

## Defining Culture: The way we do things round here

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### Introduction

The call for “a culture change in engineering education, ultimately to extend throughout the profession” in the Australian Review of Engineering Education: *Changing the Culture*<sup>1</sup> threw a spotlight not only on the need for change but the need for change in the culture. In recommending a “more outward looking culture attuned to the real concerns of communities”, better communication skills, and political and social awareness, the Australian review echoed discussions occurring simultaneously in the UK, USA and Canada. Increasingly in the last five years, the term “culture” has entered the engineering education discourse and it seems implicitly understood that engineering education has a distinctive culture, recognizable to all its practitioners. The unitary and homogeneous nature of this culture is itself open to question, but engineering educators undoubtedly recognize practices and behaviors, that transcend differences in engineering specialization and institutions. The culture of academic engineering has been said to use the ‘sink or swim’ model of education<sup>2</sup> and most courses have in common features such as the immutable nature of curriculum content, little choice in selection of subjects, a mechanistic rather than holistic treatment, and a high emphasis on problem definition and solving within specific criteria - usually involving the appropriate application of mathematical equations<sup>3</sup>.

A perceived flaw in the calls for cultural change is the assumption that engineering educators are familiar with the theories and models of culture and cultural change, which have their origins in anthropology and sociology. Engineering educators are much less likely than social scientists to have common understandings of the relationship between the concept of culture and observable behaviors and practices. The Australian Review which highlighted a need to recognize “the differences between the values that underpin the existing culture and the espoused values to which it aspires”(p. 21) did not make clear what those current underlying values were and stated that it was “imperative to question implicit assumptions, priorities and practices (p.5). Before cultural change can be effected, I believe that a conceptual framework that is accessible to engineering educators is needed to define the current culture, how it is formed and maintained. In particular, I felt there was a need to be able to demonstrate how (or if) the espoused values and ideals of engineering education were manifested in the behaviors and practices that form the “lived experience” or enacted culture.

Culture has been described as “webs of significance”<sup>4</sup> and engineering education is influenced by multiple cultural configurations. As an academic discipline, engineering education takes place within the context of the wider university culture in which tacitly accepted theories of teaching and learning are derived from long-accepted practices of course delivery and assessment. Academic disciplines, described by Becher as academic tribes<sup>5</sup>, are acknowledged to have their own cultures “each with their own way of perceiving the world”.

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But engineering also provides training for a profession which can readily be viewed as an occupational community with its own unique work culture<sup>6</sup> and well established priorities and expectations<sup>7,8</sup>. A cultural study must therefore locate engineering education within the wider academic culture, but also acknowledge the strong influence of the profession. In addition a framework for studying the culture of engineering education must allow the possibility of specific national, local and organizational cultures.

### **Theoretical background to culture**

Schein's influential model of organizational culture<sup>9</sup> was used as a starting point in this study. In Schein's theory, culture exists on three levels: on the surface we find artifacts (the observable symbols, behaviors and practices), underneath these artifacts lie values and cultural norms, and at the deepest level lies a core of beliefs and assumptions. These basic beliefs and assumptions, which nurture and support the norms and values that members hold, are outside ordinary awareness and are often seen to be inaccessible to the consciousness.

The most accessible and visible elements of a culture, the artifacts, behaviors and practices, are viewed as furthest from the core of the culture. Viewed at a surface level these artifacts can be seen as just phenomena. It is when members of a group have a history of shared experience, and develop shared values and understandings which guide behaviors and practices that these phenomena have cultural significance. Schein believed that a cultural study required looking for an understanding of the shared beliefs, values and knowledge that guide and direct the observable practices, behaviors and other visible cultural manifestations.

### **The Case study: methodology and context**

This paper is part of a study that sought to make visible the shared values and understandings of engineering education that made up the culture of a multidisciplinary School of Engineering at a large, well established New Zealand university and, in so doing, develop a model that could be used to position specific cultures at the discipline or institutional level. A new degree structure and curriculum in 1996, which appeared to have foreshadowed many of the changes recommended in the literature of the time, combined with a changing gender and ethnic balance provided the impetus to research this local culture.

The case study institution had some unique features:

- A history that had resulted in a tradition of unity between departments
- A four year professional degree course with applications exceeding places necessitating selection on academic criteria at the first year level
- A high proportion of local students (approximately 50% at first year level) predominantly from Asia, who had lived in New Zealand for less than five years
- In 1998 when the majority of data was collected for this study there were 1344 undergraduate students associated with five departments - Chemical and Materials Engineering, Civil and Resource Engineering, Electrical and Electronic Engineering, Engineering Science and Mechanical Engineering
- A ten fold tuition fee increase for NZ resident students in the last 10 years
- A strong commitment to increase the participation of women in engineering with female participation approx. 20% in the undergraduate program for approximately five years. This was well above the 1996 Australian average of 13.8% and consistently higher than other New Zealand universities offering similar courses.

- Some subjects were taught across all disciplines and all subjects except the occasional elective were taught “in house”.

Discussing cultural studies of higher education Trowler <sup>10</sup> proposed that “an insider account based on multiple methods of data collection had the potential to not only uncover the meanings, understandings and intentions of the members of a culture, but give insight into the structural contexts in which they operate and the unintended consequences of their actions”. An interpretive case study methodology <sup>11</sup> was therefore chosen, aiming to collect rich, thick descriptive data.

The data used to build the proposed model, and provide evidence not only for the observed behaviors and practices, but for the interpretation of shared values and understandings were predominantly taken from taped interviews with 17 staff and 36 students and field note diaries compiled over 3 years (1997-99) of acting as a participant observer. As a participant–observer, my role as researcher was known to the institution and its members, but subordinate to my role as a participant. To ensure credibility, information was taken from many different points of view. Those known or liable to have distinctly different opinions and understandings of a topic were deliberately sought out by the researcher. Interview statements were able to be checked against my personal observations and a variety of records and documents.

As data collection progressed, and the quantity of data obtained from multiple sources grew, it was coded using inductive coding techniques suggested by Bogdan and Biklen <sup>12</sup> (page 156). Some data were clearly related to academic practices, such as rigid course structures and the high value placed on mathematics, and others related to social behaviors and practices both inside and outside the classroom, such as the heavy workloads, binge drinking and the importance of supportive relationships. From this coded data, and Schein’s framework as a starting point the proposed framework emerged.

### **Framework for Defining Culture**

Figure 1 is my proposed framework for analyzing and defining the culture of engineering education as exemplified in a particular institution. It is, in essence, a working model, liable to change and further refinement.

Schein and later researchers named the first level of culture, the observable and experienced manifestations of culture as artifacts, behaviors and practices and these have been used as the primary categories for analysis. In this framework artifacts are the visible, tangible manifestations and symbols of the culture such as publications, buildings, artworks, and dress.

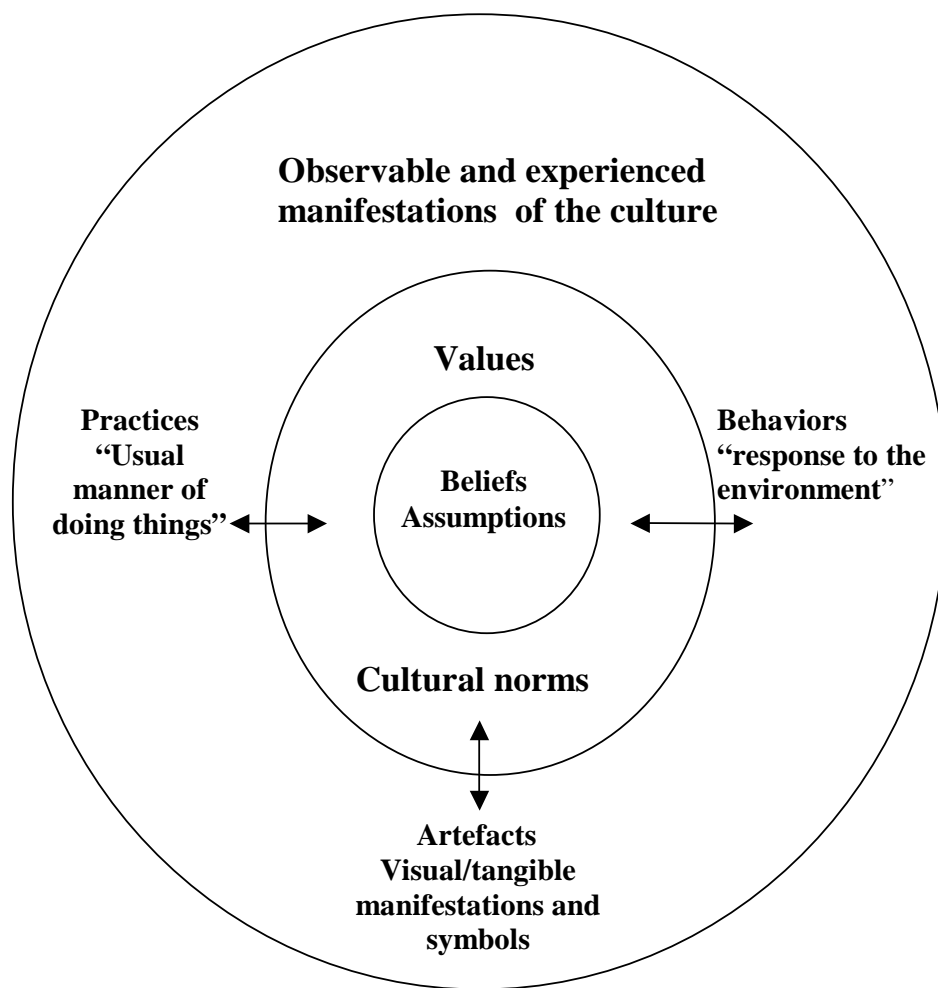
Behaviors and practices need a clear definition of their use in this study as they carry meanings which might be considered to overlap. A dictionary definition of “practice” is “the usual manner of doing something”, so I have used “practices” to refer to those aspects of the culture which might be said to represent “the way we do things round here”. Included under practices are sections on

- Pedagogy, the manifest practices by which teaching and learning occur, including the role of mathematics and design courses, the common first year curriculum, the inclusion of project based learning

- Rules systems and procedures, including assessment
- Rewards and sanctions, including promotion procedures
- Rituals and traditions, including graduation functions, the pub crawl ....
- Events , including orientation, social functions, faculty meetings...
- Interactions with the profession including Accreditation, industry sponsorship
- Interaction with the rest of the university

The goal of the analysis is not just to comment on how teaching and learning, or promotion or other practices take place, but to seek out the shared values and understandings that members of the culture have around those practices.

**Fig 1. A framework for analysing the culture of engineering education.**



Behaviors, using a definition from psychology are “observable responses (of human beings) as reactions to the outer environment”, which would include responses to other people, systems and procedures or in the terms of this study responses to the “practices”. Behaviors represent the “lived experience” or “enacted” aspect of the culture. In this category I have identified sections on

- Behaviors in the academic learning environment – which included workload, co-operation vs competition, classroom behavior and strategies for support
- Language – including humor, and the ways language reflected value systems either directly or indirectly, intentionally or unintentionally and its power to include or exclude from the culture
- Relationships – and their importance to academic and personal “success”
- Critical incidents – from time to time incidents occurred which brought responses which highlighted the values, beliefs and attitudes shared by the group.

In many instances, it seemed that the practices epitomized the formal delivery of the curriculum, whereas the behaviors had features that in much earlier literature had been named as the ‘hidden curriculum’<sup>13</sup>. These were the lived experiences, the informal learning that took place – of strategies, techniques, and relationships.

Each of these subheadings identified above, could be the subject of an investigation in itself, but time and space limit this discussion to choosing a subset of the whole to demonstrate how this framework could be used and I will use some of the visible tangible manifestations of the culture – the Artifacts .

### **Artifacts**

The term artifacts conjures up images of Pompeii and archeology. Rather than a few shards of pottery from which to deduce a culture, it is useful to imagine walking into your own institution as a stranger, looking at the building, the layout, the artworks and furnishings, and observing the people who belong there - age, race, dress. To gather further information you would look at publications, and perhaps in today’s world the website to get an impression of the culture. We instinctively know that the culture of an organization or group is not just these observable or experienced phenomena but how they are interpreted and valued.

The first level of analysis was to group my data into subheadings based on my observations, interview and questionnaire data and look for shared values and cultural norms with confirming evidence from as many data sources as possible.

### **Buildings and facilities**

The School of Engineering is part of the largest university in New Zealand, on a central city site on the top of a ridge with a main traffic route running through the middle. The School of



Engineering was housed in a building situated on a corner and across the road from the rest of the campus. The building itself, in common with other buildings constructed at the University in a period of rapid growth in the late 1960s was functional rather than aesthetically pleasing. A utilitarian building, it was dominated externally by grey concrete and glass, no grassy spaces, and the only outside open area between the buildings concreted and rarely sunlit. One staff

member described it as “*a fine example of the architectural style known as horizontal brutalism*”.

A graduate student commented

*When I first came..., we had two lectures a week on this side of the road. It always seemed like an impressive place, very efficient and very grey, a lot of concrete and big. My main impression was that it was efficient, there were set rooms, set corridors but I guess in comparison it wasn't as inviting as the rest of the campus*  
Kerry, Nov 1997

Entering the School of Engineering by the main entrance, the first impression of the foyer was bright, functional, well maintained and welcoming. The vinyl flooring and walls were in shades of blue and mauve, with the occasional greenery and a large number of tables with modern styled (but durable and bolted down) seating. The upgrading of the foyer in the late 1990s was not matched however in the rest of the building which was perceived by students as “*getting rundown*”, “*badly in need of a revamp*”, “*grey and sterile*” and “*far from stimulating*”.

“*When you are doing engineering you are isolated into the building*” and students and staff in engineering rarely needed to leave the complex of engineering buildings. Almost all teaching was done in-house, and labs, computer labs, workshops, a cafeteria, and library were all contained within the School complex. Although expansion of student numbers had put very tight constraints on available space, the academic staff responsible for timetabling classes put a high priority on keeping classes within the School buildings, and only looked for alternate teaching space as a last resort. This desire to keep classes on-site resulted, for example, in a deliberate choice to split the first year classes into two streams, rather than transfer those classes to a much larger lecture theatre “*across the road*”.

From my experience, this situation was unusual for a large, interdisciplinary School of Engineering, the usual experience being that some engineering departments were housed separately. Suggestions from the central university administration to relocate parts of the School of Engineering have been strongly resisted, with an overwhelming majority of staff affirming (in an e-mail survey, and at a specially called Faculty meeting) their desire to keep the School together. As a result, both formal and informal contact between the different disciplines occurred regularly and allowed for the formation of close interactions and an overall identification with the School of Engineering rather than individual engineering disciplines.

The isolation from the rest of the university was a perception rather than a physical reality of distance, but a very common one with students and staff. Only one road's width separated the buildings from the main campus student gathering places, but going “*across the road*” had a symbolism, all of its own.

*It's almost like we're proud of not going to the rest of the university –across the road - we say “Ooh, I'm, crossing the road” as if it is sort of shameful.....*  
Karol

*it was as much we were isolating ourselves as people were isolating us ..... because of the workload a lot of the time you would spend in the engineering library, you were isolated anyway and there wasn't really time to go and mingle over the other side.*  
Pedro

*we are here in grand isolation on this corner – the Dean is concerned to get students mixing around but I don't think they go anywhere and I don't think the staff do either*  
SStaff3

Four years of close proximity with one building and its association with friendships and shared experiences provided quite positive nostalgic memories for the majority of students interviewed and surveyed.

*I love coming in the engineering school. I feel at home there and I love the way it has the name School of Engineering written above the door*

*Geetha*

*What I liked best about the School of Engineering was..*

*Everything we needed was under one roof*

*It was separate from the rest of campus*

*It has its own establishment*

*Questionnaire F27*

*Questionnaire M16*

*Questionnaire M4*

Any discussion with staff facilities and gathering places for staff inevitably brought comments about the Staff common room which held a symbolic role in the life of the School. When staff spoke about the integrated nature of the school culture, it was common for them to take as an example the 12<sup>th</sup> floor Common Room, where all staff could meet and mingle over tea, coffer or lunch.

*“One of the major strengths of the School is the large amount of inter-departmental interaction, cooperation and activity.....The provision of one common room for the whole school is both an outward symbol and a cause of these linkages; effective interaction between faculty members comes not from planning but from friendships and informal conversations where shared academic interests are discovered and intellectual cross-fertilisation occurs.*

*Dean, Nov 1998<sup>14</sup>*

*Our tea room, the common room - a very strong point – many visitors who come here make that comment. We are able to be housed together, that is a distinct advantage*

*HOD2, 14/1/98*

The comfortable chairs were arranged in rough circles around low coffee tables, with a couple of larger tables and chairs at either end of the room. Traditionally, staff brought their tea or coffee to the circle which was not yet filled, and only sat separately if they wished to concentrate on some reading, or have a private conversation. The room commanded a magnificent view of the harbour and an opportunity was always found to bring visitors to the common room.

Closer examination of the way this room was used, made the ‘unifying’ role of the Common room seem more of a myth than a reality. For a variety of reasons which might include: changing patterns of working, the increased time pressures on staff, personalities who have known each other for many years, some dominant staff personalities, the numbers of staff who regularly used the common room at morning or afternoon tea times had dropped markedly over the last ten years. Out of an academic staff of 100 it was rare to find more than 20 in the room at any one time, and it was common to see staff come in, make a drink, and take it back to their room..

*Over time a smaller and smaller fraction of the staff use the common room. Some people have quite regular habits - common room did provide at one time an inclusive forum for debating issues. Now it is a selective subgroup*

*SStaff1, Jan98*

I observed that comments such as this usually came from senior staff who had memories of a more leisurely time, when a common lunchhour was timetabled, and 10.30am was morning tea time. I saw the room currently used from early morning until early evening, but in a range of ways other than the traditional. The nature of its use was more like a ‘drop in’ room with staff using the room as an alternative to their offices, away from distractions of phone or students, and small groups often met for work related discussions, including graduate students meeting with supervisors or research and teaching teams discussing current projects. Despite its changing use, I observed a strong loyalty to the common room’s existence as a shared place where staff from all departments could meet.

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The building and facilities and the way staff and students perceived them, suggested the following values and cultural norms:

The strong desire to keep engineering in one building demonstrated that

- Identity as engineers and cohesion as a School was strongly valued

The perception of isolation from the rest of the university reinforced that

- Engineering saw itself as having a separate identity
- Building was valued as a familiar place that epitomised “belonging”

Although its role was changing, the 12<sup>th</sup> floor common room epitomised the

- valuing of an integrated interdisciplinary School

### **Artworks and memorabilia**

Artworks and memorabilia are often features of past eras but they have the potential to provide visual signals of cultural values. My observation particularly in comparison to other faculties on campus and the lack of spontaneous comments from any staff or students, led me to conclude that artworks were not a priority in the School of Engineering. Those that were visible could be classified into three groups.

Firstly, there were a large number of visible commemorations of technical achievements and engineering works. These included photographic enlargements of engineering works, such as the progressive construction of a hydroelectric dam, or an oil refinery, and a very recent, high quality color print of the Des Britain motorbike.

Secondly, walls of corridors often contained posters originally prepared for conferences, student project presentations, or displays from previous Open Days which commemorated the research, and work done by staff and students.

Thirdly, a series of photographs of “heroes” such as the eight graduates who had become Rhodes scholars and the previous Deans of the School were displayed in the Dean’s suite. As a woman, I quickly recognised these as “men in grey suits”, but as the Dean of the time said to me when I remarked on the dominant images of masculinity “*Well, they were men, what do you expect?*”. Modern heroes such the alumni involved in the America’s Cup triumphs, or the current students who have won prestigious design competitions were surprisingly not commemorated.

There was no Honours Board, commemorating scholastic excellence, and the list of Presidents of the Engineering Students Society displayed in the foyer was several years out of date (last engraved in 1990). Although a book has been written on the history of the school, there were no memorabilia or reminders of a quite unique history on display except for a plaque just inside the front door which commemorates the founding of the School of Engineering in 1923.

As one senior staff member commented:

*There is no sense of institutional pride. No photographs, displays, roll of honour board, list of long serving staff - this building doesn't ooze any collective experience.*

SStaff1



It is necessary to be careful of jumping to conclusions, in looking for cultural artifacts. My observation after discussions with staff members, was that more works of art and commemorative memorabilia would be “*a good idea*”, and were not absent due to lack of pride, but because no staff member had the responsibility for such projects, and amidst other pressures they did not happen. It was evident that to the majority of engineering staff, appreciation of beauty and art had been focused on creativity and excellence of innovation, in engineering solutions. Although the phrase “function over form” was expressed several times by students and staff as an engineering way of thinking, there was an appreciation of symmetry, and flowing lines, that valued an engineering solution that was not only performing the task it was designed for in an optimal fashion but also had an elusive, indefinable quality of beauty to the engineering eye.

### **Emblems or logo**

All letterhead and publications included the University crest which was a traditional heraldic crest with a Latin motto “*Ingenio et labore*”, but in recent years several attempts at designing an Engineering specific logo had been proposed. Redesigning the website provided a suitable opportunity and in 2000 a logo was approved that incorporated a toothed wheel running into the ‘koru’ pattern of an unfolding fern frond (a New Zealand symbol of growth and potential). This logo is being used on the website and printed material incorporating a variety of pictorial images. It is too soon to predict whether this will become a cultural artifact but it could well become a symbol of the School’s values and goals if members of the culture develop shared understandings of what it represents and identify with it.

### **Dress**

Engineering jokes implying that engineers have no dress sense or sense of style abound on websites and as cartoons. In this institution engineering students and staff were not preoccupied with either high fashion or imaginative dress, it was not a priority in busy lives that focussed on action.

For students, the emphasis was on casual practicality, with T shirts or sweat shirts and jeans the most common dress. Students recognized appropriate occasions for more formal wear, such as scholarship interviews, where smart casual wear was the norm, and for final year project presentations to which industry was invited, where for male students a suit or at least a shirt and tie was usual. Both students and staff appreciated these opportunities for “dressing up” and it was with pride that staff commented on how well the students “scrub up”.

*There is a dress standard. Although I would say that this has changed quite a bit while I’ve been here. ....The dress standard is pretty relaxed, but there are different rules for different people..... It’s ok to dress up (particularly if you have work - which is more common than just a few years ago) but it’s not ok to dress sexy. ....The usual dress code for engineers is jeans or tracksuit pants, shorts and t shirts. Skirts are also fine. It depends a lot on the personality of the wearer, if the person is seen to be pretentious then they would be more likely to be criticised for wearing label clothing - but again it wouldn’t be something that lots of engineers would comment on*  
Trish, 4<sup>th</sup> year student, 1998

The majority of older staff were conservative in their dress, with casual wear in the holidays but a shirt and tie more common when the semester and student contact via lectures started. A predominantly younger group of staff were more casual in their dress, with open necked shirts and collared knit shirts their normal dress. Jeans were not uncommon with this group of

staff. Staff recognized that dress could be used to differentiate them from students and assert authority.

*Formality has certainly got more casual over time. Little more casual than I feel comfortable about I must admit. I shall wear a tie come Monday. For me it is normal, but not for the School. I am happy to be on very good terms with students but it doesn't help them to pretend to be equals* SSStaff1  
*I usually wear a shirt and tie when lecturing - helps maintain an air of authority. I noticed R... starting wearing shirt and tie when he had some discipline problems* JStaff1  
*Not too sure if wearing a tie for lectures is standard, a quite large core who do put on a tie for lectures – but there are dozens of other people who don't – almost bimodal – very little cross over between...* SSStaff6

In contrast to other faculties and departments on campus, I observed the prevalence of T-shirts or similar items of clothing that identified students as engineers. A T shirt was created for everything, often with costs subsidized by the Engineering Student Society – pub crawl participation, Round-the-Bays Run participation, membership of the Engineering Student Society, the Women in Engineering Network, separate engineering departments....

Several T shirts epitomized values and attitudes that students might have around their engineering education. One of the most memorable, and repeated over several years with minor variations, was the 'Super E' T shirt. Modelled on the Superman logo, in the same colors, the Big S was replaced by a big E. To me this design reflected the pride, superiority and sense of belonging that engineering students had. This T shirt was worn any day or any time, but particularly when groups of students wished to be identified as engineers such as when they visited a school, or had an organised water fight against the business students.

In recent years, the "clever" adaptation of company logos such as that for Steinlager beer, or Lotto (became blotto), had been favored. In America's Cup year, the School T shirt was a collared, short sleeved shirt that was a very close imitation of the expensive Team NZ shirts, with each sponsor's name humorously amended. These 'clever' T shirts, relying often on double meanings, puns, and in-house humor had gradually replaced the T shirts of previous years some of which had been seen as offensive usually because of scatological or sexist humor. The "bloke" or "lad" element within the student body, seemed to surge to the fore from time to time, with particularly offensive graphics. Notable in the late 1990s, when this case study was carried out, was a lack of approval and condoning of behavior which might in previous years have been viewed as "Boys will be boys".

*We have had a few T shirts which annoyed me I mean some of the T shirts aren't the best, I don't think that is right, women or non women, I just don't think that is right. .... heard a few days later that (Assoc Dean) got on to him, and said stay away if he wanted to wear the T shirt.* Jstaff3

While the School of Engineering did not put students into a uniform, the students themselves chose a form of dress which provided a homogeneity within the group, a sense of "uniformity amongst diversity". The engineering T shirts with their logos and graphics provided strong images, and an implied sense of belonging which carried with it a status, identity and loyalty to engineering. Acknowledging that student T shirt designs ranged from offensive, to witty, to cleverly perceptive, they clearly showed the range of understandings their designers had around the study of engineering and provided a way of gauging the current students' values and attitudes.

The visual manifestation of culture in the form of dress provided information about cultural values and norms which I have interpreted as

- Dress and style are not high priorities for engineering students and staff
- Dressing more formally is recognized as a signal of professionalism and authority
- Offensive imagery on clothing was not condoned
- The prevalence of T shirts with engineering logos symbolized the students' valuing of "uniformity amidst diversity", "belonging" and "engineering identity"

## Mission statements

Mission statements have become part of the wider university culture in recent years. Their value is that ideally they would be discussed and debated, so that they can embody shared values and imply commitment without reservation. Mission statements provide evidence of the espoused values of the group without commitment to specific actions which comes later at the strategic planning stage.

The School Engineering is located within a large university community and the values and goals of the wider university in turn inevitably shape those of its faculties through rewards and sanctions, budgetary prioritization and other measures. The University has as its Mission 2001 statement<sup>14</sup>

*"To enhance the position of The University of Auckland as a university of high international standing, recognized for excellence in teaching, research and administration, innovative contribution to the advancement of knowledge, and service to its local, national and international communities."*

Excellence in teaching and learning is to be achieved by strategies such as *"providing a student-focussed teaching and learning environment which encourages academic excellence, enjoyment of learning, critical reasoning and inquiry..."*

The School of Engineering unexpectedly had no individual Mission statement or overall Strategic Plan. The current pace of change, particularly in higher education funding, and overwhelming need for budgetary and resource planning appear to have put discussion on long term planning as a lower priority. For academic staff involved in management the perception of an ever increasing "mountain of paperwork and reports" have left them with a sense of "fighting fires", reacting to crises and day to day needs, rather than planning and "lighting fires".

*What happened when we discussed the new course – there were deadlines for agreement and faculty approval in order to move on, so had just enough of this debate to keep this moving.....  
Not sure of whether we have thought about the culture we are trying to create to make it stimulating, challenging etc.....don't think the school has ever seriously thought through that. – that is why the debate over the new curriculum was so diverse, hadn't identified key elements as a faculty – hadn't articulated what we had to achieve –*  
SStaff1, Jan 98

A change of leadership in 1998 did provide a "Vision for the future" document which included maintaining the perceived position as the "pre-eminent engineering school in New Zealand"<sup>15</sup>. The measure of success was seen as embedded in the School's reputation – both nationally and internationally in the areas of teaching, research and community service. Of these, the new Dean saw teaching as the most important – with the total impact on society of literally thousands of graduates practising engineering and/or doing research.

The Dean made special mention of the importance of the student culture of the school including social life, workload, friendships, interaction with lecturers and the overall “friendliness” of the place. A manifestation of the value he placed on this aspect was the formation of a Faculty committee “Student Issues Committee” with staff and student representation that has addressed both academic and social issues. To reinforce this commitment, the committee has also been the route for providing funding and resourcing assistance to a wide variety of student groups.

The “Vision” document was not debated in a wider forum and converted into a formal Mission statement and Strategic Plan, and if the values and vision expressed are to become shared and part of the institutional culture this will be needed.

Of particular interest to this cultural study will be to examine whether the espoused values proclaimed by the wider university and the School of Engineering are matched in the reality of the manifested day to day practices and behaviors of the enacted culture.

### **Curriculum/degree structure**

Formal statements of curriculum and degree structure, their emphases and balances are the prime vehicle for conveying an institution’s educational purposes. Subtle inclusions and exclusions provide clues to the goals and priorities of an individual institution but they cannot provide information about hidden factors such as administrative expediency or the teaching range within staff. In addition, they cannot convey the lived experience of how that curriculum is delivered in practice - but as publicly available documents they provide information about what is intended and espoused as valued.

Features of the degree structure introduced in 1996 were:

- A common first-year program with its solid foundation of engineering science fundamentals and emphasis on context and real life engineering applications.
- Requirement that courses include project based learning wherever possible, in each year of the degree
- Design courses in each discipline at each level of the degree
- A common core of courses that prepare graduates for professional life, such as Engineering Management, and Professional and Community Issues
- The common core included a course on Environmental Principles which emphasized sustainability and social responsibility to all engineering students in Part I, and a course entitled Human Social and Cultural Development for all students in Part II.
- A broad range of interdisciplinary study opportunities through the conjoint degrees, BA/BE, BCom/BE, BE/BProp and BE/BSc.

All of the engineering degree specializations are professionally recognized by the Institution of Professional Engineers New Zealand which provides international recognition as a signatory to the Washington Accord. Providing the “in-depth core of scientific and technical skills” to meet internationally accepted standards resulted in the curriculum and content of engineering degrees containing a large compulsory component of “*the coherent body of knowledge related to a particular branch of engineering*”<sup>7</sup> The compulsory nature of much of the program was a direct consequence of this need for professional acceptance, but this was not always well understood by students.

*I have really disliked how inflexible the course was. How little opportunity I had to make it what I wanted*  
Richard, E&E, Part IV

One of the goals of the new degree structure was to reduce teaching contact hours (and by implication content) so as to ensure more opportunities for self directed and project based learning. The high value placed on what was viewed as the essential body of knowledge in a discipline made this reduction in teaching hours a problematic issue.

*Everybody feels that his ( usually his) particular academic area is fundamental to the core of engineering and will not cut anything out of it at all, they tend in fact to pile more knowledge in as more knowledge comes – they squash it more together and not cut anything out.*

SStaff3, Sept 2000

Even the students had assimilated the idea that the content was of high value

*I feel there is so much to learn in engineering - what can they replace, there is so much information to pass onto the students, what could you leave out, if you replace one of the parts they would lose out on the information in that paper*  
Mei, E&E, Part IV

The degree structure and curriculum manifested the following shared values and cultural norms:

- The curriculum values the view that engineers must not only have technical knowledge but be socially and environmentally responsible with good communication skills
- A broad base in engineering fundamentals is valued and provided by the common Part I course
- Each discipline valued a core body of knowledge as essential to its particular branch of engineering
- the majority of courses within the engineering degree program are compulsory with little flexibility possible
- Preparing students for professional life was made explicit in the curriculum by a common core of courses running through the degree,

Other artifacts:

I have dealt here with some of the most visible, accessible manifestations of the culture. Each is worthy of closer examination in finer detail, and the list is by no means complete. I have, for example, not dealt with publications, but the images an institution presents of itself in publications both in the text and in photographic images provide valuable insights into the context in which the culture is formed and maintained.

The people who make up the staff and student bodies, their homogeneity or diversity will be indications of the likelihood of shared personal values and behaviors.

*The first days - Big, number of people,..... the mish mash of different faces, ... first year has people from all different origins, very diverse – that was really interesting – that was the most noticeable, the number and the diversity*  
Angus, First year, Oct 98

For this reason I have included the size and composition of staff and student bodies, available as statistics, in the list of artifacts

## Conclusions

This paper has only exposed the tip of the iceberg that makes up the complex picture of the culture of engineering education as evidenced in one institution. Just as the majority of the iceberg lies under the surface and is not immediately observable, so also is the true core of culture.

The proposed framework is offered as a pathway for defining the culture of engineering education as exemplified within a specific institution or department. To demonstrate the use of the framework I have identified values and cultural norms from some of the visible and tangible manifestations of the culture of one institution. Even in this limited sample some values and cultural norms were repeatedly manifested in different situations. As the data analysis grows to include the Behaviors and Practices this repetition of core values is likely to grow. It is expected that the final stage of the analysis, which will not be explored in this paper will be to synthesize the various values and norms and from them identify the shared beliefs and assumptions that are the essence of the culture.

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