International Collaboration on a Professional Development Course

Dr. Glen F Koorey, ViaStrada Ltd.

Glen recently rejoined consultancy with ViaStrada Ltd, after 12 years as a Senior Lecturer in Transportation in the Department of Civil and Natural Resources Engineering at the University of Canterbury. Prior to joining Canterbury in 2004, he worked for 10 years as a transportation engineer and traffic researcher for Opus International Consultants. Glen's wide-ranging experience includes considerable research and consulting work on road safety modelling, pedestrian/cycle planning & design, speed management, crash analysis, and the design and operation of rural two-lane highways. At Canterbury, Glen taught professional design project courses since 2006 and also delivered oral and written presentation skills to students for many years. Since 2013 he was responsible for the introduction of a new professional engineering skills course to final-year BE students.

Mark W. Milke P.E., University of Canterbury

Mark Milke is a Professor in the Department of Civil and Natural Resources Engineering, University of Canterbury, in Christchurch, New Zealand. Since 1991 he has taught and conducted research there on solid waste management, design for civil and natural resources engineers, engineering decision-making, professional engineering development and other topics in civil and environmental engineering. He was an Associate Editor for the international research journal Waste Management from 2003-2009, and has been Associate Editor for Civil Engineering and Environmental Systems since 2014. He has a BSc from Harvey Mudd College, a MSc from Univ. Wisconsin—Madison, and a PhD from Carnegie Mellon University, and he is a New Zealand Chartered Professional Engineer. From 2009-2015 he has led the curriculum review process in his department, and has been a leader in curriculum innovations by developing new courses in engineering design, communication skills portfolio, and professional engineering development.

Dr. Norb Delatte P.E., Cleveland State University

Dr. Norbert J. Delatte, Jr., P.E., is Professor and Chair of the Department of Civil and Environmental Engineering at Cleveland State University. He is the author of Beyond Failure: Forensic Case Studies for Civil Engineers (ASCE Press, 2009). In addition, he is the Editor of ASCE's Journal of Professional Issues in Engineering Education and Practice. Dr. Delatte is a registered professional engineer in the States of Ohio and Alabama and in the Commonwealth of Virginia.

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Abstract

A 4th year course entitled "Professional Engineering Development" has been offered for the past few years at the University of Canterbury in New Zealand. The course is required for students in the civil engineering and natural resources engineering bachelors' degree programs. The course was developed based on input from the Institution of Professional Engineers New Zealand (IPENZ). Unlike in the U.S., an engineering degree in New Zealand does not require a substantial general education component. Course topics include engineering history, investigation of failure cases, teamwork, ethics, risk management, and engineering today and tomorrow. This paper details the development of the course to date and its associated assessments, and discusses lessons learnt in teaching professional engineering skills in this format. It also compares trends in education on professional development in New Zealand and in the U.S. During July and August 2015, the third author, a visiting Erskine scholar from the U.S. taught part of the course, offering the opportunity to compare and contrast teaching professional development in the two countries. While the requirement for a robust general education curriculum at U.S. universities should theoretically provide an advantage for U.S. students over New Zealanders with respect to professional development topics, that wasn't really borne out in this case. The New Zealand professional development course discussed in this paper might be a good model for institutions in the U.S. and elsewhere to consider. However, it does bring its own challenges to be addressed, particularly student acceptance of the need to learn these "non-technical" skills.

Introduction

A 4th year course entitled "Professional Engineering Development" has been offered for the past few years at the University of Canterbury in New Zealand. The course is required for students in the civil engineering and natural resources engineering bachelors' degree programs. The course was developed based on input from the Institution of Professional Engineers New Zealand (IPENZ). Unlike in the U.S., an engineering degree in New Zealand does not require a substantial general education component. Course topics include engineering history, investigation of failure cases, teamwork, ethics, risk management, and engineering today and tomorrow. During July and August 2015, a visiting Erskine scholar from the U.S. taught part of the course, offering the opportunity to compare and contrast teaching professional development in the two countries.

Initial Course Development

In 2013, as part of a review of the undergraduate curriculum, the Department of Civil and Natural Resources Engineering introduced a new compulsory (or required) final (4th) year course to their BE(Hons) programme. The course, ENCN470, had a stated aim to "further develop and refine students' professional engineering skills, using Civil and Natural Resources Engineering projects and issues for context." The course included consideration of topics such as risk management (identified as an important issue by the Department's Industry Liaison Board), systems thinking, the engineer in society, and engineering ethics, as well as continuing to develop students' skills in teamwork and communications (previously discussed elsewhere[1]).

IPENZ, in its regular accreditation of the University of Canterbury's engineering programme, had identified the need for these "non-technical" attributes of professional engineering to be better covered in the undergraduate curriculum. The last IPENZ accreditation was in 2013. The review before that (2007) noted the need for more and better teaching of non-technical attributes. Although some of these topics had previously been presented elsewhere in the old curriculum, they tended to be subservient to the technical content of the courses; thus it was possible to pass without demonstrating mastery of them. This new course allowed these topics to be the core component of the final assessment[2].

Comparison of US and NZ Professional Development Requirements

In the United States, there are a number of documents that address the professional education component of the civil engineering curriculum. First and foremost, perhaps, are the accreditation criteria of ABET, Inc. that apply to all engineering programs. These include a requirement for professional and ethical issues under criterion 3, student outcomes[3].

Further insight into the professional and ethical issues specific to civil engineering are addressed in the American Society of Civil Engineers (ASCE) Code of Ethics[4]. More detailed information is provided in the ASCE 2nd Edition Body of Knowledge (BOK2)[5].

The issue of civil engineering education and general education, or more specifically the humanities and social science, is addressed the BOK2 appendix K[5]. There have been several recent (and not so recent) ASEE annual conference papers on the topics of incorporation of humanities/social sciences in curricula and professional development requirements for students, as well as on addressing professional practice issues within the curriculum[6, 7, 8, 9, 10, 11]. There appears to be agreement that the professional development requirements for engineers cannot be left to the rest of the university, and either need to be addressed through a separate course within the college or department, or integrated as modules through other courses.

In New Zealand, the Professional Development Requirements are dictated by IPENZ[12]. These requirements formed the basis for the development of the ENCN470 course. IPENZ performs more or less the same functions as both ABET and ASCE for New Zealand with respect to civil and natural resource engineering programs.

At this time, IPENZ does not expect the level of assessment rigor that is currently required by ABET. IPENZ would look at the competencies, look up which courses the program states they are covered in, then go to the assessment items for that course. The program staff provide three samples for each assessment item—one barely pass, one average, one near the top of the class. IPENZ looks at these and checks how well they think the student work demonstrates the competency and also if the pass/fail bar has been set appropriately.

The course syllabus for ENCN470 states: *"Much of a professional engineer's work relies less on the "technical" skills and knowledge developed at university and more on the "professional"* *competencies in which that technical knowledge is applied. This is reflected in the Competency Profiles developed by IPENZ for graduate engineers; it includes the following items:*

- *Investigation and Research*
- *Risk Management*
- *Teamwork*
- *Communication*
- *The Engineer and Society"*

The IPENZ Competency Profiles map well with some of the ABET Criterion 3 a – k Student Outcomes as well as with the ASCE 2nd Edition Body of Knowledge (BOK) outcomes with respect to professional development, as shown in Table 1. Whereas ABET does not provide any additional explanation on the Criterion 3 a – k student outcomes, the ASCE 2nd Edition BOK provides considerable detail. IPENZ provides additional detail as well, with a number of explanatory bullet points under each of the 12 competency profiles.

Table 1: Comparison of ABET Student Outcomes, ASCE BOK2 Outcomes, and IPENZ Competency Profiles

ABET Student Outcome[3]	ASCE BOK2 Outcome[5]	IPENZ Competency Profile[12]
(f) an understanding of professional and ethical responsibility	Professional and ethical responsibility	Conduct engineering activities to an ethical standard at least equivalent to the relevant code of ethical conduct
(g) an ability to communicate effectively	Communication	Communicate clearly with other engineers and others that he or she is likely to deal with in the course of his or her professional engineering activities
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	Humanities, Social sciences, Globalization	Recognise the reasonably foreseeable social, cultural and environmental effects of professional engineering activities generally
(i) a recognition of the need for, and an ability to engage in life-long learning	Lifelong learning	Maintain the currency of his or her professional engineering knowledge and skills
(j) a knowledge of contemporary issues	Humanities, Social sciences, Globalization, Contemporary Issues and Historical Perspectives	

For example, under IPENZ competency profile 8, "Conduct engineering activities to an ethical standard at least equivalent to the relevant code of ethical conduct:" the bullet points are:

- *"Understands IPENZ and/or CPEng codes of ethics*
- *Behaves in accordance with the relevant code of ethics even in difficult circumstances (includes demonstrating an awareness of limits of capability; acting with integrity and honesty and demonstrating self management)*
- *Informs decision makers of significant consequences from not following advice (e.g., relating to risks, safety etc.)"*[12]

And under competency profile 9, "Recognise the reasonably foreseeable social, cultural and environmental effects of professional engineering activities generally" the bullet points are:

- *"Considers long term issues and impact(s) of own engineering activities, such as use of materials, waste during fabrication/construction, energy efficiency during use, obsolescence and end-of-life issues.*
- *Considers and takes into account possible social, cultural and environmental impacts and consults where appropriate*
- *Considers Treaty of Waitangi implications and consults accordingly*
- *Recognises impact and long-term effects of engineering activities on the environment*
- *Recognises foreseeable effects and where practicable seeks to reduce adverse effects"* [12]

The only thing here that is not more or less a universal civil engineering professional practice issue it the reference to the New Zealand Treaty of Waitangi, which addresses requirements to consult with the indigenous Maori peoples in the area of the project.

At ABET accredited universities, there is an additional requirement for a general education component. This is expressed under ABET criterion 5(c) as "a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives."[3] General education is also addressed under the ASCE BOK2, under Outcome 3 Humanities and Outcome 4 Social Sciences.

In practice, in the United States, this requirement is somewhat redundant for most universities, which already have in place a robust general education requirement, typically about 25 % of the curriculum or so. At the third author's home institution, two courses each in humanities and social sciences are required, along with two more in diversity, in addition to the general education courses in writing, mathematics, and science that we would want engineering students to take anyway.

Theoretically, then, professional development at a U.S. university would be easier to achieve, since it would be built on a sound general education foundation. In practice, that is rarely the case. Students, and often faculty, fail to make the connection between general education and engineering professional development[7].

Failure Case Study Focus

An underlying theme for a large part of the ENCN470 course is the concept of "learning from experience". Noting that the students are still relatively limited in their own experience of the engineering industry, the intention is to instead draw on lessons learned from other engineers' experiences (successful or otherwise), via case studies, guest lecturers, and the students' own investigations. The emphasis was placed on developing students' skills in reflection cycles: do → reflect → plan → do. Some assignments emphasized one step in the cycle, while the failure case study focus allowed students to move multiple times through the cycle. Previous research has suggested that the study of failures provides an excellent way to investigate professional development issues[13, 14].

A major component of the course, then, was a final group failure case study project. Students had to select a notable engineering failure from the last century or so, selected from a list provided, and thoroughly discuss technical as well as non-technical aspects. The list for the 2015 course offering is shown in Table 2.

In addition to well-known landmark cases that would be found in many references[13] there are some cases specific to New Zealand. As is often the case, many of these cases led to major changes in industry practice. For example, the New Zealand design provisions for buildings in earthquakes, first developed in 1935, were a direct response to the lessons of the 1931 Napier earthquake.[2]

Each student selected six preferred cases from the list. Then, based on the student selections, teams of four or five students were assembled. The student groups prepared final reports and brief, ten minute presentations. Each group was to address:

- Concisely describe the entity/project in question and the circumstances leading to the failure(s). What were the roles of the various people and organisations involved?
- Analyse the risk management of the project. What were the risks inherent in the project? Were the risks acknowledged and managed properly?
- Analyse the teamwork and communication issues in the case and comment on what contribution they might have towards the failure.
- Identify any potential ethical issues that may have arisen before, during or after the failure(s). How might events have been different if certain ethical decisions had been made differently? (e.g. if participants had followed IPENZ's Code of Ethics)
- Consider the regulatory environment that was present before or during the failure(s). How might events have been different if the entity/project was operating under present day legislation/regulations in New Zealand?
- From the above analysis, what do you feel were the underlying causes or contributory factors behind the failure(s)?
- If you were undertaking a formal inquiry into this failure, what would you be recommending to try to prevent a similar type of failure from happening again? What lessons are there to learn for engineering entities/projects in general? How do these recommendations compare with what actually happened after the failure(s)? Note: These recommendations could include regulatory changes or changes to engineering practices/processes (both technical and non-technical).
- What were the likely effects/implications of this failure and its subsequent aftermath on society in general? What were the likely effects/implications for engineers and their relationship to society?

Table 2: Project Case Studies Available for Student Selection (Date)

1	Mapua Contaminated Site Clean-up, Nelson (1990's-)
2	ICI Riverview Chemical Plant Fire, Auckland (1984)
3	Levin Landfill, Horowhenua (1950's-2000's)
4	Lake Manapouri Power Scheme (1960's-70's)
5	Project Aqua, North Otago (2003-04)
6	Greymouth Floods, West Coast (1988)
7	Opuha Dam Breach, South Canterbury (1997)
8	Whaeo Canal Failure, Bay of Plenty (1982)
9	Matahina Dam, Bay of Plenty (1967-87)
10	Ruahihi Canal Failure, Bay of Plenty (1981)
11	Malpasset Arch Dam, France (1959)
12	Abbotsford Slip, Dunedin (1979)
13	Eschede Hi-Speed Train Disaster, Germany (1998)
14	Sydney Cross City Tunnel Toll Road, NSW (2000's)
15	Stringfellow Acid Pits, USA (1980)
16	Central Artery/Tunnel Project, Boston (1991-2007)
17	Tamahere Coolstore Fire/Explosion, Waikato (2008)
18	Ballantyne's Fire, Christchurch (1947)
19	Napier Earthquake Fire (1931)
20	Auckland Grand Hotel Fire (1901)
21	South Rangitikei Rail Bridge Collapse (1975)
22	Whangaehu River Bridge, Tangiwai (1953)
23	West Gate Bridge, Melbourne (1970)
24	Wairoa Bridge, Hawkes Bay – Cyclone Bola (1988)
25	Turakina Tunnels, Wanganui, (1940s)
26	Kaimai Tunnel collapse, Bay of Plenty (1970)
27	Stadium Southland collapse, Invercargill (2010)
28	Cave Creek platform, West Coast (1995)
29	Seymour Recycling Facility, USA (1980)
30	World Trade Center, New York (2001)
31	Auckland Power Failures/Blackouts (1998)
32	I-35W Mississippi Bridge, Minneapolis (2007)
33	Charles de Gaulle Airport Terminal 2E, Paris (2004)
34	King Dome Failure, Seattle (1994)
35	Silver Bridge collapse, Point Pleasant, Ohio (1967)
36	Love Canal contamination, Niagara Falls (1953-78)
37	Southerner level crossing collision, Rolleston (1993)
38	Strongman Mine, Greymouth (1967)
39	N. Battleford, Saskatch. Water Treatment Failure (Crypto. Outbreak), Canada (2001)
40	Auckland Water Shortages (1994-5)
41	L'Ambiance Plaza Collapse, USA (1987)
42	King St. Bridge, Melbourne, Aust. (1962)
43	Burnaby Supermarket Parking Deck, Canada (1988)
44	Sampoong Superstore, Rep. of Korea (1995)
45	North Sea Floods, Netherlands (1953)
46	Rana Plaza Building Collapse, Bangladesh (2013)
47	Fukushima Nuclear Plant, Japan (2011)

2013 and 2014 Course Offerings

The course is team taught, with 3-4 instructors each teaching approximately equal parts of the course material, and one being the overall course coordinator. It includes modules on engineering history, engineering failures, engineering leadership and teamwork, and engineering ethics. Guest speakers are invited in to complement the faculty. The course includes a group project described above, a number of small reflective individual assignments, and a final exam.

An interesting aspect of the module on ethics is the use of a “structured controversy” workshop exercise. As part of this exercise, students are assigned to represent one of four stakeholders (developer, nature advocate, consulting engineer, and regional council officer) at a public meeting to discuss a proposed project[15].

The group project was worth ~35 % of the course grade/marks, including a peer review of another group’s draft materials. In 2013 and 2014, the groups were specifically required to include a formal systems model[16] of the entity or project and a risk management matrix.[2]

Some interesting issues were identified with the group project. For some projects, it was difficult to determine the type of failure, or even, in one case (the Chesapeake Bay Bridge), whether a failure had occurred at all. In fact, while the Chesapeake Bay Bridge as a structure is in good condition, even following a few ship collisions, it has failed in its goal to open up the Delmarva Peninsula for development and to operate an economically sustainable toll operation. It therefore represents a failure of concept and function, but not of the structure itself. It was also difficult to research the regulatory environment for projects in the distant past, or those not located in New Zealand[2].

Student groups generally did much better with technical aspects of failures than with non-technical or procedural issues[2]. This has also been observed by others[13, 14]. This might partly reflect the fact that many official “Board of Inquiry” reports available for the students to review typically focused on the technical aspects of the failure, rather than some of the underlying non-technical contributory factors, such as ethical or regulatory breaches, budgetary or time pressures on staff, gaps in communication, or simple human error. Sometimes these issues are not well documented in the published literature.

The 2013 offering of the course had some first year “teething troubles” because the students found it hard to find the motivation to devote time to the non-technical issues, which they perceived as being less valuable for their future careers. This 2013 student survey comment regarding the course objectives is typical of the some of the feelings evident: *“If the course aimed to waste my time it certainly succeeded”*. Some comments from student evaluations were quite positive, however (particularly regarding the failure case study project), and the course was judged to have more or less achieved its intended purpose. That said, the course’s instructors have continued to work to improve it, particularly in terms of content delivery and assessment, which resulted in better student ratings and comments in 2014. [2] In comparison with most other Department courses however, the average ratings and feedback were still below par; although that may reflect the difficulty of teaching this material in an engineering program.

Modifications for 2015 Course Offering

For the 2015 course offering, the first author, who had been coordinating the course and teaching the largest portion of lectures, was scheduled for a sabbatical leave. The second author was assigned to coordinate the course. The University of Canterbury has a prestigious Erskine Visiting Fellowship to bring in scholars from around the world to lecture. For the beginning of the course in July and August 2015, the third author was invited as an Erskine Visiting Fellow to lecture on engineering history and on failure case studies.

The third author gave the first lectures in the course, starting with some previously developed material on the History of Bridges which were part of a course at his home campus.[17] The next set of lectures covered some historic failure cases[13, 14]. Obviously, the cases covered in the lectures had to be omitted from the cases listed in Table 2 available for student projects. The cases included not just physical failures (such as bridge collapses) but also other problematic cases like the 1976 Montreal Olympics (where cost and time overruns blighted the construction project), to highlight that "failure" can take many forms.

For the 2015 offering, an individual case study project worth 20% was added, with each student writing a review of the Hyatt Regency Collapse. The individual projects were assessed using a rubric based on the IPENZ Competency Profiles, and were intended to prepare the students better for the group project. The rubric is provided in Table 3. The students were provided with the rubric to help them better prepare their submissions.

A very similar rubric to Table 3 was used for the final group project, with the categories shown below equally weighted with 3 points each:

- Investigation of case including teamwork and communication
- Analysis of risk management
- Analysis of regulatory aspects, social impacts
- Analysis of ethics
- Ability to draw sound lessons

The quality of the writing was addressed by multiplying the score from the technical content by a Communication Modifier that could range from 0.3 to 1.0.

The basic idea was to have the students approach the group project with a crawl-walk-run approach, beginning with review cases in class, followed by each student doing an individual report on the same case, with the hope that the final group projects would be improved. The other reason was more practical, in that the visiting instructor was only available for just over the first month of the course and then had to return to home campus, and would not be available to provide input into the assessment of the final group projects. Following the group project, an individual review of their group's dynamics was also required from each student, to continue the reflection cycle theme.

Table 3: Individual Hyatt Regency Assignment Marking Rubric

Hyatt Regency Assignment Marking Rubric

Name of student:

Category (possible marks)	Marks					
	0	1	2	3	4	5
Investigation and Research, Quality and Quantity of References (5)	No references or citations	Only uses references provided in case study presentation	Reasonable reference list but lacking citations within text, some suspect references	Reasonable reference list, some citations within text, some suspect references	Fairly complete reference list, reliable references, correct citations	Thorough reference list and correct citations, uses peer reviewed literature
Discussion of Technical Issues and Risk Management Analysis (5)	No discussion of technical issues and risk management	Cursory discussion of technical issues and risk management	Incomplete discussion of technical issues and risk management	Technical issues mostly correct, limited discussion of risk management	Technical issues correct, some discussion of risk management	Technical issues correct, in depth discussion of risk management
Teamwork and Communication (5)	Does not address teamwork or communication issues	Cursory discussion of teamwork and communication issues	Incomplete discussion of teamwork and communication issues	General discussion of teamwork and communication issues but lacking details	Fairly complete discussion of teamwork and communication issues but missing some details	Thorough discussion of teamwork and communication, including names and roles
The Engineer and Society (5)	Does not address impacts on society	Cursory discussion of impacts on society	Incomplete discussion of impacts on society	General discussion of impacts on society issues but lacking details	Fairly complete discussion of impacts on society issues but missing some details	Thorough discussion of impacts on society with specific examples

Total marks (out of 20):

Case studies in lectures benefit strongly from a robust class discussion. However, class enrolment was about 166 students, and the class was assigned to a theatre type performance space, which made it a bit challenging.

Professional Development Plan

One other change in 2015 was that students were required to produce a Professional Development Plan (worth 10% of the course). This was to gather together a number of smaller previous assignments (focused on professional development activities) and help the students see a reason for improving their engagement with the engineering profession. The professional development plan was developed keeping in mind the requirements in New Zealand for professional registration include requirements for professional development.

The assignment had two goals for students:

- Understand the components of good professional development and be able to investigate them
- Develop skills in reflection and professional development planning.

Students were required to submit a formal written report describing their career plans and their assessment of professional development needs. They were also required to submit a set of reflection notes. These would be on professional development options they had explored including details of the activity and their impressions of how they might see that option working for them. Students were expected to attend at least 6 professional or research presentations, and were expected to consider other options such as:

a. Membership of professional associations and attendance at meetings
b. Site visits
c. Attendance at public talks
d. Attendance at professional conferences
e. Enrolment in courses
f. Reading magazines, websites, newspapers
g. Reading journals, books

One of the public talk options was a public lecture given by the third author near the end of his stay.

Assessment was based on:

Plan - 5% (constituting)

- Career Development Goal (1%) – is this clearly stated with some background, or justification about motivation
- Professional Development Methods (2%) – are these clearly outlined? do they match the career goal well? Is the explanation for them clear?

- Plan Details (1%) – dates, steps, documentation, measurable targets – are these set out clearly? Is documentation discussed? Is the plan practical to implement and assess
- Completeness (1%) —the plan seems to fit together well without omissions in methods.

***Reflection notes - 5% (constituting*)**

- Quality of reflection (3%) – Are the reflections deep or superficial?
- Documentation of CPD options (1%) – Students will need to provide evidence of their investigation of CPD options. This can be webpages, emails, etc. There needs to be enough documentation to ensure markers understand the option that the student explores and also includes evidence such as date, etc.
- Evidence of active learning (1%) – Students need to show active learning in terms of note-taking at public talks or during videos, or notes from readings. These can be part of the student's 'reflection' though they are not reflections as such.

Because students had little experience with reflection before this course, it was expected that students would struggle to understand our advice and expectations without receiving feedback. As a result, students were required to submit their reflection notes halfway through the course to allow us to provide feedback. We received permission from students who submitted good reflections that allowed us to anonymise and distribute their reflections to the class as a whole as exemplars.

Results and Observations

More than other courses, this course demonstrates the gap between students' views on their development and the views of the instructors. The course survey (with an admittedly low 25% return rate) resulted in an overall rating of 2.9/5 in terms of overall quality for 2015, one of the lowest course ratings in engineering. This is similar to course ratings in 2013 (2.2 from 38% return rate) and 2014 (3.0 from 37%) for the course. Comments varied greatly but some common themes would be:

- The course taught me nothing I didn't know already
- The material in this course should have been taught at an earlier stage of the program
- What was expected from us in the assignments was not explained well and I felt unsure if I was on the right track
- The grading of the assessments was arbitrary and I didn't know where I lost marks

Looking at the results from the perspective of the instructors gives a different impression. The average content mark for the individual failure report was 15.8/20 or 79% while the mark for the (more challenging) group report was also 79%. The grammar and presentation marks also improved.

For the professional development plan assignment, the quality of the interim reflection notes was very low with only 15% submitting adequate reflections. In the final submission, this improved to nearly 100%. The ability of students to see good submissions helped greatly, and was not otherwise possible in 2015 because this was the first year with the assignment. The average overall content mark was 8.9/10 (89%).

One observation, then, has been that fourth year students in New Zealand have a disadvantage in a professional development course because they have had far fewer university experiences at reflection (because of no humanities or social science courses), though they are able to develop the necessary learning skills quickly. Although students are able to reach high levels of performance, they struggle either to see that they are making progress, or that they lack initially the skills needed to make progress. They are uncomfortable with the experience of relativistic marking on assignments with no right/wrong answer. The fact that a number of student survey responses felt that some of the material should be taught earlier in the program suggests a desire to be introduced to reflective analysis techniques sooner.

The completely qualitative nature of this course (there are no numerical calculations needed for any assessment) is at odds with the mostly quantitative assessments found in all of their other curriculum courses. Thus they have been led to believe that technical correctness is the most important part of what "good engineering" is about. This feedback from students has led the Department to consider further whether more "non-technical" content and assessment needs to be introduced to students at an earlier stage, to impress upon them the equal importance of these skills as a professional engineer.

Summary and Conclusions

This paper details the development of the course to date and its associated assessments, and discusses lessons learnt in teaching professional engineering skills in this format. It also compares trends in education on professional development in New Zealand and in the U.S.

There are a number of interesting observations that could be made. In theory, the U.S. system of general education should provide a sound foundation for the critical thinking and reflection that are essential to professional development. That would make a course such as ENCN470 redundant to a U.S. curriculum. In practice, U.S. faculty and students often build an artificial mental wall between the technical and the professional. Students who may have been able to write well in their general education courses may lapse into "Yoda syntax" engineer speak when it comes time to write a technical report.

When the third author reviewed the submissions for the Hyatt Regency case study assignment, he found that many of them were well written and showed all of the hallmarks of critical thinking, and would compare well with papers written by good students at U.S. institutions. Therefore, the perceived advantage of U.S. students over New Zealand engineering students from the benefits of the general education curriculum did not seem to be documented. Perhaps U.S. institutions can do a better job of connecting the general education curriculum to engineering professional development.

Therefore, the authors believe that the ENCN470 course model would potentially be of value to U.S. institutions, and would be willing to provide the documentation to the civil engineering community.

Some students are resistant to the ENCN470 course and probably will remain so. The lectures were all recorded, and so on a good day only about half of the students at most showed up. Although in theory the students who were not there could review the lectures later, the university's evidence suggested that by and large they did not do so. There remains a considerable gap between what the departmental faculty and IPENZ see as professional development needs, and what the students think they need. The faculty will work to continue to address this. It is possible, though, that the students may not see the benefits until they have been in practice a few years.

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