SCIENTIFIC COMMUNICATION: THE ART OF PREPARING AND PRESENTING SCIENTIFIC RESULTS

Comunicação científica: a arte de preparar e apresentar resultados científicos

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ABSTRACT

This article is part of a special series designed to help authors in the process of scientific writing and communication. The objective of the study was to provide tools and strategies to prepare and achieve effective forms of oral communication, especially related to posters and oral presentations. A non-systematic literature research (PubMed/Web of Science) was performed to retrieve relevant data about how to prepare posters, oral presentation and how to control anxiety caused by oral speeches. In addition, a brief overview of innovative and recent digital tools is also provided. The scientific literature proves some interesting recommendations for preparing a good poster or a slide show and to avoid public speech anxiety as well. A list of available digital tools for such preparation was also disclosed. The rules for oral or poster communication differ from those related to manuscript writing. The quality of oral scientific communication can be improved by following such rules.

KEYWORDS: posters; health communication; anxiety; scientific communication and diffusion.

RESUMO

Este artigo é parte de uma série especial que foi desenvolvida para auxiliar autores no processo da redação científica e comunicação. O estudo teve o objetivo de fornecer ferramentas e estratégias para preparar e alcançar formas efetivas de comunicação oral, especialmente para pôsteres e apresentações orais. Realizou-se uma pesquisa não-sistemática da literatura (PubMed/Web of Science) para levantar dados relevantes sobre como preparar pôsteres, apresentação oral e como controlar a ansiedade causada por apresentações em público. Além disso, também é fornecido um breve resumo de inovações e ferramentas digitais recentes. As regras para a comunicação oral ou pôster diferem daquelas relacionadas à escrita do manuscrito. A qualidade da comunicação científica oral pode ser melhorada seguindo tais regras.

PALAVRAS-CHAVE: pôsteres; comunicação em saúde; ansiedade; comunicação e divulgação científica.

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INTRODUCTION

The transfer of knowledge is one of the most challenging tasks faced by scientists around the world and in all fields of research. One of the major points that contributes to such difficulty is the heterogeneity of the audience, which may be consisted by peer researchers, company staff, or even the general public.¹ According to Polit and Hungler, “the most brilliant piece of work is of little value to the scientific community unless that work is known”.²

Therefore, the diffusion of research results is essential for researchers and clinicians. Above all, it must be pointed out that it is also an ethical and civic obligation.³ There are several types of scientific communication at the knowledge transfer scenario, such as oral communication and poster presentation.^{1,4} It is noteworthy that oral communication can lead to high levels of anxiety with great impact on the quality of speech.⁵ Moreover, the formatting and clarity of the support material are critical for success in captivating the audience and transferring the scientific message.⁶

As facing an audience can seem to be an overwhelming experience, this manuscript aims to support researchers and clinicians in preparing a clear poster or oral presentation. The main obstacles encountered and their solutions will be specified. Using this article should help to achieve an effective scientific communication. Strategies will be detailed for the following points:

1. How to prepare a good poster;
2. How to prepare a good oral presentation;
3. Which digital tools can be used in scientific communication.

This article is meant as a tool to convey a clear scientific message when presenting a poster or giving an oral presentation. Undoubtedly, good communication depends on good research bases, such as an appropriate research question, well-designed methodology and accurate analyses of the results.⁷

A non-systematic research was carried out on PubMed and Web of Science databases to retrieve articles about scientific oral communication and speech anxiety. The keywords used were “poster”, “poster presentation” “oral communication”, “slideshow”, “speech anxiety”.

How to prepare a good poster

What is a poster and when to do it?

Posters are big pieces of paper or fabric cloth (large variety of sizes) that are hung on a vertical surface. They are meant to quickly convey information about an area of

research and its results. One key point of posters is to be “self-explaining”: readers should be able to clearly understand them only by reading. The first author generally presents the poster during poster sessions in scientific conferences and meetings. Since the speaker is directly facing the public, it is a good way to have an immediate feedback from specialists and experts. Posters can also be used for general communication to the public, students etc. Considering that a poster session can gather up to several hundreds of presentations, each poster must be “attractive” to catch the attention of the audience. Hence, the layout of posters can be as important as the scientific message *per se*.^{8,9} Recently, some scientific events provide the required structure to show digital versions of posters (iPoster) on screens.

A poster is not a research paper

Research articles and posters share some common rules, since their major goal is to transfer scientific knowledge. However, articles can be read several times to be understood and all data may be accessed again whenever necessary, which is not the case of posters. One of the challenges when creating a poster is to decide which parts of the research are critical to be described and those that are not essential.⁸ Generally, a poster focuses on the background, the research questions, the results and the conclusion. The methods section is important, but it should not be as detailed as in a scientific article. Nonetheless, if the goal is to publicize a new developed technique, details and innovations related to it are of utmost relevance and must be presented. Considering that the poster is a concise form of communication, some of the parts of research articles are not always important: abstract, references, acknowledgments and logotypes are generally not required in a poster and must be avoided or reduced at a minimum. However, some conferences impose to observe certain requirements, especially the dimensions of the poster. In some situations, the logotypes, references and even a template can be required. Knowing the audience helps to define the best approach so that information can be transferred successfully. For instance, the audience of a meeting generally consists of specialists in the field of research, so the transferred knowledge should be very specific. On the other hand, for viewers such as students, scholars of other areas or non-scientific professionals, the results must be presented in a more didactic format.

“Less is more” is an important clue to take into account while preparing a poster.¹⁰ A clear poster should never be crowded and part of it should remain blank.^{9,11} The amount of text should be limited and long phrases avoided. Clear graphics, images and diagrams, with a short explanation convey

information better than large blocks of text. Finally, it is not uncommon to find posters containing pixelated images and graphics with low resolution.

Formatting of a poster

The formatting of the poster includes the selection of fonts, size of the text, diagrams and colors. Bad formatting can quickly tire the brain out, and will certainly compromise the interest of the expected visitors. A good formatting will attract and make viewers curious, even if the results of are not the most striking in the poster session. Therefore, some critical aspects related to formatting must be mentioned. The poster should be divided into two to four equal columns. The number and width of the columns depends on the dimensions of the poster. In fact, organizing the data in long lines creates an obstacle to a good reading and to focus. The most logical flow is to organize the information from top to bottom and from left to right. Images and text must be aligned. This is a critical point for the beauty of the poster.

Only the title and the list of authors should be placed at the top and can comprise the entire width of the poster. The title must be short, precise, and informative and clear.⁹ An attractive title can be formulated as a question or as a newspaper's title, no more than two lines. The title can be written in uppercase and/or bold or written in a thick font — which are generally named “black” or “bold”. Title size should be from 60 to 80 points, depending on the font and length of the title. The list of author and affiliations should be written in a regular font, using a smaller size (45 to 35 points). The use of two typefaces can help to distinguish sections of the poster or to highlight some specific information. Nonetheless, more than two of those can be confusing. For example, one typeface could be used to write the title, list of authors, sections and main text, and another typeface for the description of diagrams and illustrations. Some typefaces are good choices, such as Arial, Caslon or Helvetica. Other typefaces must be avoided for being fanciful (Comic Sans, Jokerman) or too common (Times New Roman, Calibri). Fonts like Century Gothic and Futura have round and similar letters which are difficult to be distinguished from one another. The poster must be clearly legible from a three-meter distance, even in places with dim light.

Important information, such as results, can be highlighted using boldface. In scientific posters, the italic type must be reserved for official nomenclatures (gene names, species binomial name, mathematical and physical constants...). The minimal point size to be used in a poster is 24, but the use of even bigger point sizes is recommended.^{8,11}

The colors of the poster are crucial for the attractiveness of the poster. A black and white poster will be dull and boring. On the other hand, an excessively colorful poster can be confusing. The right middle is to use a combination of four colors: a dark one (usually black) for the text, a light one (usually white) for the background and two other colors. The background can also be an image linked to the topic. The two other colors should be used in order to draw boxes, forms and to color the diagrams. Tones of blue and green are calming colors and are quite popular in communication. Red, orange or yellow are appealing and can be used to highlight data.⁹ The contrast and tones between two adjacent colors should be adapted. For example, using white and yellow or complementary colors causes much strain on the eyes. Furthermore, think of adjusting the saturation and brightness of the colors to embellish the poster. Chart 1 summarizes common mistakes when preparing a poster and some recommendations to avoid them.

Revision and impression

Just like a research manuscript before submission, the first draft of the poster must be carefully revised and accepted by co-authors and main investigator.^{8,12} Interestingly, people not directly involved to the research or researchers from other areas can provide important feedback about the flow, typos, coherence and layout.

While a poster will look like a masterpiece on the computer monitor, be careful of its quality when printed. Some institutions and universities offer cheap service for printing, but its quality can be low. Printing services are usually available before international meetings but are

Chart 1 Common mistakes when preparing a poster.

Mistakes	What to do?
Elements not aligned	Divide the poster into columns.
Large blocks of text	Replace with graphs, flowcharts.
Excessive colors	Use two colors plus black and white.
	Green and blue are calming and commonly used.
	Red, orange and yellow to highlight data.
Illegible typefaces	Favor Arial, Caslon or Helvetica.
	24 points type or more.
Long / confuse explanation	Continuous and appropriate practice / presentation should not exceed 10 minutes.
Pollution of the layout	Keep in blank 40% of the total poster surface.

more expensive. Most posters are printed on paper, but fabric cloth is another available option. Fabric cloth posters can be more suitable for long trips (they will neither require a poster tube nor crease).⁸

Before attending a poster session, it is a good idea to print an A4 paper version or summary of the research to be distributed to the public, since some researchers could have specific interest in your research. Business cards are useful tools for networking as well.⁸ Keep in mind that poster sessions create an interesting and unique atmosphere to promote scientific collaboration and to be in touch with a possible employer.

During the poster session

The public should be able to understand the poster in about 5 minutes by themselves. However, the author should be able to give detailed explanation which should not exceed 10 minutes. It is of great importance to practice several times the oral speech to respect the allotted presentation time, to master the content of the poster and to avoid speech anxiety. Eye contact, smiling and greeting can improve social interaction and make the public curious about the poster. However, the author should let the public free and comfortable to read the poster alone by standing at the side of the poster. If any question is raised, the authors should thank the inquiry and be confident to clarify the points.

How to prepare a good oral presentation

What is and when to perform an oral presentation?

Oral presentations are more common than poster presentations and generally allow transmitting a broader set of knowledge. They take place in meetings, laboratory reunions, journal clubs, workshops and many other scientific situations. The duration of oral presentations has great variability: from 5 minutes (shortest ones) to hours of speech, in some cases. Slideshow and/or audio equipment are powerful aids to improve the quality of the oral presentation. Although dispensable, a slideshow presentation will improve the comprehension of the message. Oral presentations rely on visual and verbal learning.¹³ The direct interaction between the speaker and the audience allows a clear understanding of the message and to dispel any doubt.

Preparing the presentation

The first step is to make a brainstorm related to the topic and the key elements that will be approached. As for the poster, it is important to know the public and their background, in order to adjust the complexity of the presentation

according to the audience. The second step is to retrieve references. It is generally better to use recent specific references. The length of the presentation should always be kept in mind. Usually, a single slide requires one minute to be presented, but some cases can escape the rule. For example, the presentation of the opening slide can be longer than one minute, as the speaker must present themselves and the topic of the presentation. The explanation of a complicated mechanism within a slide will certainly require more than one minute. The speech must be concise and clear, it is useless to present partial data.

There is more flexibility regarding the use of colors, length and typefaces during oral presentation. However, some recommendations are important:

1. avoid certain typefaces (Jokerman, Comic Sans);
2. respect combinations of colors (not using complementary colors together);
3. use bright colors to highlight key aspects;
4. choose no more than two typefaces for the slideshow.

Visual outfit must be as simple as possible. Long blocks of text should be avoided, except in cases of utmost importance (i.e., precise/detailed definitions, law citation). When writing sentences cannot be avoided, one slide should not contain more than eight lines and each line should not contain more than six words.⁶ Chart 2 sums up some common mistakes made when preparing an oral presentation and slideshow.

Overcoming the stress

Speech anxiety is the fear of speaking facing a public. It is a common phobia, that can be ranked first within the group of social phobias.¹⁴ It is an important obstacle for oral communication, impacting the clarity of the speech and causing physical distress. In addition to that, this phobia can worsen when the speakers have to communicate using their non-native language.⁵

Chart 2 Common mistakes when preparing oral presentations.

Mistakes	What to do?
Long blocks of text	Replace with graphs, images, videos.
	Use key-words and short sentences.
Too long presentation	Reduce the amount of information.
	1 slide = 1 minute.
Too short presentation	Take more time to explain key concepts.
	Rethink the purpose or the message of the presentation.
Divergent speech and slide content	Use the slideshow only to support the speech.

Fortunately, some techniques can be used to ameliorate or minimize the effects of anxiety. Regular “training” helps improving the oral skills and self-confidence.⁵ Short presentations in front of coworkers or fellow students is one important aid to control the phobia. Participating in “Journal Clubs” is a good way to give regular oral presentations. All participants have to frequently choose and present a research article in front of coworkers. Another efficient technique in surmounting anxiety is the self-visualization. It consists in mentally simulate all the steps of the presentation, from its preparation to its outcomes. The speaker can be greatly motivated for the preparation by visualizing it. The visualization of the outcomes (questions, material issues) makes the speaker ready for any eventuality or question. Practice and visualization should help the speaker to avoid anxiety on the long and mid-term.¹⁵

Digital tools

Videos

Videos can be considered the new researcher’s allies and are commonly used as supplementary data in articles to show live mechanisms, especially for microscopic observations. It is an innovative way not only to communicate results, but also to illustrate protocols. In this context, the Journal of Visualized Experiments (JoVE) is a peer-reviewed online journal specialized in “video articles”, where all the parts of a classical manuscript article are presented as videos. JoVE offers detailed instructions of scientific experiments and discussion about any troubleshooting.¹⁶

Videos can also be indirectly integrated in posters — in the form of a Quick Response code (QR code) or directly inside presentations. However, the length of the videos must be taken into account when integrating in oral presentation. Videos can support but not replace the speech. Complex mechanisms, like molecular mechanisms, can be presented in 3D computer graphics animations, but require an animation design team and several months of work. A quite famous video presenting a series of molecular complexes is “The Inner Life of the Cell”, created by the animation company XVIVO, for Harvard University.¹⁷ Research teams with human and financial resources should think of videos as a new communication form.¹⁶

Quick Response codes

QR codes are 2D barcodes used to store data through an attached object. They can be personalized with images, colors and shapes, and therefore are particularly versatile and can be easily integrated to the layout of a scientific poster. Most mobile phones equipped with a camera and an adapted

application can read QR codes and convert it to its useful object. The linked object is commonly a webpage, a text, a video or an image. Diverse information can be linked by a QR code. Complementary data can be linked in the QR code, yet it should not contain any data necessary for the comprehension of the poster. The QR code can also house a digital version of the poster or provide information about the research team and its research projects. A great deal of websites offer to create personalized QR codes.

Software and applications

Although many people use Microsoft PowerPoint to create their posters, there are many others modern application programs to reach amazing results. Microsoft Publisher is an interesting option for such task. Numerous features allow the aligning of text and graphs, even around irregular shapes. It also allows adjusting any size of poster and margins. Posters can be created thanks to other free programs, such as PosterGenius, Adobe Illustrator, CorelDraw, OpenOffice Draw and others.

For oral presentations, one of the most used software is Microsoft PowerPoint. Some free programs are available for slide show creation, such as Apache OpenOffice Impress, Beamer, Libre Office Impress or NeoOffice Impress. Online tools like Prezi or Google Slides are also commonly used. Nonetheless, these internet tools can display a public version of the slideshow. They should never be used when unpublished or subject to secrecy data are to be presented. Before an oral presentation, be sure that the material needed will be available (video projector, computer). When presenting the slideshow on another computer than the one used for preparing it, be careful that the file format of the presentation will be compatible with the available software.

Many raster graphic programs allow composing and editing images and graphs. The most famous one is Adobe Photoshop, but its price and complexity can be rebuffing. There are other common free programs like PhotoFiltre, Corel Painter, GIMP. The quality of images is better in PNG or TIFF format. Other image formats can lose quality after compression or impression. Online tools such as Mind the Graph (Mindthegraph.com) have a scientific image database and allow creating scientific infographics that can be included in posters, slide shows or articles, and do not require specific knowledge in design. The Internet application Adobe Color (color.adobe.com) can help making a choice of color set for a poster or slide show. Several options in the application allow choosing a scheme of five colors and exporting this theme to other Adobe application programs. Chart 3 lists useful applications for each task when creating a poster or slideshow.

Chart 3 Useful software and applications to produce posters and slideshows.

Use	Application software	Internet applications
Create a poster	Microsoft Publisher, PosterGenius, Adobe Illustrator, OpenOffice Draw	
Create a slideshow	Microsoft PowerPoint, OpenOffice Impress, Beamer, Libre Office Impress, NeoOffice Impress	Prezi, Google Slides
Compose and edit images	Adobe Photoshop, PhotoFiltre, Corel Painter, GIMP	Mind the Graph
Choose color theme		Adobe Color

FINAL CONSIDERATIONS

Poster and oral presentations are meant to quickly and efficiently disseminate the results and/or scientific interest of a research question. However, they conform to different rules from scientific articles. This can lead to mistakes in creating poster and slideshows, which can lead to the misunderstanding

of the scientific message. Both poster and oral presentations respond to common rules.

The quality of poster and oral presentation can be improved by respecting some steps. The aim of the presentation and the logical flow must be clearly defined. Recent references must be retrieved to illustrate the speech. It is useful to know the background of the public to adapt the level of the presentation. The quality of the visual layout of the presentation is critical for its attractiveness and comprehension. Finally, a well-trained speaker should be able, at long term, to overcome speech anxiety.

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CONFLICT OF INTERESTS

The authors report no conflict of interests.

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