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‘WE MAINLY DEAL WITH MATHS’: NEW ZEALAND ENGINEERING LECTURERS’ AND STUDENTS’ PERCEPTIONS OF ‘ENGINEERING WRITING’

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Abstract

This article describes a small study undertaken at one university in New Zealand. The authors, who share an interest in academic writing, were approached by engineering lecturers at the same university who were concerned about the standard of engineering students’ written communication. The authors interviewed a number of lecturers and a small group of students to explore their perceptions of the difficulties encountered by students in the completion of written assignments and reports. The findings indicate that both groups are aware of these difficulties but there is little consensus as to how they should best be addressed. The article concludes with a few tentative suggestions and an indication of the ongoing development of this research project.

Introduction

Vocational and professional disciplines such as engineering have long been part of the academy (Muller, 2009). There is widespread acknowledgement that there is increasing government emphasis on universities’ responsibility to prepare students for the industries in which they plan to work, and the need for universities to cooperate more closely with industry (Daymon & Durkin, 2013; Sugrue & Solbrekke, 2015). For example, in the New Zealand context six strategic priorities for higher education were identified by the government in a policy document released in 2014 (Tertiary Education Strategy, 2014). The first priority identified aims to ensure that graduates are “well matched to labour market needs” (2014, p.10). Forret et al. (2007) note that to facilitate New Zealand’s knowledge economy, “companies need a steady supply of science and engineering graduates” (p.1). In particular the necessity of developing transferable skills including the ability to communicate effectively, think logically and critically, and demonstrate an ability to adapt to changing industry requirements are highlighted (Forret et. al., 2007). This ability to communicate effectively has proved somewhat problematic for engineering graduates.

It is generally recognised that the ability to write succinctly and clearly is imperative for a successful career in engineering (Calvo & Ellis, 2010; Goldsmith, Willey & Boud, 2012; King, 2008; Male, Bush & Chapman, 2011; Rosales et al., 2012; Wheeler & McDonald, 2000). Unfortunately there is an equally clear recognition of the fact that students often lack this ability (Amos & McGowan, 2012; Appelby, Roberts, Barnes, Qualter, & Tariq, 2012; Bernaschina & Smith, 2012; Cismas, 2010; Conrad, 2017; Drury & Mort, 2012). Part of the problem appears to be that those students who are attracted to professions such as engineering are often clear about their dislike of writing, and at the beginning of their engineering studies fail to see its relevance in the engineering curriculum (Beer & McMurrey, 1997; Lievens, 2012). The difficulty that many of the students encounter in structuring effective written documents has implications for their ability to communicate in the industry.

In a recent article, Conrad (2017) points out that there are essential differences between the lecture hall and the workplace. Lecturers often do attempt to create assignments that align closely with industry requirements but as she points out, "student writing will always respond to the fundamental need to 'perform knowledge' for an instructor rather than 'communicate knowledge' for readers who need it" (p. 193). Another issue that she raises is that many engineering academics do not have recent, or in some cases any, industry experience on which to draw. This makes it difficult for them to prepare their students for current writing demands in the industry.

Conrad's interest in comparing the writing practices of engineering students with those of practitioners is illustrated in this 2017 study. Conrad interviewed 22 engineering students and 16 practising engineers. The engineering departments provided examples of writing such as laboratory reports, technical memoranda and various other kinds of reports. She also examined evaluation rubrics, assignment descriptions and project-based written assignments. In addition she obtained documents from 10 engineering firms and three government agencies. Conrad found that practitioners employed simple sentence structures, that their word choice was precise, and that the language was accurate and unambiguous. They were careful that grammar and spelling were correct and the documents were sequenced logically. In contrast the students felt that it was good to be vague and that "complicated-looking sentences increased professional credibility" (p. 209). Interestingly, Conrad detected the influence of the students' schooling in that their attitude was that "proofreading was not worth much time because it did not affect grades" (p. 209).

It is against this background that the research project described below came into being. The authors were approached by lecturers in the School of Engineering at the same university. These lecturers were concerned that they were not serving the students' best interests by attending only to their engineering needs and neglecting students' ability to communicate clearly and effectively. The engineering lecturers also felt that while they appreciated the need to develop students' ability to communicate effectively, they themselves were unsure as to how this could be best achieved. It was decided that a small pilot study investigating engineering staff and students' concerns would be a good first step. This article describes the pilot study carried out at the authors' university.

Methodology

Ethical approval was granted by the university's ethics committee. The authors were invited to lectures where a large number of undergraduate engineering students were present, and were offered the opportunity to discuss the project with the students. The authors' email addresses were supplied and interested students were asked to contact us directly. An electronic notice about the project was circulated in the engineering department, and again lecturers were invited to contact the authors themselves.

The research adopted an interpretivist approach subscribing to the understanding that society is built on the preconceptions and beliefs of individuals and its focus is on "individual motivations and intentions, values and free will" (Corbetta, 2003, p.24). In order to explore individual perceptions, semi-structured interviews were employed. These interviews allowed the researchers to engage in dialogue with the participants and gave us insight into how they had experienced "particular aspects of life" (Koro-Ljungberg, 2008, p.431). While the interview questions (Appendix A) guided the interviews, the semi-structured nature allowed us to explore particular areas of relevance. The interviews were transcribed and returned to the participants for member checking. Both researchers read the transcripts and coded them individually, and then the analyses were compared, and decisions were made as to appropriate themes. In accordance with Saldaña's advice (2016) these themes were written up in full sentences as we believed this allowed us to capture the essence of what participants were saying more accurately.

Findings

Nine lecturers and five students agreed to participate in the pilot study. As far as the lecturers were concerned four main themes emerged.

- Students had difficulty writing coherently and logically

- Students struggled to demonstrate critical thinking in their writing.
- Lecturers did not feel equipped to deal with student writing issues.
- Lecturers did not believe students were properly equipped to face industry demands

Students had difficulty writing coherently and logically

Lecturers expressed their concern that student writing was often difficult to understand. One noted that it would be pleasing if the students could produce a "coherent string of sentences". The sentiment was echoed by a number of the other lecturers who spoke despairingly of "sentences that are incomprehensible" and "writing so bad you don't understand what they actually want to express", "abysmal" writing. One of the main issues appears to be that students have great difficulty structuring their writing. This was particularly frustrating as lecturers supplied the headings that students were to use but unfortunately what students wrote often did not match the headings. There were complaints that students would sometimes "write down a whole lot of rubbish just to fill up the gaps".

Students struggled to demonstrate critical thinking in their writing

Lecturers noted that there appeared to be a misconception that engineering students demonstrated their capability through the manipulation of mathematics. "But actually it's the critical thinking that's really important". Another backed this up by noting that critical thinking "is the core aspect of what we are looking for". For many students the difficulty might not lie in their ability to think critically but more in their ability to express this critical thinking in writing. It was pointed out that it was not sufficient for students to indicate the solution to a particular problem. They needed to explain why that "route or interpretation is appropriate".

The lecturers acknowledged that if they wanted students to deliver quality assignments, it was necessary to provide the students with more assistance. Report writing, they noted, is not the province of schools and asking students to produce quality reports was tantamount to kicking people into "the deep end of the swimming pool and expecting them to swim". It was clear that students needed help in demonstrating their critical thinking in writing. Unfortunately most of the lecturers we spoke to did not believe that they were able to help the students in this regard.

Lecturers did not feel equipped to deal with student writing issues

There was empathy with the students' dislike of writing. Some of the lecturers noted that they too had been drawn to engineering partly because they had believed that it did not involve a great deal of written communication. One commented, "So perhaps it's not a good idea to learn how to write from an engineer. We are certainly not the experts in that area." Even those lecturers who were confident of their writing ability did not believe that it would be in the best interests of the students to ask engineering staff to assume responsibility for improving students' written communication, adding that it was unlikely that any of the engineering lecturers would be willing to take this on. There was, however, one lecturer who did not agree with the majority view. He said that there was a feeling that lecturers had "to fill the curriculum with all of this maths and all of this stuff because that's what defines this course. Got to do all the sums, got to do that whereas actually 20% of it needs to be 'I've also got to tell you the skill of why you use it, when you use it, how to write up about it'." He acknowledged that this was not a popular view. There was also a perception that the root of the problem lay in the schooling system, and that university lecturers should not be expected to address problems that should have been taken care of before the students entered tertiary education.

Lecturers do not believe students are properly equipped to face industry demands

As indicated, lecturers were reluctant to take on the role of writing tutors. At the same time, however, there was widespread recognition that students' ability to write coherently and accurately was a real problem, and that in this regard students were not well prepared for industry demands. One senior staff member said, "By the time they leave university they know the basic theory and that's great and it's probably what we can teach them in three to four years but they're not really aware at all of how that basic theory fits into actually designing a product so they could do isolated design but how do you do the paperwork around that?" There was also a feeling that while engineering lecturers themselves either did not want, or did not feel able, to help students in this regard, the University did have some responsibility to ensure that students were better prepared for the demands of industry, "The practical applied industry stuff is currently left to industry. I think we could do a better job of that maybe".

An analysis of student interviews revealed two main themes:

- The students found it difficult to write and lacked confidence in their ability to meet writing criteria.
- The students were uncertain as to the best way to obtain help.

The students found it difficult to write and lacked confidence in their ability to meet writing criteria

None of the students interviewed enjoyed the writing challenges in the engineering courses. There was talk of "strongly disliking" written assignments and lacking the confidence to deal with them. One noted that when he wrote a report he did not find it easy "to come up with something and then write it on paper…because we mostly deal with maths". What they found particularly difficult to deal with was how reports and assignments should be structured. One noted that he felt that he was "just writing and scrambling to get something together". The sentiment was echoed by another student who commented on word limits, noting that his reaction was "Oh my gosh, I need to have more words in there. I need to make it sound more professional…so I don't really pay attention to the content. I just end up waffling so there are more words to make up". It was clear, too, that the students were taken aback by the writing demands of the engineering programs and felt that their schooling had not prepared them to cope with these demands.

There was little doubt in the students' minds that they needed help but finding this help was problematic.

The students were uncertain as to the best way to obtain help

The students were aware that assistance with their writing was available at the University's Student Learning Centre but none of the students interviewed had accessed this help. It appeared that time management was a problem, and that the students left the completion of assignments too late to enable them to seek help. However, it appeared, too, that students were not keen to seek assistance from learning advisors although they were unable to supply specific reasons for this reluctance.

An obvious source of help was the lecturers who set the assignments but again the students were reluctant to approach them. It appears that at least in part, embarrassment is a major obstacle to seeking help. One of them noted, "Writing is kind of something that people take that you should be able to do already." There was reluctance to ask questions about writing in "such a massive class" because "I don't want to look stupid", and this fear of losing face extended to the smaller tutorial groups, and to taking advantage of the times set aside for consultation with lecturers. One of the lecturers also felt that students were fearful of approaching staff for advice, that they were frightened of "getting it wrong because they don't know".

The students' strategy was to turn to friends and family but there was an acknowledgement that the advice given was not always useful. One student explained that his friends had said that his sentences were too short. "I was like are you serious? I don't know how to expand. They are like just add all these linking words, and I go okay, randomly chuck them in there". Another student asked his sister to help him because as a nurse "She does more writing than me".

Discussion

Neither lecturers nor students were satisfied with the current position around academic writing in undergraduate engineering programs and both groups appeared uncertain as to what possible solutions could be. As far as the lecturers are concerned there are a number of barriers to offering help in this regard. In the first place the curricula are very full and it would be difficult to find time to accommodate ongoing writing assistance. As one of the interviewees noted, lecturers appear reluctant to accept that it might be part of their job to deal with engineering writing issues. It appears too, from the student interviews, that students might well be reluctant to attend sessions focused on improving their writing if they did not see the immediate relevance of such instruction. The second problem that lecturers raised is their concern that they are not able, or in some cases not willing, to furnish students with instruction in writing.

The students, on the other hand, find themselves ill-equipped to deal with the writing demands of the engineering courses, and are embarrassed by this inability. It appears that because of this embarrassment, and also because of time-management issues they do not seek help from people who are employed at the University to offer them assistance. However, this does not appear to give the full picture. The lecturers that we spoke to did not mention the services offered by the university. This is in keeping with research that indicates that Student Learning Centres are, on the whole, not highly regarded by discipline lecturers. They are generally viewed as a remedial service that focuses particularly on students whose English is poor (Craven, 2009; Emerson & Clerehan, 2009; Laurs, 2010; Velautham & Picard, 2009). It appears that lecturers do not urge their students to seek help, and the students have little knowledge of the kind of assistance available to them.

This is surprising on a number of levels. It was apparent that most of the lecturers either did not want to provide help with students' writing difficulties or did not believe they were able to do so. As one noted "grammar isn't my forte so why should I be correcting it?" The consensus appears to be that the writing skills should be taught by someone with expertise in the area, but not one of the

lecturers suggested that it could be beneficial to work in conjunction with the Student Learning Centre. There was, however, discussion about ways in which the curricula could be made more flexible in order to accommodate a writing paper.

Such an approach, however, is not without serious drawbacks. As Conrad (2017, p.210) points out, "the content and practice of engineering are inextricably woven into language choices". It is not realistic to expect a tutor who has no knowledge of engineering to teach writing in an engineering context. In addition, offering students generic writing instruction presupposes their ability to transfer such instruction to the engineering context. Research indicates that it is extremely difficult to transfer generic writing skills to a particular discipline (James, 2009). One of the reasons for this is that academic literacy is not a unitary concept and the kind of writing required depends on the discipline. Certain ways of writing in one discipline are not acceptable in another (Lea, 2004; Lea & Street, 1998) and concepts such as structure and argument are not "generic and transferable" (Lea & Street, 1998, p. 162). Structure and argument are discipline-specific. It is therefore not surprising that researchers have found (Hyland, 2002; Lea & Street, 1998) that students benefit the most when writing instruction is embedded in their specific discipline context. Conrad has been working with a number of colleagues in the United States on embedding writing instruction in engineering modules, and has found that the students find such an approach beneficial (Conrad et al., 2011, 2012, 2013). These findings support earlier work in this area (Boyd & Hassett, 2000; Lengsfeld et al, 2004; Pendergraft, Daugherty, & Rosetti, 2009; Walker, 1999, 2000).

The other issue which was raised by both students and staff in this small study concerned students' prior schooling. Both groups felt that students were ill-prepared for the demands of an undergraduate engineering program, and Conrad (2017) appears to concur with this. However, she makes no suggestion as to what can be done about prior schooling, and we agree that there seems little point in pursuing this avenue. By their very nature, schools are dealing with a heterogeneous cohort of students, many of whom have no real idea of what their careers will be. Writing instruction can therefore only be generic. While this does not preclude suggestions that writing teachers might wish to concentrate on succinct and clear writing, making schools responsible for discipline-specific writing is not the answer.

Conclusion

It would appear therefore that the most sensible approach would see a melding of expertise. One of the ways in which this could be approached is for engineering departments to reach out to colleagues who have the necessary skills in teaching writing. The engineering lecturers at our university have set a good example in this regard. There is growing realisation among engineering educators that they need to "pay more attention to the non-technical skills that are increasingly required by the professional bodies and other agencies and are needed by graduates" (Duffy & Bowe, 2010, p. 7). As a result of this small study the authors have undertaken a wider investigation into the opinions and insights of professional engineers around New Zealand. The next step is to speak to a larger group of university lecturers and students. It is hoped that in this way greater insight will be gained into the issues facing engineering educators in this country, and armed with this knowledge better approaches to the teaching of soft skills such as writing can be developed.

The limitations of this research are obvious. It is a very small study of only 14 participants all drawn from the same university. Its importance lies in the identification of issues that can be explored on a wider basis.

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