Engineering students' presentations: a focus on results or methodology?

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ABSTRACT: Engineering students inevitably are confronted with project presentations. The audience often is a blend of listeners from academia to industry. Effectively delivering a message requires both understanding the audience and tailoring the message appropriately. Academic interest often will be focused on methodology, and industry on results. The conclusions in this article are that there is no ideal presentation format but that the presenter should be knowledgeable about the topic, recognise the diverse needs or expectations of the audience and use technology appropriately.

INTRODUCTION

The fundamental purpose of any presentation is communication. This may be to disseminate knowledge at a conference, seminar, workshop or in a classroom. A presentation can have several objectives, such as soliciting new project funding (e.g. proposal), ensuring continued funding for ongoing projects (e.g. interim report), personal assessment for academic qualification, marketing a product or idea, publicity, and awareness education. The goal of this article is to discuss different elements of student presentations especially *vis-a-vis* the relationship between the presentation and the audience. However, the intent of this article is not to serve as a standard guideline for students on how to make a presentation of their projects.

Project presentations by students are one of the major elements of an advanced engineering curriculum. Project results, either individual or group, constitute an important element in the overall assessment of a student, and presentations serve as useful assessment tools. The presentation also serves as an element of overall communication skills assessment, one of the major requirements for a successful professional career. The Washington Accord, which provides a mechanism for mutual recognition of engineering qualifications accredited in each of the member countries, also includes communication skills in the attributes and professional competency profiles for graduate engineers [1].

The attributes show that engineering programmes must not only teach engineering theory, experimentation, and practice, but should also provide education in the so-called soft skills (i.e. communication, leadership) to prepare students for a broad range of careers. In order to develop these attributes, it is appropriate to infuse communication explicitly in the engineering curricula so that it becomes a vital component.

The Accreditation Board for Engineering and Technology (ABET) stipulates 9 global criteria for accrediting engineering education; the third criterion has 11 programmatic outcomes, which include an ability to communicate effectively [2]. The focus of this article is on the presentation of project results, particularly a technically orientated project with a presentation delivered by a group.

COMMUNICATION SKILLS COMPONENT IN THE ENGINEERING CURRICULUM

There should be no doubt in the mind of any young engineer, scientist or other professional that presentation skills are now widely recognised as a cornerstone of a successful career. Lee Iacocca, a former chief executive of Chrysler, once said that *you can have brilliant ideas, but if you cannot get them across, your ideas will not get you anywhere* [3]. The ability to solve various technical problems, although important, is no longer enough for a practising engineer; indeed effective presentation skills are inseparable from professional competence. The value of a solution diminishes if the solution cannot be translated into a coherent presentation and communicated effectively. However, a well-prepared and

slickly packaged presentation cannot be a substitute for a poorly delivered project, lack of understanding of design methodology or experimentation, or absence of substance.

Only a few years ago, courses that taught presentation skills were considered innovative. Now, practically every educational institution with an undergraduate programme offers at least one (if not multiple) courses with a strong explicit emphasis on presentation skills. Presentation skills are also implicitly embedded in other courses where individual or team projects are assessed.

Presenting a technical topic to an audience requires specialised skills, different from other forms of public speaking. Stand-alone technical communication courses have long been the main source of communication skills development for engineering students. A better approach is to incorporate communication skills into core engineering courses because students are more likely to appreciate the value of communication skills placed within an engineering framework – *Learning is most effective when it takes place in context and when it is reinforced through the students' course of study* [4].

Various approaches have been taken to the development of communication skills in engineering curricula: integrating writing or presentation elements into existing courses [5], special writing or presentation courses, including term papers or seminars [6], case studies [7], team-based communication skills projects and simulated technical conferences [8]. Many engineering programmes have incorporated communication skills into core elements of the engineering curriculum by integrating communication instructions into required core technical courses taught jointly by communications instructors and engineering staff [9]. This strategy is seen mainly in design courses [10]. Furthermore, it was found that design courses are the most appropriate place to address and assess communication skills [11]; however, presentations are also integral components in laboratory courses, workshops for students, online resources, and other support courses [12].

A special reference should be made to the final-year project or, what is called in the USA system, the capstone project. The course is a major requirement for any accrediting body (e.g. Engineering Council of South Africa – ECSA and ABET) and the main course where graduate attributes in the form of exit level outcomes are assessed; it has always played a key role in addressing communication skills [13][14]. The final-year project normally emphasises not only the formal report of methodology and results but also the presentation of technical material by informal progress reports, drawings, formal reports and presentations [15][16]; each of these requires effective presentation skills.

THE AUDIENCE

The most important element of any presentation is the audience; this should be considered a canon of conduct and followed as closely as possible. Not only should the presenter motivate and maintain audience interest, he/she should aspire to excite and connect with the audience. The audience can be uniform or diverse consisting of peers, academics, project sponsors (financiers), employers, public relations and marketing officials. It is essential for the presenter to respect the audience and tailor the presentation to its needs and expectations. It is easy to complicate the simple; it is challenging to simplify the complex; technical or scientific presentations should be prepared always with the audience in mind. A myopic presentation becomes a linear list of technical accomplishments; as the final results of a project this format will not be well received by the audience and is sure to fail. Students should assess the composition of the audience; proactive research is invaluable in anticipating possible questions and preparing responses in advance. A simple pre-presentation audience analysis often reveals who they are, their interest, knowledge base, and level of expertise on the topic.

A presentation should be considered a dialogue with the audience. The needs and interests of the audience should be of paramount importance. The same set of data can be used in different ways by shifting the focus of a presentation. When speaking with a group of academics who are to assess the project, it is advisable to focus the presentation on the methodology and results; how the particular engineering problem has been addressed and solved. However, if the audience mainly is industry representatives, they normally would not be as interested in how the problem was solved as they would be with the results, solutions and recommendations.

THE DELIVERY

An oral presentation is an excellent opportunity for the student team to focus, simplify and *pull* the project together. It should be also an opportunity to practise public speaking, a skill students normally are not comfortable with. Student presenters also should be made aware by lecturers of the power of non-verbal communication: some regard verbal communication as making up only 30% of communication between two people in the same speech group [17]. One need only consider the power of hand gestures and eye-contact to elicit emotions to appreciate the dimension of non-verbal communication.

Students normally fear oral presentation because they associate it with past frustration; they search for the ideal presentation, the one in which each slide satisfies each member of the audience; they seek a *one-size-fits-all* solution. The outcomes from this search for universality are not always satisfying. The poor outcome, although almost inevitable, is when good engineering work is concealed by a deficiently constructed and ineptly delivered presentation. A guiding

principle for an effective presentation is to know the topic, prepare a good presentation and practise many times within the expected time limit.

Modern presentation skills include use of PowerPoint technology, which should be appropriate, legible, uncluttered by text and, when possible, animated. The danger with technology is to allow it to dominate, instead of enhance, a presentation. Too often students rely on technology the same way an injured person relies upon a crutch; technology should not compensate for disability, it should be a performance enhancer.

Team presentations are inevitable in many project-based technical courses. Coordinating a presentation among several individuals adds another level of complexity to presentation skills and competencies. Team presentations should be seamless such that transition from one presenter to the other is hardly noticeable in terms of content and flow; slides should maintain a consistent format and speakers should pass the topic like runners passing a baton in a race.

THE CONTENT

The fundamental question which students should ask and answer before the presentation is: What is the expected outcome of the presentation? A group of professors remain educators at heart and, therefore, look at the student's work from a pedagogical perspective. Hence, the main question for a professor is not only exclusively what was achieved by students, but also more importantly how it was achieved. Professors are interested in knowing whether students have learned how to solve the problem: whether they applied proper methodology, proper techniques and how the techniques have been selected; or whether the students were simply lucky.

Industry representatives listening to the students' presentation naturally are more focused on the results achieved; this is especially true in the case of an industry, which has financially sponsored the project. Even an industry without direct financial involvement in a project would still be focused on the practical applications, the practical relevance and the opportunity to implement the results for commercial purposes.

The divergent world views of academics and industry is only natural because the main objective of the university is education, whereas for industry it is application. However, in collaborative projects, supervised by professors and supported by industry, how can students satisfy their diverse audience? Is there a common denominator for presentations made to the two groups? Alternatively, what is the framework of a presentation to be made to a mixed group?

Whereas it is important to design the presentation according to the interest of the audience, it is essential from the outset to make the audience aware of the focus or objective of the presentation. The fundamental requirement for any presentation is knowledge of the topic. Students often complain about the limited time they are allowed to deliver the presentation and that it is the time constraint which prevented them from making a perfect presentation. Often, they do not realise that it should be possible to summarise the content of any presentation in not more than three sentences. If this distillation is not possible it means there is a lack of focus, or the presenter is not well prepared and is compensating for a lack of knowledge with an excess of words, slides, or words on slides. The simple general presentation rule also applies to a technical presentation as follows:

- Tell the audience what you are about to tell them: Provide the audience with a big picture preview of the voyage you are about to take them on; be sure to clearly define the problem and emphasise the significance of a solution;
- Tell them: The bulk of the presentation occurs here; it is often prudent to limit the body of the presentation to three topical areas (i.e. tell them three things);
- Tell them what you have just told them: At the end of the presentation, the presenter should summarise and emphasise the salient findings to ensure the audience has taken away the critical points.

Because a presentation to industry should stimulate investor interest, the presentation should simply and clearly explain any financial aspect of the result.

So, when answering the question, should a presentation focus on results or methodology, process or product, the answer is: both. However, the relative proportion should be consistent with the target audience (i.e. Academia versus Industry). The level and nature of audience education also must be considered, with the presenter striving to translate arcane technical engineering jargon into common diction for non-technical listeners. Presentations must be contextual in their fundamental design and students should be sure to dwell on the first step of the engineering design process (i.e. problem definition: who am I speaking to and what am I trying to communicate?) before moving on to the solution development stage of the design process (i.e. creating the PowerPoint slides which deliver the message).

CONCLUSIONS

The presentation should be customised to fit the audience; it should meet audience expectations and satisfy audience requirements. It is not a means by which to satisfy the presenter. The audience is the best judge of any presentation, whether it concentrates on results or methodology or a mixture of both. In so doing, the audience usually will rate

excellence in terms of the presenter's communication, competence, creativity, credibility, confidence, conviction and comfort with the subject matter. In short: did the presenter care about the subject matter and care about the audience?

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