



The business of science education

In 2002 the Faculty of Health Sciences, University of Sydney introduced a new undergraduate programme, the Bachelor of Health Sciences. It was designed as a generic health sciences programme in which the students are given wide-ranging elective options.

A key feature of the programme is to provide students with a strong and broad understanding of the sciences related to health, the healthcare system and important and current issues in health. In the planning of the programme it was also decided that, alongside these core topics, there should be an opportunity for students to make conceptual links between health and business. Thus, a core unit that introduces the principles of management has been included, and a variety of electives in management including organisational behaviour, human resource management, marketing, leadership and strategic planning have also been provided.

The decision to include these topics in management in a health sciences programme was based on an analysis of job advertisements performed prior to the design and development of the course. This analysis revealed that a large number and diverse range of positions are advertised that require, apart from a general understanding of health or life sciences, some knowledge or skills in management and/or business.

For example, advertisements often specify, amongst other things, some of the following – organisational skills, strategic planning/thinking skills, self-management skills, marketing, service promotion, programme development, networking and influencing skills. Some state that, apart from tertiary qualifications in science or health, the applicant should

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have “a business focus”. Clearly employers in the healthcare industry are recognising that healthcare is rapidly changing, driven by the development of new knowledge and skills, with increasing emphasis on IT, research, development and commercialisation of products, and increased consumerism in health. The relationship between technological and knowledge development and the provision of services are areas that will be of increasing significance to science (including health science) graduates in the future.

The Federal Government acknowledges the nexus between tertiary education and industry in its support for the Higher Education Workskills Olympiad (HEWSO)¹, which provides university students with the opportunity of being placed with host employers, giving them a taste of working for a major organisation. The National Association of Graduate Careers Advisory Services (NAGCAS) initiated and developed HEWSO as an important feature of the higher education-industry interface.

The benefits for students are stated to include career education and the development of employability skills including project management, teamwork, workplace communication, negotiation, ‘thinking outside the square’ and giving a presentation. This competition is designed to raise the profile of graduate attributes and employability skills across the university sector.

According to Gradlink², the official website of the Graduate Careers Council of Australia (and endorsed by the Australian Vice-Chancellors’ Committee), organisational skills are important to industry employers. In a list of requirements for the self-reliant graduate Gradlink includes such skills as action-planning, networking, negotiation, political (organisational) awareness and organisational skills. Furthermore, in its description of public sector employment, it states that,

Management training in general is usually regarded as a high priority within the public sector, with specific emphasis on project management, personnel management and business and strategic planning.

The Gradlink website also makes reference to a recent Department of Education, Science and Training (DEST) survey of employers that,

... highlighted three main areas where the skills of new graduates are often deficient. These were not to do with their technical skills but those relating to problem solving, oral business communication and interpersonal skills with other staff³.

The tenets of the learning organisation, as proposed by Senge⁴, state that employees at all levels must be involved in the design of organisational processes and in problem solving. The work of Stanley and Bradley⁵ has highlighted the fact that many innovative projects fail because of a lack of management skills, and these skills are particularly needed in those involved at the scientific, innovative levels of the organisation.

Enhancing the management training of science graduates should facilitate the



implementation of innovative projects, contributing to organisational success, and hopefully satisfaction in the workforce. Of course, there is a similar need for those in management positions to understand the processes by which scientific endeavour leads to innovation.

The work of scientists and managers has many similarities, and there is considerable overlap of skills in areas such as project and time management and analytical and numerical problem solving.

The understanding that scientific training is a sound foundation for higher level management is not new. A first degree in a science-based discipline is common amongst the directors of major Australian

companies. For example, four of the eight directors of Westpac Bank have science qualifications, the CEO of Telstra is a physicist and the Chair of Woolworths is a Professor of Botany and Biology.

Quality education must meet the needs of both students and prospective employers. From the student's perspective, the transition from university to the workplace can be challenging. The success of this transition is likely to be enhanced if one has an understanding of how one fits within the organisation, how the organisation is structured and operates, and how one can add value to it. An understanding of organisations and their management would assist the new graduate to make a successful transition,

and make an impact in the workplace. When scientists can understand the needs of management, they are in a strong position to influence management outcomes, and are more likely to have their voices heard from whatever level of the organisation they may occupy.

References

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4. Senge P. *The Fifth Discipline. The Art and Practice of the Learning Organisation*. Random House Australia, 1990.
5. Stanley R & Bradley M. Creating a Culture of Innovation. <http://www.mjassoc.com.au/upload/MJ&A%2012000%20Paper.pdf> (Accessed 26 August 2003).

Training science students in communication

Scientists communicate extensively with each other through publications, conferences and local and institutional meetings, yet many are unable to communicate their work effectively outside their professional circle. Science communicators are often employed to bridge the gap between science and the broader community. While this can and does work well, it should not diminish the responsibility of educators in equipping undergraduate and research students with the skills to be able to do it themselves.

The reasons for communicating science to the general public are many and varied. A large proportion of scientific research conducted in Australia is funded through

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the public sector, making visibility and accountability of scientists and their work not an unreasonable expectation. The outcomes of scientific research are the product and property of the community and the community has the right to access the information¹.

Scientific and technological advances are some of the greatest achievements of humankind, and we should return the favour and share our knowledge².

Effective communication with the general public also helps to maintain credibility and trust for the scientific community, something that has recently been an issue in the UK³.

Who is the general public?

This is not necessarily an easy question to answer, but what the public is *not*, is homogenous. For a scientist the general public could be considered as anyone who is not trained in their discipline. This includes politicians, lawyers, economists, journalists, blue and white-collar workers as well as scientists from other disciplines. There are also many different cultural and ethnic groups in Australia and any communication strategy needs to be geared specifically for the target



audience. This is especially important for the uptake of new technologies.

Health authorities in South Africa are working in conjunction with traditional shamans, or witchdoctors, to help deal with the AIDS crisis. Traditional healers are such an integral part of African culture that health authorities have recognised that working with them will be far more effective than trying to change centuries old customs⁴.

Those of you who work closely with indigenous communities are no doubt already aware of the need to communicate appropriately when implementing immunisation programmes or medical protocols. What works in a non-indigenous urban environment may be a complete failure in a remote community. Even within urban society we have many different target groups that need to be considered when putting in place health campaigns and education programmes.

Making science accessible

One of the most difficult tasks for the majority of scientists when writing or presenting their work to a non-scientific audience is being able to step back and determine what information is important and relevant and what can be left out. We become so entrenched in the language and detail that we lose sight of the fact that much of the work may be incomprehensible and irrelevant outside the specialist area.

The first written task my undergraduates have to do is to re-write a prac report they have submitted for another course and aim it at a general audience. This is a simulation of what we do in workshops specifically designed for postgraduate research students and scientists where they are required to do the same thing with their own research. We encourage the others in the class/cohort to give their

assessment of whether the piece would be of interest and able to be understood by a general audience. Generally the first draft does not hit the mark but, with peer evaluation and constructive criticism, most people produce a written piece that is interesting and relevant to the target audience.

Similar principles can be applied to oral presentations but these have the added complication of visual aids. Slides (35mm and PowerPoint) used for conference presentations generally are not appropriate for a general audience. Usually they contain too much detail and probably inappropriate language.

A useful exercise to boost confidence for oral presentations is to have a few exercises in impromptu speaking. For undergraduate students I start with mundane, everyday topics that are randomly drawn out of a bag. As these students come from very diverse areas of science it is unreasonable to assume they could talk on a science topic outside their field of study. This exercise could easily be adapted to students within the same discipline drawing on topics with which they could be expected to be familiar. Again, peer assessment is used in relation to suitability for a general audience, as well as feedback on presentation skills.

Encourage students to get stories published in magazines and newspapers. Most editors welcome well written, interesting stories. Many of our students have had stories published in local newspapers and in magazines such as *Australasian Science* and the CSIRO children's publications *Helix* and *Scientriffic*.

Scientists are often reluctant to interact with journalists because of past experiences or the perception that they (the media) always get it wrong.

Generally, scientists and journalists do not share a common cultural background. Issues of detail, precision, deadlines etc often put the two professions in conflict.

To overcome this there needs to be an understanding of the culture of each and the boundaries within which they work. I do not intend to expand on this in this paper but for an insight into science journalism see Spinks⁵. Cribb & Hartomo² also provide a good background to the cultural differences between science and journalism and the book is a useful resource for developing an effective communication strategy. Deeker¹ provides very clear and useful guidelines on how researchers can popularise their science by writing for a general audience.

Conclusions

Communicating science to the broader community is a rewarding, valuable and necessary exercise. It is rapidly becoming a requirement of funding bodies for researchers to include a communication strategy when applying for grants. Training science students and graduates in these skills also contributes to their professional development and employment options and should be seen as an essential part of their education.

References

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3. House of Lords Select Committee on Science and Technology. *Science and Technology – Third Report*. 2000.
4. du Venage G. Which doctor now? *The Weekend Australian Magazine* 2003; April 19-20:35.
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Presentation skills

Presentation skills are like any other skill – learnt by tuition and observation, and improved through practice and rehearsal – yet often these skills are assumed, unrehearsed, or, worst of all, *not even considered!*

What are the basic ingredients of a successful presentation? First and foremost *enthusiasm*, combined with *preparation, practice (rehearsal), presentation skills, and an awareness of the pitfalls*. Think of these elements as parts of a jigsaw which, when successfully combined, deliver the picture you want your audience to see. Your enthusiasm is what gives the picture colour (Figure 1).

Preparation

Determine a time ratio

A time ratio is the time spent in preparation and practice per minute of presentation. Determine your ratio in proportion to your experience, and the standard required (in-house, local, state, national meeting/conference).

Opening – body – conclusion

Structure your content as a scientific paper; however, present your talk as a speech with an opening, the body of material and a conclusion. Opening and conclusion should be concise, complete

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summaries; the body is an amalgam of scientific subsections.

What is your purpose? Balance the presentation to suit that purpose

The weight you assign to each subsection within the body of the presentation will depend on your purpose. If your talk is based on interpretation of results (discussion) don't get bogged down in how you produced those results.

Spoken vs written word – re-write

Convert the paper into a spoken word format. If you are reading your presentation verbatim, then you haven't rewritten your talk sufficiently. It should be somewhat conversational in nature... and we don't read to each other when having a conversation!!

Emphases – pauses

Once in 'spoken word' format, use highlighter pens, or underlines, etc to indicate where you intend to place

emphases. This helps with rehearsing vocal variety, volume and tone. Consider repetition or silence for emphasis.

Spoken word vs audiovisuals

Ensure that the spoken word and visual aids harmonise. Don't use the visuals to show one thing whilst saying another in an attempt to fit more material into the allotted time.

Finishing

Draw attention to your finish. Keep it to the point and keep it tight. A strong finish leaves a longer lasting impression than a weak one, or no finish at all.

Practice

Practice and rehearsal is a crucial part of the preparation process. This makes sense... after all, anything else in life where practice is required, wouldn't we do just that? And if public speaking is such a major hurdle, then surely 'best' practice is going to make the task easier?

Areas for practice and rehearsal

Vocal language

Volume and vocal variety help with emphasis. Reduce speed to increase emphasis. You may have to cut material in order to achieve the allotted timeframe.

Body language: gestures, movement, eye contact, facial expression

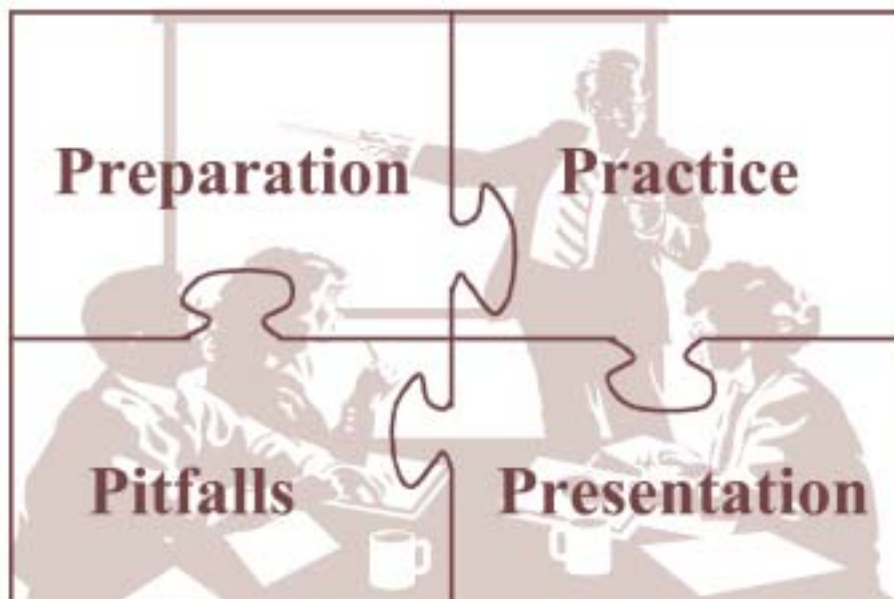
Rehearsing these items in an empty room may feel awkward – but isn't it better to feel awkward in practice and rehearsal rather than when it really matters? Maintenance of eye contact with the audience is a critical ingredient in a successful presentation.

Evaluation and feedback – by yourself and others

Record your speech on audiocassette. Videotape your presentation if you can. This will help self-evaluate vocal and body language. Distracting habits – those you were not even aware of – can then be eliminated.

Ask friends to critically evaluate a specific part of your presentation style.

Figure 1.





Encourage questions on the content – practice questions help you prepare for the real question time.

Include timing as part of your practice and rehearsal. Aim to go under time if possible – you may find that you have less time than you were originally allocated!

Presentation

I am the most spontaneous speaker in the world because every gesture, every word, and every retort has been carefully rehearsed.

George Bernard Shaw

Before

Meet the chairperson, understand the venue, practice with equipment as long as possible and.... relax! I know – easier said than done! But put what you're doing in perspective. Your audience wants you to do well. Use that to your advantage – the more relaxed you appear, the greater the credibility you will project; the greater the credibility, the greater importance your message takes on; the more important your message is, the longer it will be remembered.

Dress sense

Remember, you are not only representing yourself, but your colleagues, your supervisor, your institution, and they deserve to be well represented.

After

Try and acquire critical feedback on the actual presentation itself and question time. This feedback then in turn helps you with your next presentation.

Pitfalls

Even though you need to concentrate on the positive factors that help to make presentations a success, it is important to avoid those negative areas that may weaken your impact. You don't want to be remembered for the wrong reasons.

Nerves and adrenalin

Nerves and adrenalin are a normal part of the process.

There are two types of speakers: those who get nervous and liars.

Mark Twain

Timing

Keep to time. Failure to do so impacts on your audience, on subsequent speakers in the same session and on the audience's access to time for questions.

Use relevant material quality vs quantity

Aim to give the audience a few long-term take-home messages. This also helps with timing. Strong take-home messages act as triggers for other detail.

Look and learn

Observing others is a great way to learn what works well and what doesn't. Take notes and use these as reminders of what you've observed.

Question time

Your practice sessions will uncover questions that may arise; by exploring the possibilities, you will reduce the *probability* of an unexpected question.

Make sure you determine beforehand who will control the flow of questions – you or the chairperson. Confirm the amount of time allowed for questions.

Repeat the question back to the audience – not everyone will have heard the question. Give the chairperson a question they can use to 'kick off' question time if the audience is slow to respond to a call for questions.

Don't bluff – if you don't know the answer to a particular question, say so, and ask the audience – someone there may have the answer.

Visual aids and audiovisuals

Visual aids should be used sparingly, efficiently, and be complementary to the spoken word. Visual aids should do two things – they should be visual and they should aid the presenter. Whatever the format used, whether it be overheads, slides or software-generated slides, there are a number of useful tips to apply to design: use large (>24 font) text, preferably in bold, and a mixture of upper- and lower-case text for ease of reading; keep the design consistent throughout the set; use blank slides where needed (or for overheads turn off between slides).

Software-generated slides

Talk to those you know who have already some experience with the software; learn from them any helpful tips and ideas. Always rehearse the slides in slide presentation format – not just in edit format – to ensure that any required effects work as they are intended. Use special effects features conservatively. Clever doesn't mean smart.

Use of pointers

Using a laser pointer will, in most rooms, have you facing away from your audience – thus losing face and eye contact. Many software tools enable the data to highlight itself.

Microphones

Familiarise yourself with the various microphones – stand, lectern, lapel, handheld. Determine which is most suited to your needs, and make sure this will be available. If you're planning to move about, you'll need a lapel or handheld microphone.

If using stand or lectern microphones, before you speak, make sure that the microphone(s): are at the most comfortable height for you; are close enough to capture your voice, but won't be knocked by arm gestures or your notes.

Handouts

Handouts can be either: a skeleton of your presentation, given out at the beginning to allow the audience to follow your talk easily; or a detailed summary of your talk that allows the audience to refer back to the talk itself *as you would like them to*. This latter format should only be given out after the presentation.

In conclusion

There is much to consider when preparing a presentation, not only all the positives you need to do well, but the negatives you need to avoid. Careful preparation is the best way of ensuring that the positives should happen. Adequate practice and rehearsal is the best way of ensuring that these positives WILL happen.

Recommended reading

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