

Poster presentations to expand Engineering and Scientific communication skills

Mark A Schier, Llewellyn Mann

Engineering and Science Education Research group, Swinburne University of Technology
Corresponding Author's email: mschier@swin.edu.au

Structured abstract

CONTEXT

Communication for engineers and scientists is expanding in its different forms and requirements in industry, including oral presentations, posters, press releases, memos, executive summaries, and journal articles. However, in most cases, universities rely simply upon student written reports of theoretical and experimental work. Poster presentation is a relatively uncommon form of assessment in universities and where used is typically at the culmination of final year projects, and students have had little practice or experience in developing this type of presentation. This paper will report on the use of posters to present methodology and findings from a mini group project as training for professional communication. It will also discuss the use of feedback to improve their future skills.

PURPOSE

The aim was to train students in poster communication methods as a skill for final year project presentation and future conference or workplace needs. The poster was based upon small group projects and hinged upon the provision of constructive feedback to focus on improvement. The students also have the chance to see colleagues' posters by use of a virtual gallery on our Learning Management System (Blackboard).

APPROACH

Biomedical Engineering and Science students worked in small groups of around 2-4, on a self-chosen project topic relating to an aspect of physiology. Their task was to design a simple experiment, carry it out and obtain results. Each group produced a large (A1 size) poster in electronic format to present their background, methods, results, analyses and conclusions. This was graded according to a rubric they received at the beginning of the assignment. Additionally, feedback was provided on each of the items on the rubric (with sections of layout, labels & text, images, intro & methods, and results & conclusions). The particular type of feedback was meaningful as it gave some comments and recommendations on content and structure of the poster.

The format, approach and rubric have been refined over a period of around 6 years. For example, the original concept was poster on cardboard or posterboard, it is now an electronic version only; the nature of the feedback has been refined to push it back to the Learning Management System, rather than wait (indefinitely) for students to "collect" their work and feedback.

ACTUAL OUTCOMES

The poster grading is completed at the time of writing the abstract, and human experimentation ethics approval to survey the student group is currently being sought. We expect that students will report that they will utilise the poster gallery, and the group feedback to improve their poster design and construction skills in the future. We expect that many students will comment on the type of feedback that they would prefer to receive to help them improve their poster skills.

CONCLUSIONS

That Engineering and Science students are assessed on an additional communication medium for presenting their results to others at the end of second or third year to add to their professional skill set. This will assist them in the preparation of posters for final year projects, workplace skills and research presentation skills.

KEYWORDS

Posters, feedback, feedback

Introduction

Communication skills are vital for practicing engineers and scientists. The recent Australian Qualifications Framework requires all graduates from Bachelor (or Bachelor Honours) courses to have “communication skills to present a clear, coherent and independent exposition of knowledge and ideas” (AQF 2013, p48). For engineers, the new Stage 1 Competency Standards from Engineers Australia require all graduate engineers to have effective written and oral communication in professional and lay domains (Engineers Australia, 2011). Rubrics have a demonstrated place in advancing and assessing student learning (Wolf & Stevens, 2007), and have been applied in many contexts including project assessment (Moskal, 2000).

A consideration of the communication needs for engineers and scientists suggests many different styles are required for different purposes. Some of these are needed for internal communications, project briefings, customer reports, scientific papers, media releases, engineering drawings, conference papers, executive summaries, public information, technical reports, presentations and poster information. While this list is extensive, it is probably not exhaustive. These all have different objectives and requirements, and while there are similarities between some of them, there are different purposes and media used in their creation. They can be sorted into three broad categories: written reports; spoken presentations; and graphical presentations. While many efforts have been made to improve the communication skills of engineers and scientists (see for example Karatsolis 2012; Klasén 2011; Skinner & Mort, 2009), it still remains an issue.

This paper considers the graphical presentation and in particular, the poster presentation of work. Posters typically are a mixture of images, and text with an emphasis on good short communication. They are often used as a vehicle for “telling a story” at a conference, public even or open day, where the reader can briefly peruse a series of posters and gain some quick insight before deciding whether to look at the poster in more detail and/or ask questions about the work presented.

Engineering and Science students receive little training or experience at this type of presentation, compared to say a graphic design or media student. Even though they receive limited or no experience, often they are expected to produce a poster for the workplace, for a conference, workshop or public event.

One well-used reference for using posters for communication tools is John Woolsey’s paper published to assist scientists produce better posters (Woolsey, 1989). Here he gives side-by-side examples of average and better versions of presentations containing essentially the same information. This usually involved improving the diagrams and the flow of the poster by removing large amounts of text,

The aim of this paper is to present some tools and advice on how to implement a poster assignment, including use of a rubric, in a second year engineering or science unit. Getting students to collect their own data to present as part of the poster gave some additional real-world learning experience.

Method

Biomedical Engineering and Science students enrolled in a second year physiology unit formed small groups of around 2-5 students by a self-selection method. Their small group decided upon a theme to explore experimentally on themselves as the basis of their scientific content for the poster. Three examples of the types of exploratory work included: effects of exercise on sleep quality, effects of caffeinated drinks on memory, and reaction time changes to visual or auditory stimuli. Students submitted a group proposal to ensure that their experimental work found a balance between having enough substance without

being too challenging, so that it could be completed in the time frame in a safe and ethical manner.

Students were encouraged to think of the final poster during the planning and execution stages so that they would be alert to images, photographs, charts, tables and other visual items to present on the poster. They also had access to examples of posters from a previous group (without the grades), an assessment rubric, and a poster template that they could use or modify if required.

The poster format was not a paper or physical printed medium, rather an electronic version only. The size of the poster was set as A1 (841 x 594 mm), and the poster template reflected this as a single custom PowerPoint slide. Students were free to use any package to generate their poster and then save it as a pdf file for assessment and later display in the poster gallery.

The purpose and some guidelines were given to the students, which outlined why posters are an important communication method. The instructions given to the students are detailed in the Appendix, with some additional advice is detailed below in Table 1.

Table 1: Extract from notes given with advice to students on poster preparation.

<p>Poster format and useful information</p> <p>The poster is a means of communication. It is meant to succinctly deliver the core of your work to the audience (and this case the assessors). Posters are frequently used at scientific conferences to allow a large number of presentations to be presented and viewed by the delegates. Often they are printed and displayed on poster displays, but more frequently they are now being shown or downloaded from the conference website.</p> <p>The important thing on posters is visual communication. Not lots of words or sentences even, but photographs, diagrams, pictures, charts, tables, dot points, and symbols reign supreme in a good poster. One of the worst posters I have experienced was 12 pages of a journal paper pinned to the poster display board!</p> <p>Many formats are possible, and for each conference there may be different instructions or requirements. In some cases if these are not met, the poster will not be shown, or uploaded to the website.</p>
--

The assessment rubric (reproduced in Table 2) as one part of the instructions gave students an appreciation of the importance of the poster elements. Students had access to this at the beginning of the project with opportunities to ask questions and clarify details of the rubric to assist them in creating their poster. In fact some groups did that to ensure that their work would meet the criteria in the rubric.

When the assessment process is in place, posters are graded according to the rubric and feedback is given to the group on each of the elements along with an overall grade. Additionally, before the submission date, a list of common problems with posters is made available as a checklist for students to read and perhaps avoid some of the common pitfalls. These include the over reliance on text, the use of essay type quotations, long sentences, lack of graphical elements, readability of text and use of unnecessary referencing.

Table 2: Poster Marking Rubric

Category	1 point	2 points	3 points
Layout	Cluttered, confusing, and does not use spacing, headings and subheadings to enhance the readability. Unattractive	Some structure but appears cluttered and busy or distracting with large gaps of white space or uses a distracting background. Acceptably attractive	The layout uses horizontal and vertical white space and headings appropriately. Attractive
Labels Headings & Text	Labels are too small to view or no important items were labelled. Too much text and not readable	Many items of importance on the poster are clearly labelled. Text potentially dominates poster.	All items of importance on the poster are clearly labelled and can be read from at least 1 m away. Text supports message
Images	Image quality poor resolution Lack of images to illustrate method or results Too many images for poster size	Images inappropriate to illustrate method or results Images do not assist poster message	Images illustrate the method or results Images contributing to poster message
Intro & Methods	Rationale for the study missing. No short description of experiment	Rationale and methods present. May be too long or too short	Rationale and methods present and suitable for poster
Results & Further	Missing results (exper) Missing expected (theor) No graphical presentation (if applicable)	Missing any explanation of significance of findings or potential findings	Well described and complete in these aspects

Results and discussion

There are two elements we wish to present for the results of our practice: the usefulness of rubrics in this type of learning environment, and the provision of meaningful feedback for students to improve their skills.

Use of rubrics

The use of the rubric has enabled students to know in advance and be able to self-assess and reflect as a group on how they have met the grading criteria. The criteria in the rubric are not just for the sake of marking and assessment, but also for improving the quality of the poster. They were split effectively into those associated with the presentation: layout, labels, & images; and those associated with the content: intro and methods & results and further. It was felt it was important to give clear guidelines of the expectation of the assessed piece of work at the beginning of the project. The rubric has been refined over several iterations to make it a better assessment tool and more clearly differentiate between the quality of posters, as one of the first iterations had too many categories and all students performed well based upon the earlier rubric. Additionally, the quality of the posters has improved with clearer delineation of what is important in the rubric. Students are also given access to a previous gallery of posters to see how they are presented, and we receive some comments about those from students based upon the current rubric. These are generally from students, for example, who want to know if there was too much text, or the images were too small or unclear. The improvement in poster grades has been noted over several years, but it may be possible that example poster influenced this improvement. We would argue that because the

example posters were student work from previous years (appearing without the grade with 'warts and all'), the main benefit has come from the rubric.

Meaningful feedback

Providing feedback to students happens after the assessment process is completed. The group receives their grade in Blackboard along with the individual components from the rubric and any general comments posted back to the Grade centre in Blackboard. An example is shown here in Table 3 of the feedback one group was given. This feedback stems directly from the rubric and gives a quick snapshot for the students, as well as some additional text feedback overall.

Table 3: Feedback to students

Total	Layout	Labels	Images	Intro/method	Results	Comments
12.5	2.5	2.5	2.5	2	2.5	Methods lacks detail

Other considerations

The posters have been completed over several iterations of the unit running over several years. We began with card or paper posters so that there was a physical submission of the poster. There are issues with this including cost to the student of generating the poster, and storing the posters for the teaching staff. Like many other assessment objects, students are somewhat reluctant to pick them up, and usually there was a disposal issue at the end of the semester. On the other side, there are some positives for a poster display in as physical location, which means that students and staff can actually walk around and look at the work in one location. However, we made a decision that the overall costs outweigh that benefit and because nearly all students were using electronic means to generate the poster, we changed three years ago to only use electronic format posters. While this focussed on engineering and science, the findings could be useful to academics in other discipline areas.

Conclusions and future directions

The use of posters as a communication tool is an important skills for engineers and scientists to develop. Rubrics have been shown to be useful in providing students meaningful feedback on their posters, and at the same time increasing the quality of the posters themselves.

Human ethics application is in progress to enable us to survey the students about their experience of the poster presentation assignment, the feedback and whether it has provided new skills or improved already present skills within the students. Some of the interim findings will be outlined in the presentation.

References

- Australian Qualifications Framework (2013) 2nd Edition. Accessed at <http://www.aqf.edu.au/wp-content/uploads/2013/05/AQF-2nd-Edition-January-2013.pdf>
- Karatsolis, A. (2012) Assessing Visual Literacy: The Case of Poster Presentations. Presented at Professional Communication Conference (IPCC) IEEE International, Orlando Florida.
- Klasén, I. (2011) Communication in Engineering Education - A New Way of Looking at Integrated Learning Activities and Forms of Communication. Presented at the 7th International CDIO Conference, Copenhagen.
- Moskal, BM. (200) Scoring Rubrics: What, When and How? Practical Assessment, Research & Evaluation, 7(3).
- Skinner, I. & Mort, P. (2009) Communication Skills Developed within the Engineering Curriculum. Presented at the Australasian Association for Engineering Education Conference, Adelaide.

Wolf K & Stevens E. (2007). The role of rubrics in advancing and assessing student learning. *The Journal of Effective Teaching* 7(1): 3-14.

Woolsey, JD (1989) Combating poster fatigue: how to use visual grammar and analysis to effect better visual communications. *Trends in Neurosciences* 12(9): 325–332.

APPENDIX - Detailed instructions given to students

Introduction

This assignment is one where you will work in a group to do some research on yourselves as group members. These should ideally be non-complex questions, which can be addressed by a short experiment or set of experiments. We have limited equipment and laboratory space available for this work, so if you are able to record your data without requiring the lab space, you will have much greater flexibility on timing and use of a busy resource. Your group needs to present a scientific e-poster as the final item for this work.

Rationale

There are several skills and benefits of working on this assignment.

1. The experience of designing of a short, simple experimental or theoretical study. You will be given some feedback on your proposal to assist with the design of your study.
2. Adding an additional method of communication to your repertoire. This is very different from laboratory reports, essays, and oral presentations. It requires skills of visual communication, editing, and summarising. Some information on posters preparation is included in this document.
3. Group work is also included as it is a skill that takes many years of practice to understand how groups work. Additionally, you may also gain knowledge on to interact with groups where you may have different roles, depending upon the other team members.

Method

There are two choices for the project: an experimental study, and a theoretical study. The recommended is the experimental study as this gives a chance to not only plan and design the study, but also actually carry out the recording and gain the experience of 'seeing it through'. In some cases the experimental model may not be possible, or too difficult to achieve, where the theoretical study may be the best outcome. Note that the criteria are slightly different for the grading of these two project styles (there will be more emphasis on the design for the theoretical project).

You need to first of all organise yourself into a group or join with others already in a group.

If you are looking for project ideas and/or group members, there is a discussion forum set up for this purpose on Blackboard. Feel free to use other communication channels to locate and join with others in this work.

Register your group on BB from the users/groups button on the left margin. You can use a group that is empty to create a new group, or join other members if they have already created a group.

Once you have done that, your group can post its proposal (or upload). I will give feedback and approval soon after you upload this. Tip: the earlier you load your proposal, the earlier it is likely to be approved, and the quicker you can start with your work.

You need to submit the poster and a "thumbnail" of the poster for assessment as the final files. The poster is for assessment; the thumbnail is for inclusion in the poster gallery.

Assessable stages

5%	Proposal--consisting of text pasted into comments box	due end of week 3
15%	Final poster—consisting of two files added to upload	due end of week 11

Poster format and useful information

The poster is a means of communication. It is meant to succinctly deliver the core of your work to the audience (and this case the assessors). Posters are frequently used at scientific conferences to allow a large number of presentations to be presented and viewed by the delegates. Often they are printed and displayed on poster displays, but more frequently they are now being shown or downloaded from the conference website.

The important thing on posters is visual communication. Not lots of words or sentences even, but photographs, diagrams, pictures, charts, tables, dot points, and symbols reign supreme in a good poster. One of the worst posters I have experienced was 12 pages of a journal paper pinned to the poster display board!

Many formats are possible, and for each conference there may be different instructions or requirements. In some cases if these are not met, the poster will not be shown, or uploaded to the website.

For this unit the poster requirements are as follows:

Size	A1 (841 x 594 mm)
------	-------------------

Orientation	Landscape
-------------	-----------

File format	.pdf (Adobe portable document file) for main file .tif (graphics image file) for thumbnail
-------------	---

The recommended way of constructing your poster is to use PowerPoint as the framework to add you text, images, symbols, tables, and headings (collectively called elements). Alternatively, you can use Keynote, other presentation software, or drawing software if you have experience and can use these already. I would suggest PowerPoint as many of you have used it before.

There are some features of PowerPoint worth knowing, as they are very useful for this type of activity.

1. Custom page setup, use this to set the page to be the size of the poster (i.e. 84.1 cm width and 59.4 cm height)
2. Guides for making sure your poster elements are aligned vertically and horizontally. Find this by pulling down the menu on view and in the last section roll down to guides and click static guide.
3. Optional are 'snap to grid' that keeps smaller objects positioned according to gridlines. I find this one useful for some things, but annoying for others.
4. Make use of the display size. 50-75% is good for looking at the poster as a whole, 75-125% is useful for seeing the columns or rows, and 200-400 for the detailed items, text or fonts within elements
5. Create text boxes on the slide of the size you require. Use the cut and paste function from Word to incorporate your text into the boxes.
6. As a rough guide the following size fonts should be used for clarity. Title 70-100 point Headings 50-70 point, text 20-40 point.
7. Images should have strong lines for borders or arrows etc
8. Ability to save in different formats, for example pdf and tiff both of which you will need to complete the assignment.

When you have finished save to a pdf file (one of the options under the save as menu). This will be your main submission file. Before you exit, also save as a tiff file (with 400 horizontal). Upload both files to Blackboard.

There is an optional PowerPoint template available on Blackboard, if you want to use this.

Grading criteria

1. Initial proposal (5%)

Proposals submitted on time with required information will give full marks. Proposals missing information will be returned for update and resubmission (potential penalty up to 1 mark). Late submissions will be given a 1-mark penalty.

2. Presentation (15%)

Graded according to the criteria below. As a guiding principle, if there could have been a diagram, picture, chart and words/text was used instead, then marks will be lost.

Category	1 point	2 points	3 points
Layout	Cluttered, confusing, and does not use spacing, headings and subheadings to enhance the readability. Unattractive	Some structure but appears cluttered and busy or distracting with large gaps of white space or uses a distracting background. Acceptably attractive	The layout uses horizontal and vertical white space and headings appropriately. Attractive
Labels Headings & Text	Labels are too small to view or no important items were labelled. Too much text and not readable	Many items of importance on the poster are clearly labelled. Text potentially dominates poster.	All items of importance on the poster are clearly labelled and can be read from at least 1 m away. Text supports message
Images	Image quality poor resolution Lack of images to illustrate method or results Too many images for poster size	Images inappropriate to illustrate method or results Images do not assist poster message	Images illustrate the method or results Images contributing to poster message
Into & Methods	Rationale for the study missing. No short description of experiment	Rationale and methods present. May be too long or too short	Rationale and methods present and suitable for poster
Results & Further	Missing results (exper) Missing expected (theor) No graphical presentation (if applicable)	Missing any explanation of significance of findings or potential findings	Well described and complete in these aspects

Copyright statement

Copyright © 2013 Schier and Mann: The authors assign to AAEE and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to AAEE to publish this document in full on the World Wide Web (prime sites and mirrors), on Memory Sticks, and in printed form within the AAEE 2013 conference proceedings. Any other usage is prohibited without the express permission of the authors.