How to Give a Good Scientific Presentation

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Abstract **- The major goal of this paper is to serve as a guideline for organization of research presentations. Systematic description of complete process which includes five steps: Constraints considering, Structure planning, Design, Practise and Delivery of presentation is given. This procedure can be used for thesis presentation, as well as for conference, or technical reports to research sponsors, both by graduate students and professional engineers.**

Keywords **– Scientific presentation, Engineers education.**

I. INTRODUCTION

The outline of almost every good talk is the same [1]:

"Tell them what you're going to tell them;
Then tell them;
Then tell them what you told them."

As a researcher you will have many opportunities to present results of your research. Your presentation may be given in research laboratory, a university course or a conference. The goal of this paper is to provide you with some tools to help you design and deliver your presentation.

Major principles for giving a scientific presentation can be found in numerous literature [2-11]. Inspiration for us to analyze this topic was lack of systematic description of complete process which includes planning, creating and delivering the presentation.

The one thing which is emphasized in everything written about presentations is: **Content is key!** Many speakers forget that the content is the most important issue, not how nice a presentation is. Quite often flashy presentations hide the fact that there is no content. Remember that the discussion after the presentation is when the speaker demonstrates who he really is. This is where many good presentations get blown away.

While the content of the presentation is of primary importance, the presentation style also affects the overall impression of the audience and can enhance or detract from the actual scientific impact of the content presented. Number of quality scientific papers were not adequately evaluated because of their poor presentation. Balance between the quality of content and ability to clearly convey scientific information in an oral presentation is critical to both teaching and research. The best presentations are built on a clear message, supported with well-organized facts and enhanced with illustrations, charts and graphs. It is always a great pleasure to attend presentation where results are well presented, the flow of the lecture is easy to follow, and the illustrating materials are clear.

An effective presentation depends on five important steps presented in Fig. 1. The rest of the paper will give detailed explanation for each of these steps.

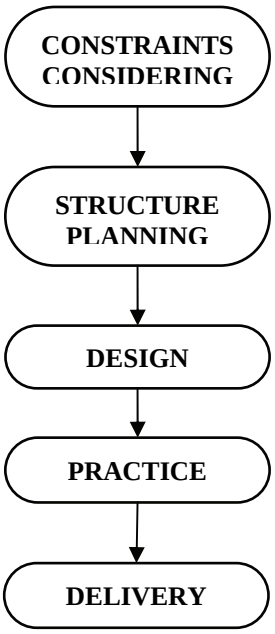

Figure 1. Five steps for effective presentation

II. CONSTRAINTS CONSIDERING

The structure of the presentation is strongly influenced by following constraints:

A. The Audience

Your talk needs to convey information to the audience. It is therefore imperative that you know who your audience is. Knowledge of your audience is an important prerequisite in making decisions about the content, format, language and style of your presentation.

You have to give answers to the following questions:

- Who are the members of your audience?
- How familiar are they with your topic and content?
- What do they already know about your topic?
- What do they want or need to know?

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Consider your presentation from the audience's point of view. What's in it for them? If you can show them early on that they will benefit in some way from listening to your presentation, you will have a much better chance to achieve your outcome.

It makes no sense to present a complex topic at your level of understanding, you may be the only one who understands it. For example, if you write formula $f(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp(-\frac{1}{2}(\frac{x-\mu}{\sigma})^2)$ to a group of arts students, they will get nothing from it. Therefore, try to gear the presentation to the audience level of understanding.

B. The Time Limit

It is very important to plan your presentation time carefully. In the research environment over-time is considered one of the worst sins. Content of the presentation has to be decided according to provided time. Short talks (10 – 15 min) have a different strategy from long talks (45 – 60 min). Anyway, assume **1 to 2 minutes per slide** depending on complexity**.**

For a short talk, there is no time to explain analytical analysis, implementation details or formulas. Focus on the "take home message" and the data to support it.

If you give a long talk, lots of time can be used to discuss the methods in detail if they differ from standard protocols.

III. Structure Planning

Structure planning refers to defining of presentation skeleton which includes first level titles and subtitles, as will be described later. Whenever possible, you should first define skeleton and after that, during the design process, you should develop the contents of all paragraphs. Depending on type of your talk, two types of structures are described [2], [3].

A. Research Presentation

Every research presentation should contain at least one slide for each of the following titles:

Introduction, to include the basic facts needed to tune the reader to the presentation;

Problem statement, to define precisely the problem being attacked by the research under consideration, and why is that problem important;

Existing solutions and their criticism, to survey briefly the major existing solutions form the open literature and to underline their deficiencies from the point of view of interest for this research;

Proposed solution and why it is expected to be better, to give the essence of the proposed solution (i.e., the essence of the idea which is to be introduced), followed by a logical discussion about the expected benefits stemming from the idea;

Conditions and assumptions of the research to follow, to summarize the environment of interest. The term *conditions* refers to the specifies of the real environment, and the term *assumptions* refers to the simplifications which simplify the analysis without any negative impacts on the validity and representativeness of the final results.

Analytical analysis, to show one or more of the following:

- proof of validity of the major idea of the presentation;
- calculation of initial values for simulation analysis to follow;
- rough estimation of the performance and complexity;

Analytical analysis will not give the final answers; however, it will help understanding the concept . It will be helpful both to the researcher and the reader.

Simulational / Implementational results, to show performance and complexity . For some types of research, this one could be the major and the longest part of the paper.

Conclusion, with the following three major elements:

- revisiting the major contribution from the performance/complexity point of view;
- stating who will benefit from the presented results;
- what are the newly open problems and research avenues.

B. Review Presentation

An important prerequisite for a good research paper is that a good review paper is prepared first, to demonstrate that major solutions for the problem of interest are known.

In the case of a survey paper, the major requirement is to have two main parts:

Concepts part to define the major issues. The concepts part should be preceded by a classification of concepts.

Systems part to define various algorithms and implementations, etc. The systems part should be preceded by a classification of systems. Each system in the systems part should be described using the same template (e.g., origin, environment, essence, advantages, drawbacks, relevant details, performance consideration, complexity consideration, conclusion, trends, etc.). The choice of elements for the template is flexible. What is not flexible is that the same elements must be used in each template.

IV. Design Process

It has been said that we remember 20% of what we hear, 30% of what we see, but between 50% and 75% of what we see and hear [11]. Always have in mind that your audience have a limited attention span i.e. they phase in and out of the presentation. Attention span is actually quite short 10-20 seconds. So how do you keep them with you?

You have to make two certain decisions when designing your presentation:

- What information ?
- What format ?

Because of their overlapping, it is impossible to give separate answers to the previous questions. Review of basic principles of designing presentation is shown next.

A. Content

The basic principle of slide's content design process is: **Minimize the content and keep it simple!** Create simple and clear slides which can be read easily and get back in touch with the presentation. The slide message should be clean and easy to absorb. All content should not be put on the slides because the audience will focus on reading of slide's content and the speaker will be ignored. Only the most important points should be on the slide:

- Maximum of 8 lines per slide.
- No more than 8 words per line.
- 1-2 minutes per slide.

B. Headlines

Each slide should be clearly titled, indicating focus of slide. Use strong headlines that concisely states the idea of the slides. Headlines should:

- Orient the audience.
- Help define presentation's structure.
- Help keep speaker on track.

C. Semantic Splitting

The rule of semantic splitting [2] could be defined as: If a sentence must be spread over more than one line, each line should represent a separate thought As an illustration, two examples are shown next:

Text without semantic splitting:

- Writes get satisfied on distance or locally, depending on what brings better performance
- Good if reads and writes are interleaved with similar probabilities of occurrence

The previous text with semantic splitting:

- Writes get satisfied on distance or locally,
  depending on what brings better performance
- Good if reads and writes are interleaved,

with similar probabilities of occurrence

D. Visual Aids

General principle for visual aids is to keep them simple and clear. Also, clear explanation of the used variables and how they were measured, is essential.

Equations - Use them only where necessary in cases you give a long presentation (45 – 60 min). If you have enough time to use them, explain clearly every variable. They quite often turn off a non mathematical audience. Instead of using them, a conceptual model may be much useful.

Tables - Complicated tables are not visual aids. They have been described as instruments of torture for the audience. Tables of data suitable for written publication are highly unsuitable for a scientific presentation. Try to summarize the findings without using tables. If you must use them, state why the result is important to your hypothesis.

Graphs - Graphs should replace tables where possible in a visual presentation. They are better than tables in showing relationships. Always follow next principles:

- State the significance of the relationship shown and why it is so important to the issue you are examining;
- Always describe the variables;
- Always show regression statistics;
- Use colors in graphs with multiple relationships;
- Limit relationships to 3 per graph, better to show two graphs than confuse the listener;

E. Text

Text size - You will find some variations in recommendations for the size of body text. However, use the 24 karat rule for "golden presentations" - don't use fonts smaller than 24 points. The size of the room is the key, large rooms require large typeface points no smaller than 30. Text height should be one centimeter for every one meter of distance from your audience.

Font

- Use no more than 2 font styles, too many fonts can be distracting. Most references recommended to use only one font, two is the maximum.
- Try to use clear fonts like Arial or Helvetica.
- Avoid fancy fonts, scripts, fonts with shadow effects and italics because they are difficult to read when projected.

Colors - Although it is possible to change the slide's color scheme, **it is best to use the base palette for the template, developed by design experts.** However, if you want to experiment, high-contrast colors are only wise solution. Light text (yellow, gray or white) on dark background (blue, olive or purple) is always good solution.

Background Colors - Dark colored backgrounds are easiest to read. Blue, black or purple are suggested. For education purposes, use deep forest green, olive or teal. Never use a clear white background, at least apply light color. Remember that color evokes psychological responses. Red is stimulating, it increases excitement, heightens emotion and can cause problems. Brown is also a color to avoid.

Foreground Colors - Yellow is easiest to read on blue background. It is stimulating color, excellent for combination with blue and red text. Gray is neutral, it eliminates bias. Light violet is expansive and open-minded color

V. PRACTISE

Nothing improves a presentation more than one practice talk! This is perhaps one of the most important principle [6]. If you practice your presentation just once, your talk will be infinitely smoother.

A. Actually Practise

This does not mean running through the slides and going "yeah, then that stuff, then the next slide, then the experiment

part, a couple of diagrams, data, conclusions". Actually stand up and give the talk. Practice improves the flow of the talk. There will be less "um's" in the talk if you practice. People have a natural tendency when speaking in public to pause and say "um" when they forget what they were going to say for just an instant. By running through the talk you will develop a natural flow. You will come up with phrasings and ways to describe things that you will use when you give your presentation. Most importantly you will discover things that you don't actually understand. **Explaining something to someone else is the best way to determine if you really understand it.** Don't fool yourself into thinking you can explain it, try it. If you don't understand, you have time to figure it out before the talk. Even things you know well might be difficult to explain. Practicing helps you to find the words. Also, giving a presentation can be a nervous business, practice can help alleviate that fear.

B. Memorize the First Few Lines

Starting out is the hardest part of the talk. Once you get going and into a flow things are easier. But that first little bit is nerve racking. One thing you can do is to memorize the first few lines you are going to say. Don't memorize the entire talk, just first few lines: "Hello, I'm Stevica Cvetkovic. The title of my presentation is How to Give a Good Scientific Presentation. The goal of this paper is to provide you with some tools to help you design and deliver your presentation...". Wing it from here.

VI. DELIVERY

The challenge to the speaker is to hold the attention of the audience. An important part of delivery is your interaction with the audience through: 1) Voice, 2) Movements, 3) Stage Presence. In order to have effective presentation, you must accept following principles.

Prepare strong wording to emphasize strong points or transitions. Examples for beginnings, middles and endings are shown:

Beginnings: "My name is ... and I will be talking about..."

Middles: "That concludes what I have to say about cross sections. I will now discuss..."

Endings: "To summarize, I would like to show you ..."

Talk to the audience, not the overhead, or the computer. Avoid to read your slides. The audience's attention should be on the speaker. A paper can never serve as a speech or vice versa.

You are your own best visual aid. Use your body language, facial expression and gestures to add impact to your verbal message.

Deliver dramatically. If you mumble to yourself no one will pay attention. Speak with conviction. Change you voice level as much as possible, monotone puts you to sleep.

Ask the audience questions, whenever possible. Or at least challenge them to think about the issue. Example: "If this worked this way then we would expect this result, but we got this! Why? " Then explain.

Keep it interesting. If you have practical examples, interesting tidbits or humorous asides, people will be less likely to drift off to sleep.

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