AutoCRC: Supporting collaboration between the automotive industry and undergraduate students

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Abstract: The Cooperative Research Centre for Advanced Automotive Technology (AutoCRC), founded in 2005, has become an integral part of the Australian automotive industry's R&D sector. Its mission: Through industry-led research collaborations, AutoCRC will deliver smarter, safer, cleaner manufacturing and vehicle technologies for Australia's benefit.

AutoCRC, through its education program, works with 8 universities and various companies to provide up to 100 students per year with the opportunity to work on final year projects that are designed to solve industry wide or company based problems. The AutoCRC Undergraduate Final Year Project Program is in its first full year of operation and early signs indicate that there is value for both industry and students in the collaborative approach that is encouraged.

Cooperative Research Centres

Australia's Cooperative Research Centres program was established by the Commonwealth in 1990. The program emphasises the importance of collaborative arrangements to maximise the benefits of research through an enhanced process of utilisation, commercialisation and technology transfer. It also has a strong education component with a focus on producing graduates with skills relevant to industry needs.

AutoCRC

The Cooperative Research Centre for Advanced Automotive Technology Ltd (AutoCRC) is an agent for the development of innovative technologies in the Australian automotive industry. Our mission: "Through strategic industry led research collaborations, AutoCRC will deliver smarter, safer, cleaner manufacturing and vehicle technologies for Australia's benefit." AutoCRC recognises that the current shortage of graduate engineers with relevant skills is a risk for the automotive industry. In response to that risk, AutoCRC has instituted an education program that focuses on undergraduate, postgraduate and professional development areas. This paper will focus on one undergraduate program.

Undergraduate Program

The AutoCRC Industry Based Final Year Undergraduate Project Program is designed to allow students in the final year of their undergraduate degree the opportunity to work with industry professionals on real problems that affect individual companies or the wider industry.

It is widely recognised that industry experience is one of the most significant factors in determining the employability of new graduates. An article by Morton (2006) in The Age newspaper (15/8/06) cites the findings of a British survey of graduate employers: "It's clear that gaining real-life work experience as part of your course, or on your own initiative, is an absolutely key requirement for students". In the study, 46 percent of employers gave a high rating for "candidate's level of relevant work experience". Anecdotally, many employers are now recognising that students with industry experience through industry based projects, co-op years, industry based learning (IBL) programs or holiday employment are more competent and work savvy than peers with better grades but no work history. AutoCRC projects are a source of real industry and research experience for up to 100 students per year from eight universities around Australia. A case study by Abu-Mulaweh (2003), of a similar program funded by the American Society of Heating, Refrigeration and Air Conditioning Engineers concluded that outside support for capstone projects dealing with real life engineering issues is badly needed and, where given, improves the quality of the projects available.

The cases described in the paper also indicate that the quality of work achieved by the students is quite high, leading us to the assumption that working on real life projects, with adequate funding is likely to lead to better learning outcomes than alternative, low budget, university based projects. This is supported by McDermot and Machotka (2006) who assert that in the case of projects that aim to solve specific industrial problems it is common for students to transcend the knowledge of their supervisors and hence for them to move rapidly towards acknowledging their own ability as professionals and therefore to form professional relationships, behaviours and attitudes. Chinowsky, et.al. (2006) investigating project based learning, have determined that working on projects develops both students metacognitive skills and their transformation intelligence (a combination of intellectual, practical and emotional intelligences) - both of which are essential to address industry requirements for graduates with "the vision to integrate conflicting demands into an elegant solution that is pivotal to the final outcome."

Features of AutoCRC industry based final year projects are:
- The projects are instigated by industry and championed by industry staff.
- AutoCRC ensures that projects are appropriate to our research themes (Figure 1).
- Universities select the projects that fit most closely with their teaching and research programs, see Figure 2 for allocation of projects by University.
- University based supervisors and industry champions collaboratively scope the project to ensure that the project is challenging and achievable, and will produce positive learning outcomes for students and useable knowledge for industry.
- Students are required to maintain confidentiality and to assign IP through their university to AutoCRC.
- AutoCRC provides $5000 funding for each project (up to 50 projects annually) to ensure that universities can provide an exceptional learning experience in terms of access to laboratory and testing facilities, computer software, prototyping, and in some cases prizes and stipends.
- Students are encouraged to accept opportunities to develop skills and attitudes such as professionalism, meeting protocols and presentation skills.
- Students are required to present their projects at three public forums throughout the year:

  o The first forum introduces new projects in a poster session.
  o The second forum allows students to present their progress in very limited time and get feedback on any issues or problems that they are having – it also allows supervisors to assess their progress against objectives set at the start of the project.
  o The third forum is a final presentation – in some cases this is used by the University as part of the thesis assessment.
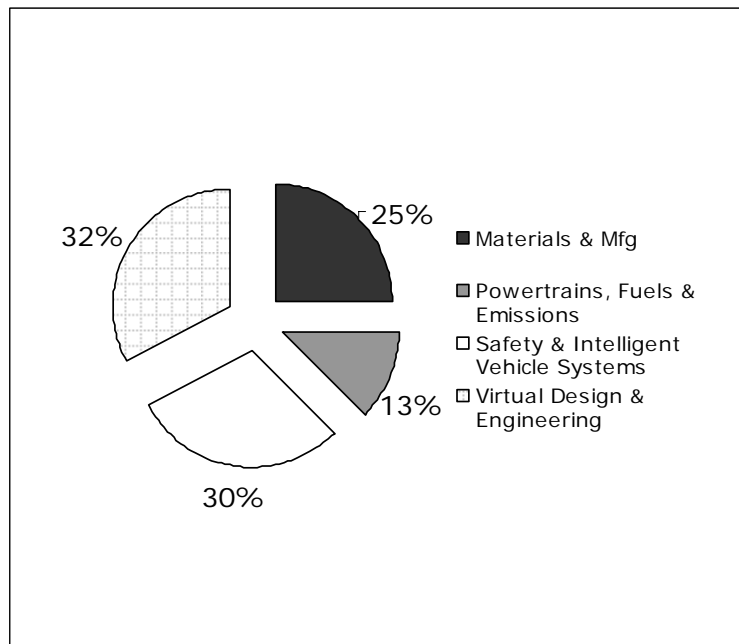
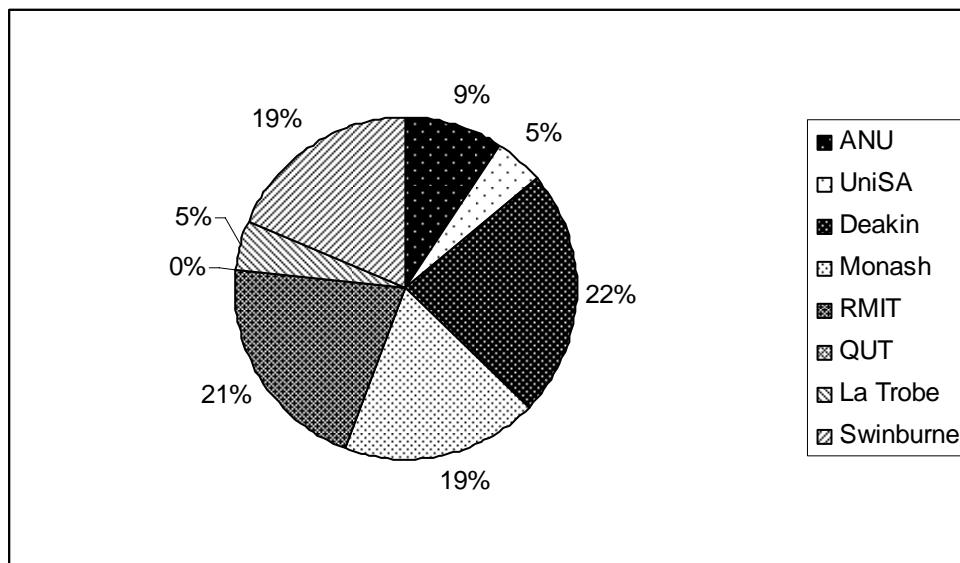**Figure 1. Distribution of undergraduate students (n = 70) by AutoCRC research theme**

Figure 2. Distribution of uptake of projects (n=44) by participating universities

Preparing students for the future

In the context of the automotive industry we agree with Hadgraft and Goricanec (2007) whose survey of a series of engineering education reviews led them to conclude that engineering graduates will need to have economic, environmental, social and technical skills in order to fulfil the requirements of engineering jobs of the future. This program addresses some of these skills that graduate engineers will need in the following ways:

Social

AutoCRC encourages multidisciplinary teams, for example, in one project groups from different disciplines and different universities are working on separate parts of the same problem and need to communicate, work together and negotiate appropriate outcomes for a project which will result in a demonstration electric vehicle.

The projects that industry provide are not limited to engineering problems and hence at forums there is a good deal of cross fertilisation of ideas as groups and individuals from academic backgrounds as diverse as mechanical engineering, electronics engineering, IT, computer science, design, business, and psychology collaborate.

Environmental

Much of the focus of new work within the Australian automotive industry is on improving environmental standards. Many students therefore are involved directly in projects whose aim is to enhance environmental outcomes, through the use of new materials, new techniques or environmental information. It is inevitable that these students will develop an understanding of the environmental imperative that is the current driver of innovation in the automotive industry.

Economic

Students are expected to develop a budget for their project. They are allocated $5000 per project and are required to report on expenditure at the conclusion of the project. On top of this the automotive industry is a profit making business. Some students will be required to assess the cost of implementation of their results, others will be comparing and optimising different processes – inevitably cost is a factor of optimisation within any manufacturing industry.

Technical

Students work with technical specialists who have access to knowledge that isn't available at universities. The automotive industry does not publish information in the same way that the academic community does. This means that information and techniques may be accessed only by specialist engineers. Gaining the right and the ability to use confidential technical information and proprietary software is an obvious boost to students ability gain work as a professional agent within this guarded environment.

Feedback from students

The program includes a formal evaluative feedback mechanism at the final thesis presentation stage. As this isn't available at the time of writing, students from one project group (working on Life Cycle Assessments of joining techniques) were asked to provide comment on the program. In general the students seem pleased with the program and even saw dealing with issues like difficulty in accessing industry supervisors, and time delays in accessing industry confidential information, as being an opportunity to develop skills that will be needed in their careers. The students all recognised that the forums were designed to give experience in presentation skills but also noted that they appreciated the opportunity to see how other students approached their projects, and that they had made valuable contacts and expanded their networks.

There was a good amount of flexibility amongst university as to their use of funding, the group of students surveyed were each given $1000 to cover expenses and the rest of the funding was put towards technical software and a trip to visit the Holden manufacturing plant in Elizabeth. Their responses to the question "Would/could you have completed the project without AutoCRC funding?" tended to indicate that, in their view, the funding wasn't essential to the project but that it did make for a better experience – one student bought a computer, one student was able to reduce his part-time work, and two students felt that while the scope of the project was daunting, the funding provided good incentive to take it on and to commit the required effort.

Australian Automotive Industry

The benefit to industry of hosting student projects is that it provides a low cost program to investigate challenging problems that are not necessarily pressing but which may provide innovative solutions or processes. Companies have the opportunity to "try out" potential graduate employees and to develop a presence within universities. It is noted in the report "Educating Engineers for the 21st Century" (Spinks et al 2006) that one of the most highly sought after attributes of a graduate engineer is "the ability to apply theory in practice". Hosting a student final year project allows engineering firms to assess this in a real situation. Furthermore, where a student has a good experience in an industry based project they are likely to recommend it to the next cohort – creating a competitive desire (due to limited places) to be part of the program and to engage with industry participants. Industry participants do shoulder a cost in hosting the projects – they have to release staff time to champion the project; this means regular project meetings, assistance with access to and use of information and technology and attendance at forums. Melin et al (2006) note that universities conducting industry based capstone projects rely on commitment by industry to define the scope of the projects and in many cases to be available for meetings, marking and involvement in delivery of courses. Professionals, like Chris Boylan from General Motors Holden and Lachlan Hurst from the Victorian Partnership for Advanced Computing, who choose to put in time and effort to support final year project students, report that the advantages for them include: progress on projects that would otherwise be too time consuming, opportunity to gather innovative and lateral solutions from students, access to student reports, opportunity to learn from students experience and professional networking both within a large corporation and with outside individuals (Boylan 2007 pers. comm., 14 August, Hurst 2007 pers. comm., 14 August).

Changes indicated for 2008

For AutoCRC, this program was a response to a perceived need to promote careers in the automotive industry and to assist universities in providing relevant industry experiences for students prior to graduation. At the point of writing we are confident that we have achieved our goals and we are aware that there are improvements that can be made to the program. These include:

- Ensuring that individual industry champions are committed to, and interested in, the projects before commencing.

- Providing a "professional skills" day early in the program for students to develop an awareness of industry expectations and how to meet them.

- Timing is important – projects need to be identified and allocated early enough to allow for recruitment of students prior to the end of the semester prior to the project official start dates.

- Providing funding in two instalments based on evidence of adequate progress, this will reflect industry practise and ensure that students are urged to maintain professional standards.

- A more robust IP/confidentiality arrangement to reflect industry concerns.

Conclusion

Providing financial support of up to $250000 annually for final year undergraduate students to complete industry based projects is a positive step for AutoCRC and the Australian automotive industry. It allows students to do research that is of real value to industry and gives them the opportunity to develop and display skills that are not obtainable at university. It presents the industry with a view of new graduates, their capabilities and their work ethic. For the universities that are involved it opens up new avenues to interact collaboratively with industry as a research partner and educational resource. The role of AutoCRC in brokering projects, providing financial support and legal documentation, and in offering appropriate professional development opportunities, is essential

to the success of the program and its availability, on an annual basis, for up to 100 students. The program may be unique in its structure and appears to be a good model for undergraduate students to engage in industry based projects with successful outcomes for all stakeholders.

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