

# Poster Presentations:

## Conceptualizing, Constructing & Critiquing

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Posters are important for distributing information about research to peers in biology and other fields. Scientific organizations meet annually and researchers attend and often present their results orally or in a poster format. Because poster presentations are becoming more commonly used at scientific meetings and science fairs, many colleges, and now high school classrooms, are requiring their students to construct posters as a method of improving written, visual, and verbal communication skills. However, many students are never taught the specific characteristics that constitute a good poster.

Typically, posters provide an efficient means of conveying a brief outline of background information, methods, and discussion while being more specific about the study results. Posters are often comprised of the typical sections of a published paper (that is, Abstract, Introduction, Materials and Methods, Results, Discussion, Acknowledgments, and References). However, a poster is usually brief and lacks much of the discussion-type detail presented in journal articles. It is left up to the abilities of the poster presenter to elaborate on other important details or implications of the research.

Posters should be an artistic and colorful representation of research, that tends to demonstrate the author's creativity and pride. Posters have numerous characteristics that make them appealing to the reader, including the use of photos, graphs, tables, background, and text colors, characters used to highlight components, etc. For example, pictures (color or black and white) are a great way to convey information (one picture is worth a thou-

sand words). Background color is of paramount importance because certain colors obscure text, inhibit reading, and thus the dissemination of the findings (for example, white text on light blue background).

The exercise of constructing and presenting a poster is important because it uses an inquiry-based procedure to develop written and oral communication skills about scientific ideas in accordance with the *National Science Education Standards* (National Research Council, 1996). Specifically, the poster construction project addresses Content Standard A (science as inquiry through a conceptual framework) and Content Standard B (by guiding learning through orchestrating discourse among students about their projects).

Our objectives are to introduce criteria for constructing posters with the style and quality of professional scientific meetings and to provide a conceptual framework for constructive critique. In this paper we will not concentrate on the specific sections of the poster, but rather the physical components that comprise it and how to format them (Figure 1). We have tested our poster suggestions and procedure (Newbrey & Baltezare, 2005; procedure available on the Web) on approximately 100 high school students who were required to construct, critique, and present their laboratory research in poster format to their peers. In addition, a large number of college students have successfully constructed a poster from these instructions using the various versions of Microsoft PowerPoint, such as PowerPoint 2000 (1999). Some of the high school students constructed posters in as little as 45 minutes, however most spent several hours putting together a good first draft using components prepared from class papers.

### Layout & Content

When presenting at scientific meetings, the organization usually provides some specifications about the size of a poster (four feet by three feet, etc.). Scientific

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organizations will also provide information about the criteria used to judge posters for competition. We have included information for judging and critiquing posters modified from the Society of Vertebrate Paleontology Annual Meeting Guidelines for presenters (Eberth, 2004), because the information provides important criteria necessary for designing a good poster and developing an assessment rubric.

## Criteria for Judging Posters

### Layout

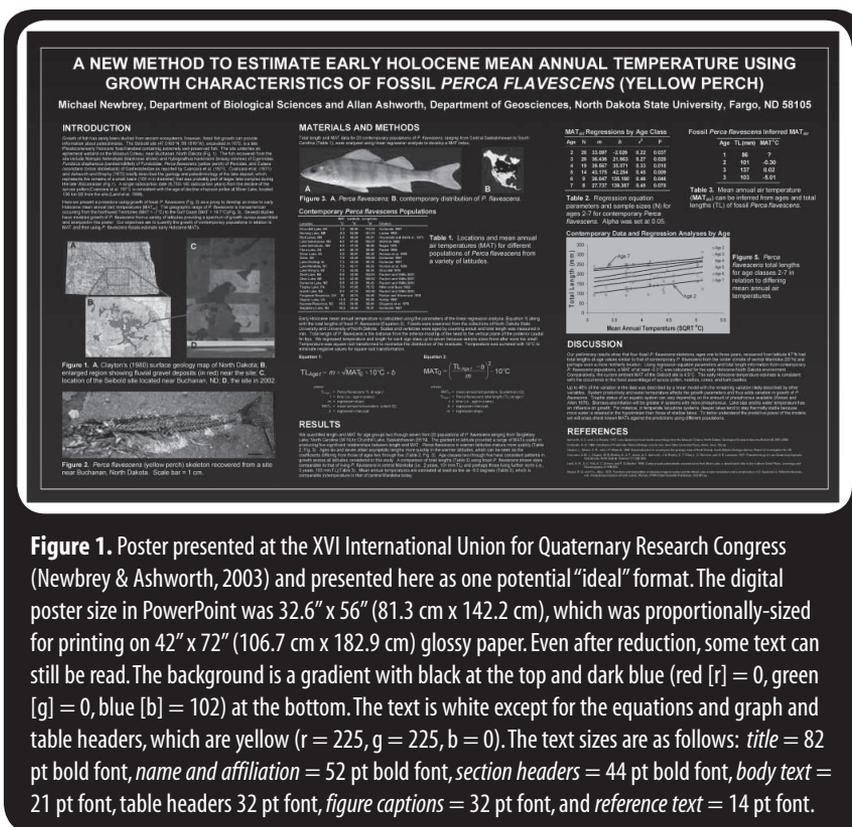
A poster title is descriptive and should be placed high on the poster so that it can be read 15 feet away. The title is followed by the author information, name(s) and affiliation(s) in a smaller font size. The content of the poster should be bracketed with an Introduction at the beginning and a Conclusion (may also be contained in the Discussion) at the end. These sections are critical because they are often the only sections that are read. Some organizations require a brief Abstract prior to the Introduction. The flow of information through the poster should be explicit and organized in columns. Text in the body, graphs, tables, and figure and table captions should be discernable from at least three feet away. A poster should demonstrate creativity expressed in the study design.

### Content Critique

Does the Introduction provide the basis of investigation and the direction/approach to answer the question being considered? Is the methodology of the investigation clear? Are the results presented and are they understandable? Do the results support the conclusions drawn or are there possible alternatives in interpretation? Do the conclusions follow from the original intent, given in the Introduction? The poster should be self-explanatory, so that the main points are communicated without the presenter being there. This is very important! Each illustration may have a short title with a more detailed caption below. Posters should be proofread for correct spelling and grammar and the poster should show creativity in presentation of the material. In the classroom, encourage the students to proofread other students' posters to learn skills in critique (Figure 2) and improve self examination as supported by the *National Science Education Standards* (National Research Council, 1996) Content Standard B by working together as colleagues.

## Characteristics of a Poster

The poster characteristics in this article are provided to design and create a poster in Microsoft PowerPoint, however, other programs such as Adobe Photoshop 5.0 (1998) or Freelance Graphics 9.8 (2003) can also be used. We selected PowerPoint because it is commonly available. We suggest that the reader peruse this document in its entirety and then, if necessary, use the technical procedure provided on the Web



**Figure 1.** Poster presented at the XVI International Union for Quaternary Research Congress (Newbrey & Ashworth, 2003) and presented here as one potential “ideal” format. The digital poster size in PowerPoint was 32.6” x 56” (81.3 cm x 142.2 cm), which was proportionally-sized for printing on 42” x 72” (106.7 cm x 182.9 cm) glossy paper. Even after reduction, some text can still be read. The background is a gradient with black at the top and dark blue (red [r] = 0, green [g] = 0, blue [b] = 102) at the bottom. The text is white except for the equations and graph and table headers, which are yellow (r = 225, g = 225, b = 0). The text sizes are as follows: title = 82 pt bold font, name and affiliation = 52 pt bold font, section headers = 44 pt bold font, body text = 21 pt font, table headers 32 pt font, figure captions = 32 pt font, and reference text = 14 pt font.

site to create a poster. Consider this document as a guide for determining characteristics of a poster. Also, creators of posters will experience difficulties when working with any software, so we encourage students to save their documents often and save them on two separate memory devices.

## Layout Characteristics

Start by setting the size (i.e., 48” x 36” or 122 cm x 91 cm) of the poster and choose the orientation of the slide by selecting either portrait or landscape. Usually, posters are presented in landscape format because most easels and poster-display panels will accommodate a landscape orientation.

## Background

The background color can function to catch a reader’s eye from a distance but also, more importantly, to highlight the text of the poster. We suggest a very dark color or a light color to contrast the text of the poster. A good “very” dark color is dark blue (for example, set: red, green, blue to 0,0,102) or dark green, dark gray, and dark purple because they are soft and easy to look at. You may choose “very” light colors as a background with more choices in color, but make sure the colors are not too bright.

Fill effects can also be used as a background, such as a “gradient, texture, or JPEG picture” as a background. A gradient is a change in color over a distance. Gradients can provide an aesthetic effect of two color extremes while retaining the characteristic of a subtle change in color to facilitate readability. We suggest that the top be black in color to highlight the title, while the second dark color represents the middle and perhaps bottom.

Textures and pictures can provide an excellent background in some cases but be aware that “busy” textures may

make reading the text on the poster difficult. Texture is the fine aggregation or non-aggregation of background color. An image can also be imported as background fill and can have very aesthetic effects. However, this is inadvisable for most pictures because of their non-regular shifts in extreme colors, which may obscure light or darkly-colored text. The picture should possess the qualities of being either very light or dark to contrast the text.

## Title & Author information

The title should be as short as possible, as well as interesting and informative. Use either Times New Roman or Ariel fonts and set the color to either a very dark (such as black text on a light background) or very light text (such as white on a dark background). Contrast is important for reading from a distance so that people reading the poster don't have to strain their eyes. The text size of the title should be 60 pt or larger and "Font Style" should be bold. Titles should be all capital letters for readability. If you choose not to have all capital letters, use a larger font size. Use the same font throughout the poster; this is a common problem seen at professional meetings.

On the line below the title, reset the text size to approximately 70% of the title text size (for example, if the title text is 60 pt [48" x 36" poster], then the following line should be 45 pt). The name and work/school address should follow. Use this format: Name, Science Department, West Fargo High School, West Fargo, ND 58078, E-mail: john.doe@hello.com.

## Body

The text representing the body of the poster should be formatted into equal width columns with each column a single text box (Figure 3). Proceed by typing in the text box or "Copy" and "Paste Special" as unformatted text to eliminate tab and hard return errors. The embedded tabs and hard returns make formatting difficult or impossible in PowerPoint text boxes (i.e., unwanted and un-adjustable spacing, long tab distances, etc.). We recommend that columns of text within the poster not be outlined by a four-sided box because too many lines distract the reader. If a box is necessary to highlight a point, set the line thickness so that it is thick enough to be viewed after enlargement, at a distance (4 pt or more).

The main body of the text should be of the same font and colors with sizes commonly set at 18 to 25 pt (preferably 20 or larger for 48" x 36" poster). Text can be highlighted using

A common error, the use of the word "Affect" is incorrect. "Effects" should be used. Also a space is needed preceding the word. Affect (verb): to produce an effect on, influence. Effect (noun): 1. meaning, intent; 2. result; 3. appearance; 4. influence.

The headers are too small or missing.

The materials and methods are not detailed.

The image resolution is too low such that it appears pixelated.

The text and figure are positioned too close to this side.

Picture of the student working on his/her project

The figure captions are not descriptive and this one is crowded to the bottom.

The table indicates nothing to the reader because it lacks independent values and an adequate description. It also has too many horizontal and vertical lines.

The graph indicates nothing because no axis labels are used. And the legend abbreviations are not defined in the figure caption. The graph is positioned too far away from its figure caption and is overlapping the methods. The figure's caption should be placed further from the table.

There are no references. Always cite the references.

The columns are not aligned. To align the columns, place all text in a single text box.

**HYDROPONICS: AFFECT OF MISSING NUTRIENTS**  
Name, Science Department, West Fargo High School, West Fargo, ND 58078

**Introduction:** What is the effect of missing nutrients in a solution on green plants? That is what hydroponics is. Hydroponics is a term applied to cultivation of plants in nutrient solutions without use of soil. Nutrients are supplied to liquid solutions and plants are supported by porous material, such as peat, sand, gravel or glass beads. This medium acts as a wick in relating the nutrient solution from its source to the roots. Though photosynthetic green plants manufacture their own organic food using carbon dioxide and oxygen as raw materials. Plants physiologists have discovered that plants require carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, magnesium, sulfur, calcium, iron, manganese, boron, zinc, copper and molybdenum. In hydroponics 2) Nutrients is supplied by the nutrient solution, a mixture of pure water and dissolved nutrients. (V. Green 1)

This experiment can address self-sufficiency and the genetics of the plant. The use of these chemicals is the same as would be in their natural environment. Nitrogen and hydrogen carbon oxygen are the basic units from which plant growth is most important. The loss of any of these will result in a weak plant and possibility of the plant Carbon dioxide is necessary for photosynthesis.

**Hypothesis:** Plants in the complete nutrient solution (1) will grow taller and stronger than the plants growing in the solution minus calcium (2).

**Prediction:** Calcium is an important nutrient in the solution and plays a key role in plant growth and photosynthesis.

**Procedure:**  
1. Place one plant in each paper towel in germination  
2. Place both plants in the solution  
3. Fill beakers and install an aeration  
4. Suspend roots in each nutrient solution  
5. Place trays of beakers to reduce water evaporation  
6. Record growth on specified graph  
**Independent Variable:**  
Amount of Nutrients in each solution  
**Dependent Variable:**  
Growth of Plants in Sol. 2 then in Sol. 1  
**Constant Factors:**  
Air pump, light, and clean seeds  
**Control Group:**  
Solution 1 (Complete Nutrient)  
**Experimental Group:**  
Solution 2

**Figure 1:** This graph shows the growth rates between each solution.

Comp Nutrient	Minus Calcium
1	2
2	5
3	7
4	9
5	11
6	14
7	16
8	19
9	23
10	21
11	27
12	26
13	30
14	33
15	32
16	38
17	36
18	49
19	52
20	55

**Figure 2:** Shows a student checking nutrient levels and measuring plant growth.

**Table 2:** Shows the amount of growth per plant in cm.

**Figure 3:** Shows a student working on his/her project.

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most journals and societies do not approve of the use of vertical lines in finished products. Too many lines can distract the reader and make it difficult for the eye to follow.

## Pictures

Good pictures can dress up a poster and stimulate the interest of potential readers. Good pictures may show your study area, study design, effects, results, conceptual models, flow charts, graphs, etc. and must have the resolution necessary to appear in focus when enlarged. Poor pictures will only detract from the quality of the poster and, thus, your reputation. Digital cameras are great for generating pictures that lend themselves well to enlargement. JPEG format pictures of greater than 3 megabytes are preferable, however, 1.5 megabytes will function quite well. Images of a TIFF format will withstand more edits while enlarging their quality and, hence, are preferred. To select a picture from the Web, save the picture to a file, and then follow the instructions for inserting the picture from a file. Do not "Copy" and "Paste." This procedure should ensure the highest quality picture possible for the poster and will help prevent problems with low resolution when it is enlarged. Never use someone's pictures or written material without proper citation of the material. All too often students misunderstand how to properly acquire and cite material taken from the Web and, as such, plagiarize someone else's work.

If you feel the need to draw the reader's attention to an aspect of a picture or a characteristic on a graph or table, use an arrow perhaps in conjunction with bolded text. Arrows can be very useful for pointing out key aspects or identifying attributes. Do not overuse arrows or the reader will become desensitized to their presence.

## Printing the Poster

To determine if the product can be read at a distance, print the poster on an 8.5" x 11" (21.6 x 29.7 cm) sheet of paper. The body of the text should be easily read on the 8.5" x 11" printout. However, for full size posters the file can be printed to larger-display sizes on digital plotters at universities and commercial printers. At North Dakota State University, poster printing costs run from \$15.00 to \$25.00 depending on size and whether the paper has a matte or glossy finish. Glossy finish is more expensive, but produces sharper contrasts than matte finish. Inform your students that often a revised version of the poster may be necessary because digital

**Section Header (bolded)**

**Title (all capitals and perhaps bolded)**

**Name and affiliation**

**Text box used to form a column with graphs overlapping**

**Graphs created in Excel**

**Table created in Excel**

**Outline box with transparent interior**

**Text boxes, which are outlined here as an example, can overlap because they are transparent**

**Figure 3. A diagram showing the different components of a poster. In the figure some of the text boxes are outlined for illustrative purposes; do not use outlines around text boxes. Too many lines are distracting.**

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plotters do not always print as the poster appears on the screen (e.g., misplaced text and colors). Errors can occur from the inability of some print drivers to interpret the coding of characteristics within the poster.

## Fliers

Fliers should contain the title, names, all contact information, abstract, meeting information (i.e., name, date, and location of the meeting), and an image of the poster on a single 8.5" x 11" sheet of paper. Because presenters cannot always visit with all interested persons and their audience may want to remember the results and contact information, fliers can be very useful in disseminating relevant information. We have referenced fliers up to three years later to cite the research; poster titles, authors, and meeting information are necessary to construct a proper citation. Fliers can be printed in color and are often available for distribution while the poster is displayed, however, fliers can also be made available on a Web site. In our experience, we have printed approximately 60 fliers for meetings with an attendance of about 1,500 people. However, this is largely variable depending on the general interest and applicability of the topic. Students should be aware of the usefulness of fliers and perhaps be required to construct fliers for an assignment. In addition, students should be required to provide a peer review of their fellow students' fliers. The reviews themselves could be graded on the basis of their assessments.

## Conclusion

Constructing posters can help students develop better written and oral communication skills, and poster creation expertise that will be beneficial in future work or academic endeavors. At the conclusion of the exercise, encourage students to present their posters to their classmates. Often, a researcher at a meeting will approach a poster presenter and request a short, concise oral presentation about the research

rather than read the entire poster content. This presentation usually conveys the presenter's communication skills, and often prospective employers will remember both the good and bad presentations and posters. Emphasize this to your students because it can make a difference in obtaining future employment. The students can present their posters to their peers in the classroom setting even with small classroom budgets. Posters can be presented with a digital projector or, with less optimal results, an overhead projector, by printing the posters on overhead projector transparencies. This experience is applicable to students of many academic interests because many companies and corporations use posters for internal training and passive education.

## Acknowledgments

We are appreciative of the reviews provided by Jennifer Newbrey and Kim McVicar of North Dakota State University, and three anonymous reviewers. We would like to thank the GraSUS program, which is a GK-12 program supported by the National Science Foundation Project DGE-0086445, and North Dakota State University for paying for the printing costs incurred for posters created by the Advanced Biology students at West Fargo High School, West Fargo, North Dakota, which significantly enhanced this procedure.

## References

- Adobe Photoshop. (1998). Adobe Photoshop 5.0. Adobe. San Jose, CA.
- Eberth, D. (2004). Society awards: SVP student poster prize. Society of Vertebrate Paleontology. Available online at : <http://www.vertpaleo.org/awards/poster.html>.
- Excel 2000. (1999). Microsoft Excel, Microsoft Office 2000. Microsoft Corporation. <http://www.microsoft.com>.
- Freelance Graphics. (2003). Freelance Graphics, SmartSuite Release 9.8. Lotus Software, IBM Software Group. Cambridge, MA.
- National Research Council. (1996). *National Science Education Standards*. Washington, DC: National Academy Press.
- Newbrey, M.G. & Ashworth, A.C. (2003). A new method to estimate early Holocene mean annual temperature using growth characteristics of fossil *Perca flavescens* (yellow perch). Reno, NV: XVI International Union for Quaternary Research Congress
- Newbrey, M.G. & Baltezare, J.M. (2005). *Procedure To Construct Professional Quality Posters*. The file is available to download in Adobe PDF and Microsoft Word formats at: <http://www.ndsu.edu/grasus/baltezare/>.
- PowerPoint 2000. (1999). Microsoft PowerPoint, Microsoft Office 2000. Microsoft Corporation. <http://www.microsoft.com>.
- Word 2000. (1999). Microsoft Word, Microsoft Office 2000. Microsoft Corporation. <http://www.microsoft.com>.

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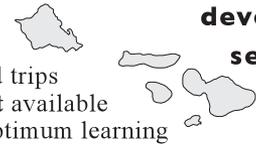
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