix the problem without comment, and continue. The more calmly you handle the problem, the more confident you will feel. Once you have completed your presentation, take questions from the audience. Answer questions as truthfully as you can. If you know the answer to a question, confidently answer it. However, do tell your audience if your answer is your opinion, something you read in your background research, or a result from your study. If you don't know the answer, admit it. Don't make up answers. However, feel free to give your best guess, as long you say that that is what you are doing. Here are some possible responses to audience questions:

> *I thought of that question as well, but couldn't find any research to answer it. However, with what I learned in my experiment, I think that maybe A does affect B because....*
> *Yes, you're right. I didn't consider that as a possible variable that I would need to control. If I did the experiment again, I would probably solve that problem by....*

When you are finished taking questions, smile, take a seat, and bask in a job well done.

Responsibilities as an Audience Member

You have an important responsibility to be an active listener during the presentations by your classmates (even if your presentation is next in line and that's all you can think about!). Below are some suggestions for being a good audience member.

First, listen and take notes. Take notes on the important points of each presenter, such as the variables he or she was testing, results, and conclusions, taking special note of the experimental design. See Appendix B, "Research Presentations Observation Sheet," for help with organizing your notes (pp. 195–196).

Second, be prepared to ask questions. Don't ask superficial questions such as, "Did you like doing this project?" or other questions that could be asked about any project. Instead, really listen to the experimental design of the presenter and be looking for ways to improve on the study he or she conducted. Feel free to ask clarifying questions about something you did not understand. Here are some questions to have in mind when listening to a presentation. (*Hint:* These are questions teachers or science fair judges may ask when assessing papers and presentations.)

- Did the researcher keep experimental groups and control groups the same?
- Were there extraneous variables that the researcher overlooked?
- Were there flaws in how the experiment was set up?
- Did the methods affect the results in ways not addressed by the researcher?
- Were the results explained well?
- Did the researcher explain possible reasons for flukes or inconsistent data?
- Were the researcher's conclusions consistent with the data that were presented?

When asking questions, be respectful. Just because a student doesn't mention a specific aspect of his or her research in the presentation, does not mean he or she has not thought of it. The oral presentation is only a few minutes, and much has to be left out. Therefore ask your questions in a tactful, respectful way: "Is it possible that while the experiment was being set up, A affected B and this influenced the results somehow?"

You can be proud of yourself if you are able to summarize other people's research and ask quality questions. That means that you not only learned good scientific research methods while doing your own project but that you are able to apply those methods to other projects as well. That application skill is a valuable one that is difficult to teach as well as to learn.

Oral Poster Presentations

Poster presentations differ from other presentations in that the audience members move around to the presenters, each of whom is standing by a poster that summarizes his or her research study. This allows many researchers to share their studies at one time and allows audience members to focus on specific topics that interest them. In preparation for the poster presentation, you will need to create a poster and prepare a short, two-minute speech about your research study.

You'll probably be able to use and modify your paper for the poster. However, you'll have to do more than just print out the paper and stick it to a poster board. Carefully read the suggestions below.

Creating the Poster

Follow the specific requirements given to you by your teacher and/or the institution that is hosting the poster presentation or symposium you will be attending. Rubrics, grade sheets, or requirements checklists are often provided ahead of time to help student researchers prepare for a symposium. Be sure that all the elements that will be judged are present in your poster.

Poster Design Tips

Posters will most likely be placed on easels or tables. Foam board, mat board, or strong refrigerator cardboard are common materials for posters. Tri-fold display boards, available at most craft and hobby stores, are commonly requested. Poster sizes are large, ranging from 36 in. × 36 in. to 40 in. × 60 in.; check with the people who are running your poster presentation or symposium before making a purchase. Most do not want the flimsy poster boards readily available at drug stores.

A person viewing the poster should have no trouble reading it from a distance of 5 ft. All words on the poster should be typed; choose font styles and sizes appropriately. Use color, illustrations, photographs, figures, tables, and other visuals along with text to make it more inviting. Consider using arrows to indicate the flow and organization of the poster. Craft and hobby stores have all kinds of poster supplies.

Poster Components

These are the poster components that are most commonly requested for research symposium events and other poster presentations. Check for specific requirements. Also refer to Chapter 11 for greater detail on what information goes in each section.

Descriptive Title

The title should describe the entity and two variables studied. It should be in large print and easy to read.

Hypothesis

State your hypothesis or research question word for word. It should be placed in a prominent place on your poster.

Introduction

Describe your background research. As in your paper, cite the resources you used and provide a Works Cited list.

Materials and Methods

You do not need to list the materials, but make sure they are all mentioned in your description of how you set up the experiment. You have limited space, so briefly describe what you did, how you collected both quantitative and qualitative data, and how often. Add enlarged photographs of your experimental setup to help clarify.

Results

Describe and display your data. Using photographs, figures, and tables as well as written text, show the results of your experiment. Be sure that the figure and table numbers match the numbers you use in the written text.

Conclusions

In the first sentence of this section, restate the hypothesis or research question and say whether or not a clear connection can be made between your two variables. Then use background research (appropriately documented) to explain *why* the results may have occurred. Include procedures that may have influenced the results.

Works Cited

Include an MLA-style Works Cited list (unless the rules for the symposium require that you use the reference style of the American Psychological Association [APA] or another style).

Other Works Consulted (optional)

Here is the place to list those resources that you used in your background research but didn't cite in your paper. Whether or not to include this list is up to you.

Abstract

The abstract is a paragraph that briefly describes the experiment. The abstract is what people can read if they don't have time to read all parts of your poster. It should be short, clear, and to the point. It describes your hypothesis, what you researched, the results, and an explanation of the results. (*Note:* Your abstract may or may not actually be on the poster. It is often submitted at the time you register your poster for a symposium. The symposium officials might put the abstracts from all the presenters into a booklet or put them online before the symposium so that people can browse the topics in advance.)

Preparing for the Poster Symposium

Many of the same suggestions that were described earlier for oral presentations apply to poster presentations as well. You should dress professionally, have water, and make sure that your poster is complete. You might consider bringing emergency supplies, like a glue stick, in case you need to do repairs. Most likely, you will be assigned a place in the room to put your poster as well as a specific presentation time. You are required to stand by your poster during that entire time (anywhere between one and three hours) to answer the questions of viewers, including judges, who are circulating around the room.

Stand by your poster, and as people linger, start a conversation with them. Ask if they would like to hear about your research project. Be prepared to give a short (two-minute) overview; don't be surprised, however, if people interrupt you to ask a question.

Audience members at poster symposiums and presentations include professors, graduate students, undergraduate students, teachers, and other students your age who have done research. It may be that you will not know which person is a judge; therefore, you must put on your best show for every person you talk to. If you don't know the answer to a question, don't pretend you do. Say, "I'm not sure. I didn't come across anything to answer that in the

research I did." Keep eye contact as you say this (don't look down; you have nothing to be embarrassed about!). If you're answering a question but are not sure if your answer is accurate, preface it with a statement such as, "I'm not sure, but to the best of my knowledge, this…is a possibility."

Being a Poster Symposium Audience Member

During the times in the day when you are not presenting, you might want to circulate and visit other students' posters. If the other students don't engage you in conversation, take the first step and ask them about their research. Then follow up with quality questions. Mentally, try to find weaknesses in their experimental designs, such as aspects they did not keep constant. When asking about these possible weaknesses, use respectful questions such as, "Did you consider the possibility of…" or "How did you control…." Also, focus questions on whether presenters analyzed their findings. Did they come up with explanations that directly relate to the data they collected? Once you have a good idea of a person's experiment, thank him or her and move to another poster. Remember, these presenters are just as nervous as you were when you were being questioned. It is helpful for everyone if you can put them at ease.

Chapter Questions

1. What are the qualities of a good oral presentation?
2. How can visuals both help and hinder a presentation?
3. Describe the components of a poster.

Chapter Applications

You should prepare a day-by-day schedule of what you need to do for your presentation, working back from the date of the presentation. Give yourself plenty of time to do the tasks listed in this chapter, especially practicing your presentation out loud. When you present your results orally and visually, you are going through the same process as that of professional STEM researchers.

In Chapter 1, I described the scientific research process as "messy." Now that you have been through the process yourself, you may see why the linear analogy of the staircase is not realistic. Instead of being frustrated by the fact that the research process is not always clear-cut and uncomplicated, I hope you can see the power of being flexible. Scientists always have a well-thought-out plan before beginning any research study but must remain open

to what happens within their research and make appropriate changes as they go. The more you know, the more you realize you don't know.

You have completed a STEM research experiment by doing extensive background research, designing an experiment, collecting data by keeping it organized in a laboratory notebook, analyzing data, writing a scientific paper, and presenting the results to your peers. It's official! You have experienced STEM research in the truest sense of the term. The next time you hear a news report that begins, "The latest research shows…," you will have a firsthand understanding of all the time and effort that went behind the words.