

UNIVERSITY OF WOLLONGONG

School of Electrical, Computer and Telecommunications  
Engineering

# Graduate Attributes Challenge 2004

A report on the connection between the UOW Graduate  
Attributes and graduate employability skills

by

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# 1 Executive Summary

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The University of Wollongong Graduate Attributes are qualities that the University expects of all its graduates. This report presents a study into how the graduate attributes relate to graduates from the School of Electrical, Computer and Telecommunications Engineering (SECTE), especially their relevance to potential employers of electrical engineers.

The study acknowledged two target groups as being of particular relevance: final year students undertaking an Informatics Engineering degree, and potential employers of graduates from SECTE. Interviews were held with members of each of these groups. Three areas were covered by the interview:

- Interviewees were asked to form an opinion of important characteristics of engineers without knowledge of the Graduate Attributes
- They were then asked to study the Attributes and to rank them
- Finally, they were asked to give an overall impression of the Graduate Attributes and to suggest improvements and a possible 10<sup>th</sup> Attribute

The interview was constructed with the intent of forming a profile of the Graduate Attributes most applicable to electrical engineers, and their relevance to employers.

The study showed that there is a strong correlation between employee desires, student expectations and the University of Wollongong Graduate Attributes. Communication and time management skills, initiative (proactive) and hand's on practical skills were all identified as being qualities of particular importance to employers, and would like additional emphasis placed on these areas. Teamwork and interpersonal skills are also considered to be relevant since many engineers work in project groups. Core engineering skills, such as analytical problem solving and knowledge of discipline are essential; however the emphasis was placed on engineering methodology and problem solving skills, since most knowledge is job specific.

The University of Wollongong's Graduate Attribute represent a strong understanding of the needs of industry and a commitment to producing engineers with skills relevant to their discipline.



## 2 Introduction

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The University of Wollongong graduate attributes are the characteristics or qualities that the University expects of all its graduates. **The Graduate Attribute Challenge (GAC)** explores how these attributes relate to each field and what the employers are looking for in their employees. Each faculty has a team with the responsibility to investigate the relevance of the Graduate Attributes to their field and how they apply to the work force. Our team represents the **School of Electrical, Computer and Telecommunications Engineering (SECTE)**.

The study targets final year students undertaking an Informatics Engineering degree, and potential employers of graduates from SECTE. A survey was used to collect data for the study. It focused on desirable qualities in graduate engineers and their direct relationship to the University's Graduate Attributes. The survey approached the Graduate Attributes from two angles. Initially it prompted the interviewee to form an unbiased opinion of important qualities. Following this, the interviewee was made familiar with the nine Graduate Attributes, and asked to rank them.

The report is structured as follows: Chapter 3 outlines the methodology used to conduct the study with specific reference to the survey used to collect data. Chapter 4 contains the results of the survey. Chapter 5 is the conclusions. The Appendixes contain a list of contributors, including companies surveyed and the survey used to interview employers.



### 3 Strategy

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The study was implemented through use of two similar surveys. The first survey targeted potential employers of engineers from SECTE. The employer survey is included Appendix B. The second targeted final year Electrical Engineering students.

#### **3.1 How are the interviews designed?**

In order to produce consistent and reproducible results a survey was carefully designed according to a number of criteria, in particular:

- Clarity
- Brief & focused
- Consistency
- Yielding pertinent & quantifiable results

The survey used for the Graduate Attribute Challenge allowed for an investigation from two crucial view points. The first view point addresses the challenge from an unbiased eye. This means that the companies and the students give their own opinions on what attributes graduates should have without having prior knowledge of the UOW Graduate Attributes. The second view point explores the value employers and students give to the UOW Graduate Attributes, the intent being to relate their views to those of the University of Wollongong.

#### **3.2 Context of the company & interviewee**

This section aims at putting the interviewee in context. Relevance and importance of engineers to the company are assessed. This first part is necessary to validate and weight the next parts of the survey. The information obtained can be used to make further educated interpretations about the data gathered at a particular company.

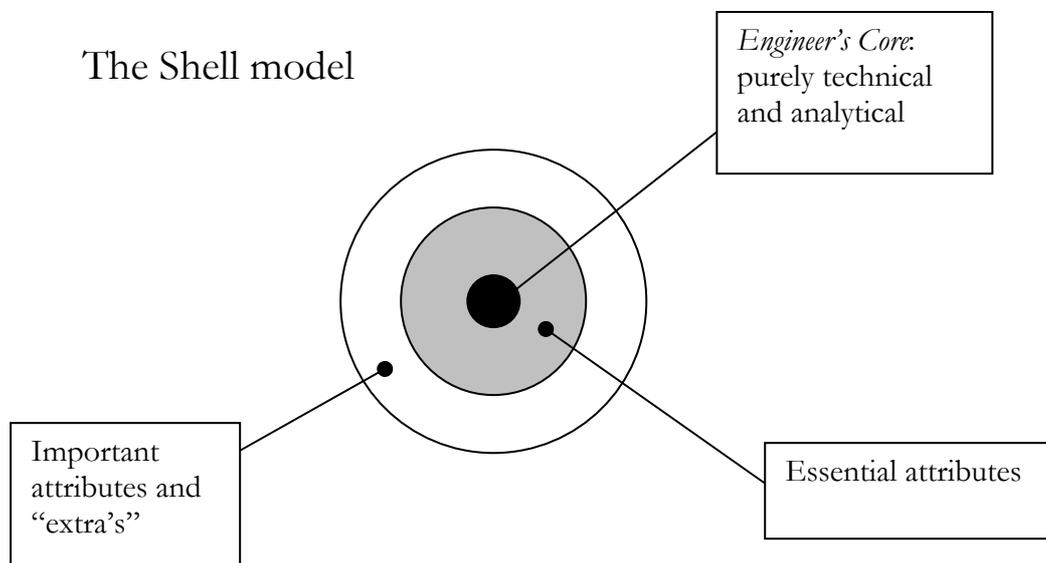
The student version of the survey does not include this section. The context was validated by selecting students of Electrical Engineering in their final year.

#### **3.3 Engineer your ideal engineer**

One of our main goals being to understand what attributes really matter to the employers; a shell model was designed to represent their needs. In this question the employer is given the freedom to build his ideal engineer. The person is asked to name the most important characteristics s/he wants to see in the graduates s/he would employ.

So that the results are unbiased, the nine attributes defined by UOW have not yet been revealed to the employer at this stage of the survey.

In this thought experiment, the employer is given the *engineer's core*, on top of which he will add the characteristics he looks for. The *engineer's core* is made of purely analytical & technical skills. It is emphasized to the interviewee that no other characteristics are part of it, such as people skill, confidence, or other soft skills in particular. This base contains the two most essential characteristics of an engineer, as they were extracted from the definition of *engineer*. It is assumed that the technical level of the ideal engineer is good and fairly broad.



**Figure 3-1: The Shell Model**

In a first stage, the 3 most important characteristics of an engineer are being asked. It is encouraged to say the first attributes that come to one's mind, as it this method is believed to yield more representative ideas of what is important. For the same reasons the number of qualities is voluntarily kept to only 3.

In a second stage, more characteristics are asked and are recorded with a relative importance based either on the order they are given or as discussed with the interviewee. A fuzzy boundary exists between this outer layer and the previous 'essential attribute' layer and the interviewee point of view is taken into account to adapt this boundary if necessary.



The data obtained from this question holds important information about the characteristics an engineer can not go without to obtain a job. It also give an idea of the extras that are most appreciated in graduate profiles, which increases a candidate's chances for success. Furthermore this unbiased data is later correlated to the list of attributes created by UOW. Not only these results are compared to the list but they could also be used for its fine-tuning.

In the student version of this question, the student is asked to fill the model with the attributes s/he believes s/he has acquired during the last 4 years at university.

### **3.4 Importance and relevance of the 9 attributes**

The employer is now shown the list of nine graduate attributes defined by UOW. The interviewee is asked to rank the attributes by order of importance. The data gathered in this part is particularly valuable as it is related in a direct manner to the overall goal and also constitutes a base for benchmarking. The ranking produces a 'curve' which is characteristic of engineers desirable to the employer. This curve or **profile** tends to be typical of engineering and hence also tends to distinguish it from other fields e.g. finance, arts...

Similarly, the student in their interview is asked to rank the attributes by order of importance in his perception of what he has become.

### **3.5 Improvements**

The final part of the survey focuses on the possible improvement of the attributes. It gives the employer an opportunity to communicate to the University what it would like to see more in the graduate engineers it deals with. It also stimulates the employer to suggest a possible 10<sup>th</sup> attribute to add to the list. This part is made of 3 questions and concludes the survey.

In the student survey, the student can suggest some qualities they would have liked their courses to put more emphasis on. They can also suggest a 10<sup>th</sup> attribute.

## 4 Results

The results of the survey are presented in three stages. The first stage addresses the validity of University of Wollongong Attributes list. The second concentrated on the value employees and students gave to the list itself. The third discussed improvements of the graduate attributes.

### 4.1 Characteristics of the Engineer

Using the shell model, employers and students suggested qualities that were desired in the “engineer”. The qualities were then graded and given a weighting. The next stage was to find the attributes from the UOW list that matched up with the qualities given.

#### 4.1.1 Employers have their say

Although the employers were all from an engineering field, each employer had their own idea on what desired qualities their engineer needs. Some of the qualities mentioned included:

- Analytical Skills
- Communication skills
- Time Management
- Innovation
- Customer Service
- Literacy
- Leadership
- Interpersonal Skills
- Knowledge
- Initiative

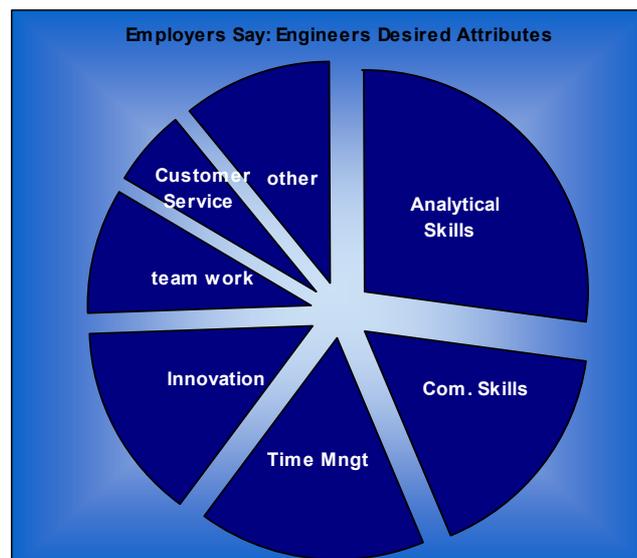


Figure 4-1: Employers desired attributes in an engineer.

The graph shown in Figure 4-1 demonstrates the employers combined attributes. According to them, analytical skills were the most essential core to an engineer, with communication and time management skills arriving next on their priorities. It was interesting to note that knowledge was of little importance in the desired engineer. Many of the employers justified their reasoning by the fact that most graduates learn 90% of the knowledge based demands of the job on the job and not at university.

### 4.1.2 Students have their say

Similarly, students gave their own ideas behind what qualities should an ideal engineer.

Some of their responses were similar to the responses given previously. They included:

- Analytical Skills
- Communication Skills
- Interpersonal Skills
- Time Management
- Team Work
- Innovation
- Literacy
- Independence
- Ethics
- Curiosity
- Confidence
- Sense of Improvement

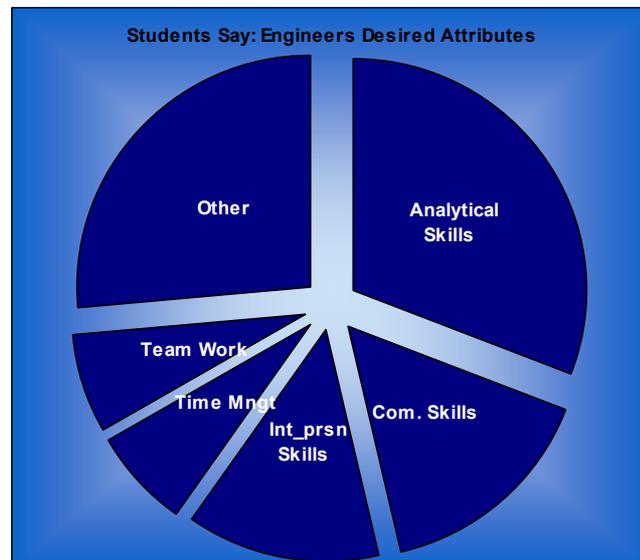


Figure 4-2: Students desired attributes in an engineer.

The students' responses shown in Figure 4-2 demonstrated that they believe analytical and communication skills are fundamental attributes in an engineer. It was interesting that interpersonal skills followed by a slight margin, when compared to the employers ranking it eighth on their desired attributes.

### 4.1.3 Comparison of Employer and Student results

All the suggested qualities could be matched with an attribute from the University of Wollongong list of attributes. In addition all the attributes were mentioned. **This meant that both employers and students consider all the University of Wollongong Graduate Attributes to be of value to engineers in the workforce.**

Figure 4-3 depicts the desirability of each attribute in an engineer. Learning, Knowledge of Discipline and Computer literacy ranked poorly in this study. The high ranking of attribute 5, analytical decision making, is a result of our definition of an engineer. The low ranking of attributes 1, 2 and 7 can be attributed to this definition, since most people would consider them as core qualities of an engineer.

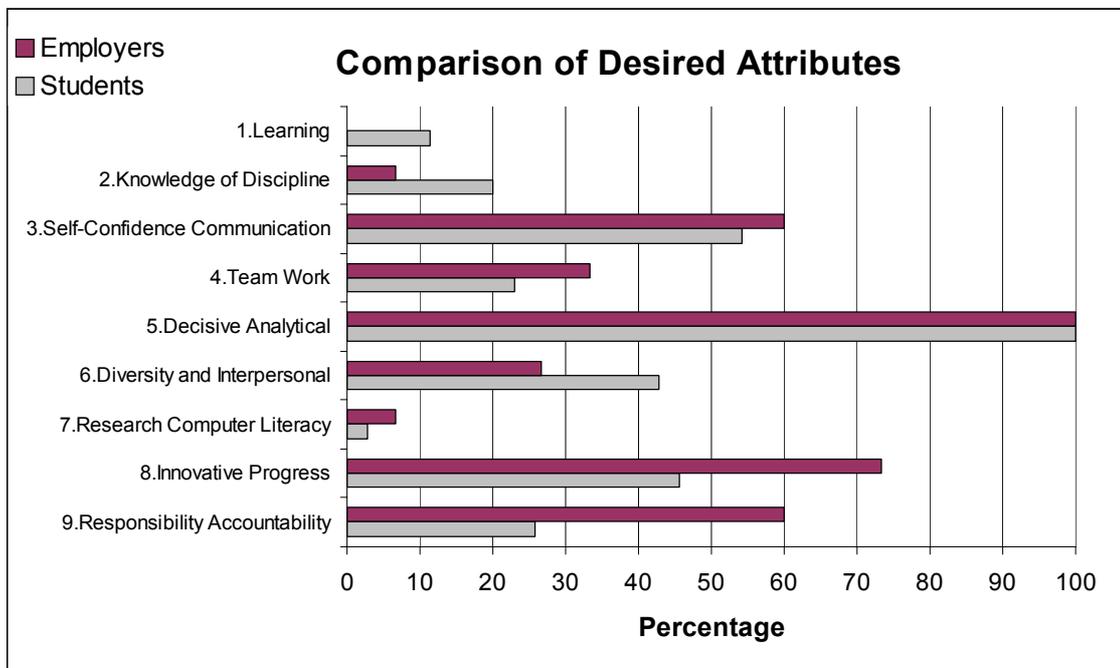


Figure 4-3: Comparison between employers and students desired attributes in an engineer.

## 4.2 Relevance of UOW List of Attributes

Having now been made aware of the attributes acknowledged by the University of Wollongong, the contributors were asked to rank the attributes. The normalised importance of each attribute is shown in Figure 4-4. The average percentage importance accounts for the employers and the students overall rank of the attributes of the University Of Wollongong.

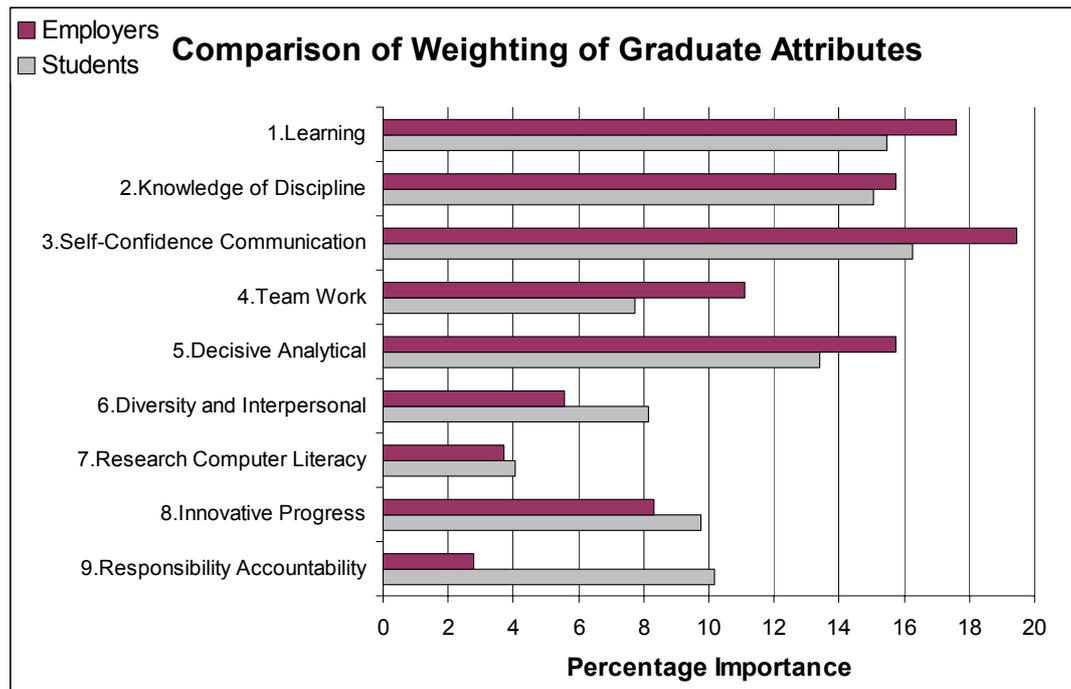


Figure 4-4: Shows the ranking of the attributes through the employers and the students.

It was interesting that this time, both employers agreed on the same quality. It was not however the “analytical skills” attribute (no. 5), but the “communication skills and confidence” attribute (no. 3) that they considered to be the most critical in an engineer.

## 4.3 Improvements

All qualities necessary for graduate engineers were in some way relative to an attribute found on the University of Wollongong list of Attributes. It was suggested that certain qualities required further emphasis of perhaps their own attribute. Time management and organizational skills need to be emphasized in attribute nine. Proactive behavior or initiative should be emphasized in attributed 1 and 8. Attribute 2 should include the need for hands on experience. Part of the University of Wollongong’s appeal for engineering firms is that it produces engineers with good practical skills.



## 5 Conclusion

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The study showed that there is a strong correlation between employee desires, student expectations and the University of Wollongong Graduate Attributes. Communication skills were considered the most important skill outside of the core engineering discipline and this skill was identified as being a problem for many engineers. Time management, initiative (proactive) and hands on practical skills were all identified as being qualities of particular importance to employers. Teamwork and interpersonal skills are also considered to be relevant since many engineers work in project groups.

Specific knowledge is not considered as important as the discipline, or method of thinking, since most knowledge is job specific. Having said this, a recent study<sup>1</sup> has shown that there is a lack of power engineers. This lack identified part of the lack as being a result of electrical engineers are now having to cover far broader region of knowledge, including telecommunications and electronics. This is perhaps an indication that the knowledge taught at universities has more relevance than is generally attributed by employers.

A second reason identified for the lack of engineers in this study was that the analytical skills possessed by engineers makes them desirable to financial firm. The relevance of engineers to the financial sector was not covered in this study and may be an avenue for future investigations.

The University of Wollongong's Graduate Attribute represent a strong understanding of the needs of industry and a commitment to producing engineers with skills relevant to their discipline.

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<sup>1</sup> *'Assessing the future of electrical power engineering'*, Vic Gosbell & Duane Robinson, 23 April 2004, Institution of Engineers, Australia 2004



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Hatch Webpage [http://www.hatch.ca/About\\_Us/HatchOverview.htm](http://www.hatch.ca/About_Us/HatchOverview.htm) Accessed: 5th September, 2004



## Appendix A – Contributors

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### Team

#### Sali El-Torgoman

Sali is in the process of completing a Double Degree with a Bachelor of Engineering (Electrical) and a Bachelor of Arts (French). Her focus as an engineer lies predominantly in the area of power and control. She has embarked on an engineering thesis in the field of renewable wind energy. This thesis involves the modelling of a Squirrel Cage Induction Generator within a fixed speed turbine system using PSCAS simulation software, under the supervision of Dr Sarath Perera. She has been involved with the steel industry, working in the area of Programmable Logic Controllers, where she spent summer 2003 at the Port Kembla slab making domain. She has also spent time in France enriching her fluency in French, whilst at the same time working on a project for the Rhone-Alps Health Services in the domain of adhoc network research.

#### Tony Larchez

Antoine is currently doing his Masters by research in the field of Mechatronics at the University of Wollongong under the supervision of Prof. Fazel Naghdy. His research focuses on the active compensation of vibration for the next generation of vehicle mirror systems. In 2002 he obtained his degree in Electrical engineering, with an emphasis in Microelectronics from E.S.I.E.E, Paris, France equivalent to masters by coursework. At the same time he obtained his DEA degree (research oriented) from the University of Paris VI. In 2000 he obtained his *License* (equivalent to a bachelor) in Computer science and Signal Processing. He has been working on the development of flip-flop circuit for high speed microprocessors at UC davis, USA . Other project includes the control of a linear motor and improvement of cathodic protection system for gas pipelines. Among his interests are psychology, business, leadership and science.

#### Lianne Moller

Lianne completes her Bachelor of Engineering (Electrical) and Bachelor of Science (Physics) degree at the University of Wollongong in December of 2004, with a focus in the areas of Power, Electronics and Control. Her honours thesis involves the development of a control system in PSCAD for a Doubly Fed Induction Generator, as used to connect variable speed wind turbines to the grid, supervised by Dr Sarath Perera. Over summer 2003, she was involved in research into the effect of air-conditioner starting transients and operating characteristics on the grid for the Integral Energy Power Quality Centre at the university, supervised by Dr Duane Robinson. A paper on this work was presented at the 80<sup>th</sup> Annual EESA conference and received best paper. Other experience includes work at Australian Superconductors working on a variety of hardware and software projects related to the development and production of superconductor tape and its use in the power network.



## **Interviewees**

### **Peter Berry**

#### **Engineering Manager**

#### **Areva T&D (Transmission and Distribution) – System Group**

Areva T&D was acquired from Alstom T&D and is now a part of Areva Worldwide. Areva T&D is involved in HV systems, Power Transformers, Switchgear and Automation and Information Systems. Peter Berry has been working with Areva T&D for 16 years and is a member of the Systems Group. This group is primarily involved with HV power systems and substations design and construction. He is responsible for the technical outcome of the projects. The group is generally involved in 10-12 projects at any one time, each having duration of anything from 12 to 18 months. Areva T&D is usually involved with the entire project, from the design stage, through to factory testing, and eventually commissioning the project onsite.

### **Jane Mills**

#### **HR HATCH**

#### **Wollongong Office**

Hatch is a leading global consulting, engineering, technologies, information systems, and project and construction management organization. The business units and affiliates of the Hatch Group provide a full range of technology-driven, value-adding solutions and services to clients in the mining, minerals, metals, manufacturing, infrastructure and energy sectors through a network of 80 permanent offices worldwide. Programs and projects under management have an aggregate value in excess of \$15 billion. Hatch is an employee-owned company of more than 5,800 employees. Fees for 2004 are expected to exceed \$700,000,000.

### **Dianna Naumoska**

#### **HR BlueScope**

BlueScope Steel Limited (formerly known as BHP Steel Limited) (ASX: BSL) was publicly listed on ASX in 2002. BlueScope Steel was formerly a business group of BHP Billiton. The decision to separate BlueScope Steel was announced in March 2001, at the time of the merger between BHP Limited and Billiton plc. BlueScope Steel is a proven performer in the global steel industry, with a very strong business reputation in the Asia Pacific region. Company restructuring in recent years has made significant progress towards improving profitability and creating a strong, vital business. A committed workforce, together with a decade of investment in product innovation, technology and manufacturing facilities, provide a strong platform for growth, particularly in Asia.

### **Neil Browne**

#### **Integral Energy**

Integral Energy retails energy to 807,000 customers, or 2.1 million people, in households and businesses across a network franchise spanning 24,500 square kilometres in Greater Western Sydney, the Illawarra, and the Southern Highlands. Although mainly based in NSW they are also active in the Victorian and ACT electricity markets. Integral Energy sponsors the Power Quality Centre within the University. Neil Browne has been the manager for power quality protection & operation analysis manager and has been with the company since 2001.

## Appendix B – Employer Interview

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### Graduate Attribute Challenge

Interviewee:

Date:

The University of Wollongong graduate attributes are the characteristics or qualities that the University expects of all its graduates. **The GAC** explores how these attributes relate to each field and what the employers are looking for in their employees. Each faculty has a team with a responsibility to investigate the relevance of the Graduate Attributes to their field and how that applies to the work force. Our team represents the School of Electrical, Computer and Telecommunications Engineering (SECTE).

These finding will be presented to a panel, where the team with the best research will be awarded. The panel consists of university executives, private consultants and members of industry.

Attribute 1		A commitment to continued and independent learning, intellectual development, critical analysis and creativity.
Attribute 2		Coherent and extensive knowledge in a discipline, appropriate ethical standards and, where appropriate, defined professional skills.
Attribute 3		Self confidence combined with oral and written skills of a high level.
Attribute 4		A capacity for, and understanding of, teamwork.
Attribute 5		An ability to logically analyse issues, evaluate different options and viewpoints, and implement decisions.
Attribute 6		An appreciation and valuing of cultural and intellectual diversity and the ability to function in a multi-cultural or global environment.
Attribute 7		A basic understanding of information literacy and specific skills in acquiring, organising and presenting information, particularly through computer-based activity.
Attribute 8		A desire to continually seek improved solutions and to initiate, and participate in, organisational, social and cultural change.
Attribute 9		An acknowledgement and acceptance of individual responsibilities and obligations and of the assertion of the rights of the individual and the community.



## QUESTION ONE: Relevance of Engineers

- ❖ Do you hire engineers as part of your recruitment?
  
- ❖ How many engineers would you say you employ annually?
  
- ❖ Would these engineers that you hire be graduates or experienced engineers?
  - If graduates, what domain of engineers that you would take?
  
  - If experienced, what experience would they have?
  
- ❖ What kind of roles would these engineers take on at COMPANY?
  
- ❖ What kind of training do you offer these employees with respect to these roles?
  - Examples:
    - CPEng (IEAust)
    - Leadership skills
    - Further technical training
    - Financial management
    - Further research PHD, masters etc
    - Communication Workshops
    - Conflict Management
    - Multilingual skills
  
- ❖ Is this training in-house or external?

## QUESTION TWO: Employer Attributes

**CORE ENGINEER:** is a person who uses knowledge, mathematics and practical experience and applies them to the design of useful objects or processes.

**MANTLE:** With reference to COMPANY, what are the three most important attributes that you would add to the engineer, taking into account that the core of engineer is that of analytical skills?

**CRUST:** What would be your ideal engineer working at COMPANY

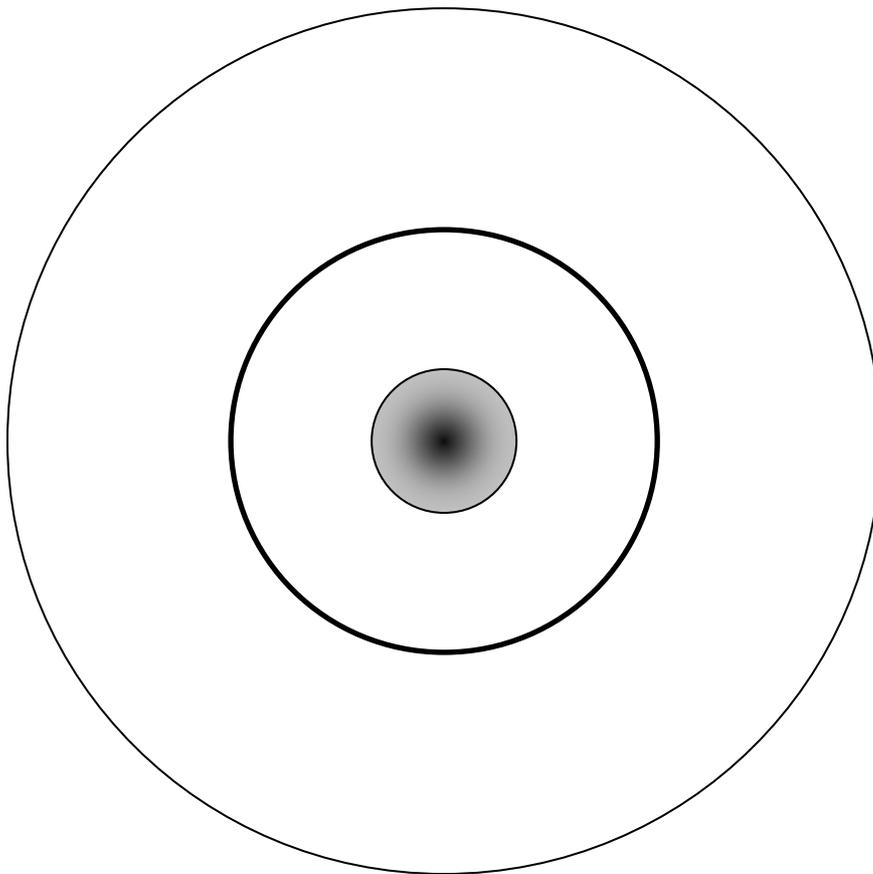


Figure 6: Engineer - The Shell Model



### QUESTION THREE: Linking UOW Attributes with Employer Attributes

Attribute Number	Rank (1-9)	Average Time (%) spent with that attribute	Importance (%) in potential employee
1 Learning			
2 Knowledge of Discipline			
3 Self Confidence Communication			
4 Teamwork			
5 Decisive			
6 Diversity			
7 Literacy esp. Computer			
8 Innovate Progress			
9 Responsibility			



## Appendix C – Study Plan

The following outlines the planned and actual objectives for the study. The suggested plan was based on the plan given at the beginning of the program. Variation from the plan can be accounted for by the need to fit in with employer and student timetables rather than any major problems or issues during the study.

Activities	Week 0	Week 1	Week 2	Week 3
Orientation				
Form Teams				
Plan Project				
Research Attributes				
Form list of potential Employers				
Determine Interview Format				
Approach Employers				
Interview Employers				
Interview Students				
Analyse Results				
Report Outline				
Prepare Written Report				
Prepare Poster				
Prepare Presentation				

Planned   
 Actual 