

THE PSYCHOLOGY FOUNDATION OF AUSTRALIA

(Incorporated in New South Wales)

c/o School of Psychology, University of New South Wales, Sydney 2052, NSW, Australia

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The Psychology Foundation of Australia is a grouping of research oriented psychology schools formed to represent the scientific discipline of Psychology in Australia and the maintenance of high standards in the training and professional practice of individuals trained in psychology. We have responses to two of the general questions posed in the document entitled: *Vision for a Science Nation: Responding to Science, Technology, Engineering and Mathematics: Australia's Future*

Question 2: Do you consider there are any areas that require more urgent action? Have we missed anything?

An important part of resolving current concerns regarding STEM disciplines is to ensure that a modern understanding of the STEM disciplines is adopted and that adequate attention is paid to the issues that drive the people making the critical choices. In our view the STEM discipline of Psychology should be included in a more integrated fashion to help with these tasks.

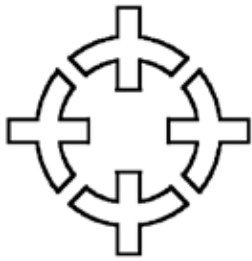
The document *Vision for a Science Nation: Responding to Science, Technology, Engineering and Mathematics: Australia's Future* provides a list of current Government activities which may be seen to overlap with the aims outlined in the Chief Scientist's report on STEM in Australia. However, the overall plan still has some important omissions, including an integrated approach that takes into account the likely views of the intended participants. We write this from the perspective of work in Psychology, one of seven Hub sciences (based on an analysis of citations of over one million articles published in more than 7000 scientific journals in 2000 producing hub clusters: mathematics, physics, chemistry, earth sciences, medicine, psychology, and the social sciences) which underpin activity in a broad range of research areas (Boyack, K.W., Klavans, R., & Börner, K. (2005). Mapping the backbone of science. *Scientometrics*, 64, 351-374.).

In commenting on this report Cacioppo (The Association for Psychological Science Observer Vol.20, No.8 September, 2007) noted that "the location of many of the disciplines in this map of areas of science has face validity as well. Electrical and nuclear engineering fall between mathematics and physics, chemical engineering and analytic chemistry fall between physics and chemistry, and statistics falls between mathematics and the social sciences. More interestingly here, public health, neuroscience, neurology, radiology, cardiology, and genetics are among the sciences that fall between psychology and medicine, whereas education and gerontology fall between psychology and the social sciences.

The more insular the field, the closer a field will lie to the outside of the map. Those

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with many interdisciplinary linkages are more likely to lie toward the middle of the map. It is interesting, therefore, to note that psychiatry, law, political science, and economics all lie along the outside, whereas psychology is closer to the middle, reflecting its interdisciplinary nature. Another map depicting the linkages among scientific fields confirmed that psychology is a hub discipline — that is, a discipline in which scientific research is cited by scientists in many other fields. For instance, medicine draws from psychology most heavily through neurology and psychiatry, whereas the social sciences draw directly from most of the specialties within psychology.”

Psychology has a great deal to offer as a STEM discipline itself, providing a very popular training in the rigours of scientific method, measurement and the combination of biological, behavioural and experimental approaches to understanding human activities. As a discipline it introduces many students to scientific research, even though a good proportion are enrolled in non-STEM core curricula, because the accredited training programmes must all meet the requirements of an evidence-based discipline training. The basic undergraduate programme also mandates multiple units in statistics and experimental design, providing mathematical skills to many students in non-science majors and having done so ensured that they can go on to be more productive and make better evidence-based decisions in any career.

Including Psychology highlights some of the omissions in the current plan. While there is an acknowledged role for social sciences in many of the priority areas, there is not a full recognition of the value of a focus on the human participants.

There seems to be a failure to recognise the likely decision processes participants in STEM careers will engage in. Long-term financial planning has become an important aspect of deciding on a University education. Training is more expensive, as are the purchases required for a normal life. Intelligent students must, and will, take these factors into account when choosing a course of study. Thus the determining factors become the expected financial return and career security, in addition to areas of intrinsic interest to the student. These factors manifest themselves in several areas. Current teacher salary levels mean that students capable of choosing between many options will often choose better financially rewarded careers. Students capable of leading the next generation of STEM research are currently confronted with a university career that offers only casual employment. They are impeded in developing research skills by inadequate levels of research funding and fellowship schemes that change regularly and seemingly at the whim of people with primary interests directed elsewhere. Employers are negative about the strengths of STEM training. Those employers, who have abandoned the active roles in training that they occupied several decades ago, are unwilling to take new graduates into STEM roles, even though those

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businesses are always likely to be the best placed to understand what is required in current business practice, although not necessarily what skills will be needed twenty years down the track. The document does aim for closer integration between business and STEM training, which is desirable, but is couched more in terms of altering the curricula than in providing on the job skills development. Cadetships, studentships and apprenticeships are increasingly rare due to changes in business attitudes to their workforce but they still seem to be the best option for meshing efficient STEM education with workplace roles in both business and universities.

Overall then, our view is that while it may be a useful step to map career paths for STEM qualified people, it is more important to make the career paths more attractive than it is to map them.

Question 4: Which of these proposals will enable you and your organisation to contribute to Australia's STEM performance?

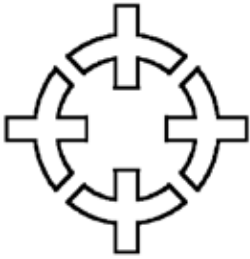
How can the hub science of Psychology help?

The document describes problems with low student interest in STEM disciplines that is at odds with the experience of Psychology. On any criterion adopted to describe a science Psychology meets the benchmarks but it is typically not included as a STEM discipline. However, in many universities students complete Psychology degrees as a major in their BSc degree. Those students that do not are still trained in an evidence-based science because accreditation of programmes ensures that must be the case. The strong interest in Psychology arises from the intrinsic interest in the science of human behaviour which impacts on every area of human activity. The outputs are different in Psychology. The most widely known are clinical applications but psychology develops an understanding of how people process information (relevant to learning and training, in addition to specific situational influences such as road safety), how workplaces should be designed for optimal performance (relevant to any work environment but also for the design of new roles, for example the effects of fly-in/fly-out work on performance, in addition to social cohesion, or the interaction between decision making and the design of display systems such as in air-traffic control). The products are different methods to understand and optimise performance rather than tangible manufactured goods but they are no less valuable to the performance of the economy overall.

One of the listed aims under Education is to deliver contemporary science. Psychology does exactly this. As a hub science it has wide interactions with other sciences but is currently benefiting from 30 years of rapid progress in the understanding of the

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brain and its function. As a consequence of the substantial improvement of the tools available for brain sciences it is now possible to examine the linkages between human behaviour and brain function. This development of Psychology, incorporating biological, physiological and cognitive science has led to cognitive neuroscience and while the world is still at the early stages of this research effort it is of broad interest to the community, helping to popularise STEM research. Psychology has outstanding contributions in other areas too but this one, in particular, attracts enormous interest. The area, therefore, provides an excellent vehicle to engage student interest and to act as a platform to introduce the basic skills required in STEM disciplines.

Australia lags the world in recognising Psychology as a STEM discipline. There are few Psychology members of the Academy of Sciences in Australia, although there is a National Committee for Brain and Mind, but the Royal Society of the UK and the National Academy of Sciences in the USA both have a substantial Psychology presence. Psychology can attract students to STEM disciplines and engage the community in those areas if the processes in the Government's response make it clear that there is a real benefit in understanding how people behave and how those characteristics influence the other things we design, produce and aim to achieve. To do this well an approach intrinsic to STEM disciplines is, and must be, adopted.

We hope these comments are of value to the review of this critical area of activity.

Yours sincerely

signed on behalf of The Psychology Foundation of Australia.

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