

Engaging Engineering students with the wider community: The Endeavour program at the University of Melbourne

Robert Schmid^a, Nicole Meaker^a, and Doreen Thomas^b.

Department of Electrical and Electronic Engineering, University of Melbourne^a,

Department of Mechanical Engineering, University of Melbourne^b

Corresponding Author Email: rschmid@unimelb.edu.au

BACKGROUND

Engaging university students with the wider community is widely recognised as helping to prepare them for professional life while also enhancing the University's reputation and public standing. Running for more than a decade, the annual Endeavour program of the Melbourne School of Engineering at the University of Melbourne engages engineering students with a wide audience of engineering industry members, academics, school students, the university community and the general public. The principal activities are the annual Endeavour Expo, held in October each year, in which final-year engineering students publicly demonstrate their design projects. Endeavour also has a broad schools program, in which engineering students visit primary and secondary schools throughout Victoria to give an interactive classroom presentation.

PURPOSE

In this paper we explore the notion that enhanced engagement outcomes can be achieved through combining public exhibitions of students' projects with schools outreach programs. The activities and organisation of the Endeavour program at the University of Melbourne will be the subject of the study. We demonstrate the effectiveness of the program in engaging with its audience, and also the benefit to the engineering students participating in it. We offer suggestions for how others might implement a similar program elsewhere.

DESIGN/METHOD

Surveys have been conducted with participants to obtain feedback for evaluation of the program. The success of the program's engagement activities will be measured and evaluated in terms of the feedback received, as well as the level of community participation and the level of sponsorship and grant support obtained.

RESULTS

The increasing scope of the Endeavour program and the broad range of enthusiastic support that it receives from the wider community demonstrates that it is successfully achieving its objective of promoting engagement activities that are mutually beneficial to students of the Melbourne School of Engineering and also the wider community.

CONCLUSIONS

The Endeavour program provides a model example of how engaging university students with the wider community can offer benefits to both students and a diverse range of community groups.

KEYWORDS

Community engagement, professional development.

Introduction: Engaging the University with the wider community

Engaging university students with the wider community is widely recognised as helping to prepare them for professional life while also preparing them to be global citizens. Public engagement includes the university's many interactions with the wider community, including knowledge partnerships, interactions with alumni, advancement programs and international activities. Such partnerships enable the growth and public utilisation of knowledge, and contribute to the social, economic, environmental and cultural life of the wider community. Engaging university students with the community also enhances the University's reputation and public standing (University of Melbourne, Office of the Vice-Chancellor, 2010).

The need for community engagement programs in addressing declining numbers of student interest in science and technology has also been recognised by both government and academic commentators. Pearce, Flavell, and Dao-Cheng (2010) documented that a skills shortage in engineering posed constraints on economic recovery in a resources-led economy, and proposed better student preparation and industry engagement with higher education. To promote public awareness of the profile of engineers and scientists, and also to address declining enrolments, Shi (2010) proposed exhibiting the accomplishments of engineering and science students' projects in public institutions. Gibbings and Bullen (2011) described and evaluated programs aimed at encouraging school students in regional areas to participate in higher education by conducting engineering camps.

In this paper we explore the notion that the engagement approaches described by these authors can be further enhanced by combining the public exhibition of student projects with hands-on presentations within secondary classrooms. We describe the Endeavour program, presented by the Melbourne School of Engineering (MSE). This program is a collaborative venture of all the engineering disciplines of the MSE, and provides a broad platform that brings together students, academics and practising engineers.

We will demonstrate the effectiveness of Endeavour's programs in engaging the university with a wide audience of school students and industry partners, and describe the corresponding benefits for all the participants. The success of the program will be evaluated in terms of the level of community participation and the feedback received, as well as the level of sponsorship and grant support obtained. Finally, we offer suggestions for how others might implement a similar program elsewhere.

Program of Endeavour Events

Held annually since 1998, Endeavour Design Expo is the main event of the Endeavour program. Its primary focus is to showcase capstone project work by the Schools' final year students to an audience of industry representatives, school students, alumni, the university community and the general public. The Expo is held during the final week of semester 2, usually in the last week of October. This public exhibition is held in Wilson Hall at the University of Melbourne. Each capstone project team are allocated a booth equipped with table, posters and PC from which they present their work to Endeavour's patrons. In 2011 over 330 students presented more than 100 projects to an audience of more than 5000 patrons (Ying et. al., 2011). The Expo includes an Industry Night for professional guests and academics to view projects and interact with project students. The night provides important networking opportunities for students, academics and industry.

In addition to the Design Expo and Industry Night, Endeavour includes a school's program with both outreach and on-campus events for primary and secondary school students. The Endeavour Roadshow, presented by engineering students, travels to schools across Victoria and presents interactive workshops designed to inspire students and promote engineering as a profession. In 2012 the Roadshow program has presented to twenty schools from diverse socioeconomic backgrounds and geographic areas, including primary and secondary

schools, rural and metropolitan schools, and a range of single-sex and coeducational institutions.

The Endeavour Adventure is an on-campus program held in conjunction with the Endeavour Design Expo. School students visit the exhibition and engage in a range of on-campus activities including interacting with engineering students, seminars, workshops and campus tours. The program has a particular focus on promoting Women in Engineering and includes gender-targeted seminar programs. In 2011 eight schools and over 250 school students attended the Adventure Program (Ying et. al., 2011).

Throughout the year the Endeavour program also delivers a range of seminars for capstone project students including the Connection Seminars, in which industry guests present their company profiles and projects. In the Alumni seminars, engineering alumni talk about their experiences of life after university and advise current students on how to survive and flourish in the professional world.

Objectives and Principal Stakeholders of Endeavour

The program is delivered primarily to support the professional development of capstone project students. Working on their year-long projects develops students' technical skills, their ability to work in a team, and their professional attributes, all of which are valued highly throughout engineering and other professions (Department of Education, Science and Training, 2002). The Endeavour program provides capstone students with the opportunity to develop their communication skills by showcasing their work to a diverse audience.

The diverse program and cross-disciplinary approach of Endeavour provide a means for engagement between the academic engineering community and a wide range of people with an interest in technology and engineering. These include practising engineers, government, school students and their teachers, and members of the public with an interest in the application of science and technology. The program of industry seminars gives capstone students access to real-world examples of professional employment. Industry Night provides them with networking opportunities within the profession. The Design Expo provides alumni of the MSE the opportunity to attend a school-based event and view the work of new graduating students. The schools program gives primary and secondary students' insight into the work of an engineer, which may inspire some to pursue careers within a technology-based field. Being open to general public, the Endeavour Design Expo augments University programs such as Open Day by providing an opportunity for members of the public to visit the university and learn about the university's academic programs.

Endeavour Management

The Endeavour program has become a high profile event in the MSE annual calendar. The successful delivery of the program is important for the School's reputation within the educational and professional sectors; effective management of the program is consequently given a high priority by the MSE. It is managed by a team of students and academic staff drawn from all five departments of the MSE. The student members of the management team, known as the Endeavour Management Team (EMT), are responsible for the management and facilitation of all aspects of the program, which include fundraising and financial management, marketing and industry partnerships, liaison with the capstone student body, and organisation and logistics for the program of events.

The scale of the Endeavour program requires significant financial resources. A core component of this funding is provided by the MSE, with the remainder raised through a broad range of University, government and industry sponsors. The cross-disciplinary approach of the Endeavour program has proven successful in securing industry sponsors from a broad range of business sectors.

Managing Endeavour provides a unique opportunity for the students on the EMT to gain a rich practical management experience and develop their project and event management skills, which contributes significantly to their professional development. The skills and attributes developed by the team include all of the generic skills defined by Male et. al. (2010), most specifically team work, communication skills, ingenuity, management and leadership, entrepreneurship and professionalism. The scale of the event enables the students to gain extensive administrative and financial management experience, with budget development and monitoring central to the success of the project. In addition to the inherent practical skills, the student's gain a more inclusive university experience, forming strong connections with the academic staff, fellow students and the University in general.

Evaluation of Endeavour

Endeavour is now a major event of the annual calendar of the MSE at the University of Melbourne. Of primary importance to the program's success is the extent to which it engages its stakeholders in an inclusive program that forges links between these stakeholders and the University. Endeavour's success will now be evaluated.

The engagement of the capstone student body and their experience is of primary importance to the success of Endeavour. The capstone project student experience has been evaluated through free-text questionnaires, inviting students to reflect on the program and offer their views on its academic, exhibition and industry components. The majority of students reported that the opportunity to network with industry representatives and showcase their work were the most highly regarded aspects of Endeavour. They enjoyed the range of seminars and networking opportunities that were provided by industry representatives and they felt that presenting their work in an exhibition-style event was a fitting way to celebrate their achievements. The additional workload required by students to prepare presentation material for the exhibition was not deemed excessive and was considered an important aspect of the educational benefit of the program (Meaker et. al. 2010, Ying et. al. 2011).

With the aim of the Endeavour Schools Program to increase Engineering awareness and interest amongst school-aged students, a major indicator of the success of the program is the scale of involvement. The Endeavour Roadshow program has increased its reach over the past three years, from 200 students in primary and secondary schools in 2009, to 400 students in 2012. As a further success measure, school students involved in the Roadshow evaluated their experience through questionnaires; 650 secondary students and 278 primary students were surveyed over the 2009, 2010 and 2011 programs. The results of the secondary student questionnaire can be found in Table 1. 91.4% of secondary students indicated that the program made them more interested in the field of engineering. This represents a 30.2% increase, with only 61.2% of students indicating they had some interest in engineering before taking part in the program. 81.8% of secondary students indicated that the program encouraged them to consider engineering as a possible career path. (Maxwell et. al. 2009, Meaker et. al., 2010, Ying et. al., 2011) Although self-reported changes in attitude provide limited accuracy, the results of the questionnaires do indicate the success of the Endeavour program at engaging school students with engineering.

A further indicator of the success of Endeavour is the annual 10% increase in attendance at the Industry Night as the program's reputation grows amongst the academic and industry sectors; in 2011 165 guests attended the event. Attendance at the Design Expo is difficult to evaluate quantitatively as the event is open to the public however the venues are consistently full each year, even as the venues and number of projects on display grow larger. Recent growth may also be attributed to the full complement of five engineering departments now participating in the event, indicating that Endeavour is considered a successful program by all MSE stakeholders. The continuing increase in attendance at both the Design Expo and Industry Night clearly demonstrate the success of Endeavour at engaging engineering students with the wider community; the fundamental component of both events' success is their link to capstone projects.

The program is highly valued by its industry participants with the number of industry sponsors growing each year and ongoing support received from a number of continuing sponsors. A principal sponsor for many years has been the State Government of Victoria's Department of Business Innovation (DBI). The DBI 2011 ICT: Start Here, Go Anywhere initiative aimed to disseminate information to a target audience of school students, undergraduates industry and academia. Their participation in Endeavour 2011 was an important promotional vehicle for the campaign as it provided the Department with an important opportunity to participate in community engagement activities (Rogan, 2011).

Another measure of the program's success in its engagement activities can be provided by the level of grant support it receives. The University of Melbourne is a participant in the federal government's Higher Education Participation and Partnerships Program (HEPPP). See Department of Education, Employment and Workplace Relations, (2012) for more information about this program. Funding received by the university through this program is administered by the university's Teaching and Learning division, under the direction of the University Provost (deputy to the Vice Chancellor). It is used to support university programs

Table 1: Roadshow Secondary Student Questionnaire Results 2009-2011 (sample size: 650)

QUESTIONS				TOTAL	%
Were you interested in Engineering before this presentation?					
Definitely				162	24.9
Sort of				236	36.3
No				243	37.4
Never heard of it				9	1.4
Did our presentation and activity encourage you to consider Engineering as a possible career path?					
Definitely				187	28.8
Maybe				345	53.1
No				118	18.2
Did the information about Engineering projects make you more interested in the field of Engineering?					
Yes				389	59.9
A little				205	31.5
No				56	8.6
Do you think you will pursue further education in Engineering?					
Definitely	92	14.2			
Maybe				368	56.6
No				190	29.2

that pursue partnerships with the wider community. In 2011 Endeavour received a HEPPP-funded grant to substantially broaden its schools outreach program to include many schools from lower socio-economic status. This grant was awarded to Endeavour due to its successful and ongoing schools outreach program, the Endeavour Roadshow. This HEPPP grant has recently been renewed for 2012, further indicating that the Endeavour program holds the confidence of senior University management.

Figure 1 represents Endeavour's annual funding breakdown over a five year period; proportional yearly totals are shown over the years 2008-2012 with the levels of Sponsorship Funding and Grant Funding shown as a percentage of each year's total. Sponsorship Funding includes funding obtained from industry and university sponsorship, Grant Funding

includes university and government grants. Industry sponsorship of Endeavour has grown considerably since 2008, with 2009 showing a fall in funding attributed to the global financial crisis. The data also shows the significant increase in grant funding obtained by the Endeavour program in the years 2011 and 2012. The growth in both industry sponsorship and grant funding clearly demonstrates the value of the program to its industry, government and university stakeholders

The Endeavour program's success is based upon capstone projects and their ability to engage audiences of all ages. For students completing their engineering studies, the program succeeds in building alumni and industry relationships and assists students in developing generic engineering competencies and skills. The feedback received from each of the stakeholder groups has been overwhelmingly positive indicating that Endeavour delivers successful outcomes for its participants and the MSE. The results provide substantial support for the notion that linking a public exhibition of student projects with community outreach activities provides enhanced engagement outcomes for all stakeholders.

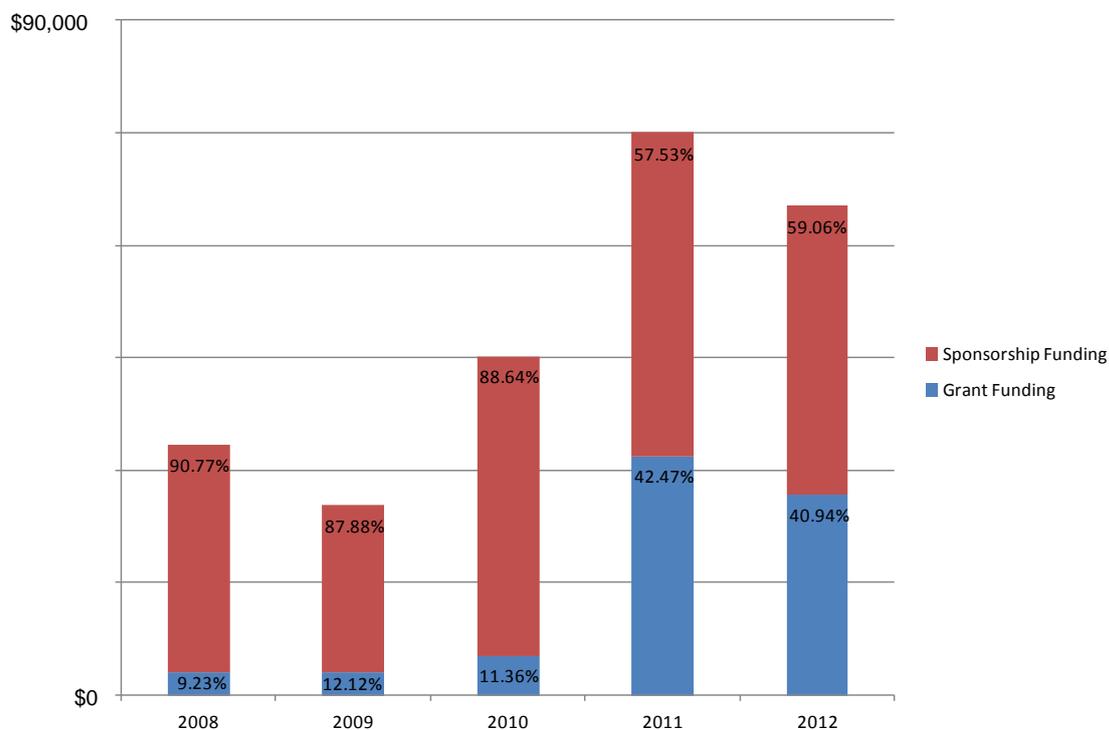


Figure 1: Endeavour's Annual Funding Breakdown

Replicating Endeavour Elsewhere

Here we offer some brief guidance for those who may wish to develop a similar program elsewhere. Endeavour commenced within the Department of Electrical and Electronic Engineering in 1998. Initially its sole activity was the showcasing of the final year projects (now known as capstone projects) at the end-of-year exhibition. Over time the program has seen numerous enhancements and additions, and many of these having been first proposed by student members of the EMT, including the Schools Roadshow and Adventure programs. In the past three years the other departments of the MSE have elected to incorporate the exhibition of their capstone projects within Endeavour to create a truly school-wide program.

The overall direction and objectives of Endeavour are predominantly defined by the supervising academic staff who ensure the program meets the objectives of the MSE, as well as mentoring the management team through all the decision making and planning processes associated with the program. As such, it is critically important to have key academic staff

leading the program, and at least one departmental head has always been involved in directly supervising the student team. Support from many of the MSE professional staff, including IT, Finance and Marketing are also essential for the program and also increases greatly the professional experience of the students on the EMT.

The MSE provides foundation funding to ensure the program's viability while corporate sponsorship and grant income are obtained. Sponsorship arrangements are negotiated by the student management team, who develop a range of sponsorship packages at varying levels of funding commitment. The support of many of Endeavour's industry sponsors is due to its extensive School's program, which underlines the benefits of jointly engaging with industry and schools.

Selection of the EMT students is conducted by the supervising academics near end of the preceding academic year, with selection open to final year or penultimate year students. The selection process is conducted so as to resemble that of a graduate recruitment program. Interested students are invited to submit their resumes for consideration and a selection of the applicants are invited to attend a panel interview with the academic supervisors. Team selection generally is finalised early in December of the previous year.

The incoming student management team are provided with the reports and documentation from previous years and are encouraged to meet informally over the summer vacation to discuss plans for the forthcoming year. From the beginning of semester one, the team meet with their academic supervisors weekly to discuss the direction of the project and the team's progress toward the defined objectives. The student management team are encouraged to define their own roles and responsibilities within the group. The student team choose a Team Leader or Project Manager and allocate a range of roles amongst the members. Roles and responsibilities within the team include School's Program, Marketing and Communications, Finance, Sponsorship, Events Management, and Student Liaison. Meetings are formally arranged by the EMT with agendas and minutes recorded each week.

The EMT are provided with office space, computing resources, a University email address and web space. In return the students receive academic credit toward their engineering degrees equivalent to 25% of a full year study load. Assessment of the management team is conducted via two written reports, with a large component of the assessment given to the academics' judgements about the overall achievement of the students, both individually and collectively. The considerable weight of academic credit granted to the management team motivates the students to work hard for the program's success.

The Endeavour management team is provided with a rich management experience including project and event coordination, fundraising, marketing and extensive stakeholder management. Students involved in the team each year have expressed the view that the 25% credit load attributed to the program provides a suitable reward for the challenging and varied workload experienced throughout the year. An additional benefit identified by management members is the opportunity the program provides to build lasting relationships with a variety of individuals from industry, the university and the wider community.

Conclusions

The Endeavour program at the MSE has become a centrepiece of the University of Melbourne's community engagement activities with the wider community, and offers benefits to both students and a diverse range of community groups. We have demonstrated how the program engages the interests of its key stakeholders and offered suggestions for how a similar program may be organised elsewhere.

References

- Department of Education, Science and Training. (2002). *Employability Skills for the Future*. Retrieved 18 Jun, 2011, from: http://www.dest.gov.au/NR/rdonlyres/4E332FD9-B268-443D-866C-621D02265C3A/2212/final_report.pdf
- Department of Education, Employment and Workplace Relations, (2012), Retrieved 3 Aug, 2011, from: <http://www.deewr.gov.au/HigherEducation/Programs/Equity/Pages/HEPPPProgram.aspx>
- Gibbings, P.D. & F. Bullen, *Development and Validation of a Regional University's Model for Community and Industry Engagement*, Paper presented at the 2011 Australasian Association for Engineering Education Annual Conference, Fremantle, WA.
- Maceiras, R., Cancela, A., Urréjola, S., & Sánchez, A. (March 2011). Experience of cooperative learning in engineering. *European Journal of Engineering Education*, 13-19.
- Maxwell, B., Graham, L., Madhaven, R., & Yeung, C. (2009). Endeavour 2009. The University of Melbourne.
- Meaker, N., Jones, Z., Ng, G., Chung, W., Wang, K., & Kai Teng, J. (2010). Endeavour 2010. The University of Melbourne.
- Pearce, A., Flavell, K., & Dao-Cheng, N. (2010). Scoping our Future - Addressing Australia's Engineering Skills Shortages: Australian National Engineering Taskforce.
- Rogan, D. (2012), Private email communication with the Authors.
- Shi, J. (2010). *Promoting Engineering and Science via Community Based PBL Projects* Paper presented at the 2010 Australasian Association for Engineering Education Annual Conference, Sydney, NSW.
- University of Melbourne, Office of the Vice-Chancellor. Growing Esteem 2010: Research, Learning and Teaching, Engagement, Retrieved 3 Aug, 2012, from: growingesteem.unimelb.edu.au/__data/assets/.../GrowingEsteem2010.pdf
- Ying, K., P. Peng, K. Lewis, N. Kalam, A. Zhen and F. Daryanto. (2011). Endeavour 2011. The University of Melbourne.

Acknowledgements

The authors would like to acknowledge the many past and present staff and students at the University of Melbourne who have contributed to the success of the Endeavour program for more than a decade. We also thank the anonymous reviewers for their constructive comments which lead to some refinements in the paper's exposition.

Copyright statement

Copyright © 2012 Schmid, R. Meaker, N. and Thomas, D: 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 2012 conference proceedings. Any other usage is prohibited without the express permission of the authors.