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Student reflection on engineering responsibility exemplified in a professional code of conduct

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ABSTRACT

CONTEXT

South African engineering graduates are required to demonstrate the acquisition of eleven graduate attributes set by the Engineering Council of South Africa (ECSA, 2020). One of these, graduate attribute 10, relates to Engineering Professionalism, where students are required to demonstrate "critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence". Students are required to provide evidence of their understanding of engineering professionalism in terms of the ECSA Code of Conduct, which regulates the conduct of registered engineers in South Africa.

PURPOSE OR GOAL

This research investigates student understanding of their engineering responsibility as is evidenced in a formative assignment set as part of the fourth-year civil engineering course at the University of Cape Town. This recognises student learning around professional engineering responsibility to be a significant area of engineering education and research. The research thus aims to investigate student understanding of the professional code as exemplified in their comments analysing the ECSA Code of Conduct.

METHODOLOGY

This research will examine student assignments submitted as formative assessment of student understanding relating to ethics and professionalism relating to their professional code. This data was analysed by using the software NVivo, grouping comments in terms of different categories relating to:

- the specific item number of the code,
- reasons provided to justify the significance of the item in terms of personal, professional or public interest,
- areas which students flag as difficult to understand and
- areas where the students provide alternative formulations or suggest changes.

This data was consolidated to provide evidence of student learning relating to their professional responsibility in terms of a particular Code of Conduct.

ANTICIPATED OUTCOMES

This research is anticipated to provide insight as regards how students interpret the professional Code relating to personal priorities, professional considerations and/or responsibility to the public. The research also aims to demonstrate the value of the student voice in developing understanding of professional responsibility. This is seen to provide support for including student perspectives alongside expert and experienced perspectives engaging critically and constructively with how regulatory documents communicate to both inspire and regulate engineering professionals.

CONCLUSIONS

Providing evidence of student understanding relating to a specific code of conduct provides a new perspective on a key document for professional engineers in the context of South Africa.

KEYWORDS

Engineering professionalism, engineering responsibility, student reflection, professional code of conduct

Introduction

Student learning within engineering is the subject of a growing body of research (Fink, 2007; Case, 2013; Hattingh, Dison and Woolacott, 2019). Whereas learning in the sciences can be approached as the objective acquisition of facts and process, associated with this is the act of translating fact and detail into theory and meaning. Student reflection is a distinct area of student learning that requires students to intentionally activate both critical and consolidating functions to construct meaning and significance. Fink's analysis (2007) identifies significant learning to be the learning that persists beyond the specific context of the interaction and that impacts the identity and being-in-the-world of the individual.

This research positions student reflection as a valid and valuable lens through which to engage with student understanding relating to a professional code in a particular context: the Code of Conduct of the Engineering Council of South Africa (ECSA). Lave and Wenger's (1991) theory of "legitimate peripheral participation" may be applied to students' relationship to their profession and to their professional responsibilities. During their studies, students develop their professional understanding of their profession through proximal contact and interaction with the profession (Wenger, 1998). This interaction includes the engagement with disciplinary experts within the academic context; work experience (Martin, Maytham et al., 2005), experience on site (Gwynne-Evans, 2018) and as part of a community (Allie et al. 2009).

This research examines student submissions of an assignment that is part of the Professional Practice course in fourth year civil engineering programme at the University of Cape Town. The assignment requires formative critical engagement with the engineering professional code in the South African context. The 2021 civil engineering class at the University of Cape Town were divided into 20 groups of 6 students each. Groups were allocated to a specific project site where students set up and undertake a site visit. Students use what they learn in the context of the site visit, a desk study and through communication with the professional engineers to assemble a report pertaining to professional responsibilities and practice. Course assessment includes both individual and group assignments relating to a range of graduate attributes assessed at exit level.

Professional Codes of Conduct are constructed by experts in a specific geographic or disciplinary context and are complex, socially-embedded sensemaking processes (Statler and Oliver 2016). They are positioned to both inspire and to regulate behaviour of the professionals under their regulation (Harris, Pritchard et al., 2014). Codes of Conduct are thus positioned as living documents that respond to changes in context and/or technology, critique by stakeholders (Hilhorst, 2005) and the requirements of a discipline. Codes of ethics and professional responsibility require professional engineers to take responsibility for their actions and to apply their best professional judgment to their decision-making, no matter what other parties, including employers and clients, request or demand (Matsuura in Abass, 2020).

The ECSA Code of Conduct is one such document that has undergone changes in the 24 years since it was first published in 1997. At the onset of multi-party democracy in South Africa, legislative changes were effected in all areas of public and corporate life. These changes were implemented to bring legislation in line with the 1994 Constitution. Law-making over the past twenty-five years has been a response to this landmark shift in policy. There are thus clear traces of visible shifts of approach within policy and legislation.

This paper investigates the following research question: How does research into student reflection on their understanding of professional responsibility as represented in the ECSA Code of Conduct highlight areas of the professional Code that need to be clarified?

Methodology

The data for this research was accessed from fourth year civil engineering students' assignments. In the specific assignment, students were required to annotate the ECSA Code of Conduct in predetermined groups. This entailed students reflecting on the requirements of the Code, to initiate and respond to comments by group members on different items of the Code. The students were

required to identify important areas of the Code that connected with their increasing understanding of their identity and responsibility as an engineering professional. This assignment was designed and set during the remote teaching and learning period initiated as a result of the curtailment of classes due to the onset of the COVID-19 pandemic. The original motivation for the assignment was to replace classroom discussion with a formal record of peer engagement and reflection. The student's engagement with the process showed an unexpectedly deep level of engagement and learning that prompted a formal research project the following year, requiring ethics clearance.

Reflection may be posited as a "professional practice and process that supports students to learn through experience" (Coulson and Harvey, 2013). Effective reflection for learning through experience requires a capacity for understanding one's own thinking and learning processes, critical self-awareness of values, beliefs and assumptions, and an openness to alternative, challenging perspectives. This process requires learners to take an active role in developing and applying their reflective skills, inferring a capacity for agency that may not be well developed in all learners. Coulson and Harvey identify a shared context and goal of learning as providing the initial scaffolding goal for learning-to-reflect. Developing a shared understanding and context for reflection provides the opportunity to practice the skill of reflection through giving and receiving feedback. The group assignment requiring the annotation of the Professional Code of Conduct provides that shared context for reflection. Here the group annotation requires students to critically and reflectively engage and respond to, one another's comments on the different sections of the Code of Conduct.

Although initially conceived of as a formative assessment, leading to the formal summative assessment, the record of comments provided a dataset that was available to be analysed. This was done using the software NVivo, grouping comments in terms of different categories relating to:

- the specific item number of the code
- the reasons provided to justify the significance of the area in terms of personal, professional or public interest
- areas which students flag as difficult to understand and
- areas where the students provide alternative formulations or suggest changes.

This data was consolidated to provide evidence of the way in which students' engagement with the formulation of the ECSA Code of Conduct demonstrates the students' ability to engage critically and reflectively with a document that forms part of the professional regulation of their profession. Here the Code communicates both as a vison document and as a regulatory document (Gwynne-Evans, Chetty and Junaid, 2021).

This assignment was deliberately placed early in the course as a way of connecting students with the formal code and as a way of encouraging a culture of teamwork and building understanding through critical engagement and interaction. Peer annotation of the ECSA Code of Conduct was seen to provide an opportunity to demonstrate critical engagement with text in a way that supplements the way students learn science-based subjects. The process was seen to enable and enhance students' ability to apply their critical gaze to a particular document in a way that would stimulate their awareness of critique as a process and develop their confidence and skill to articulate an argument. Both these capacities would further enhance the students' fulfilment of assignments requiring them to build an argument and to apply specific areas of the Code of Conduct to their experience of professional practice. In terms of the Nvivo dataset, this analysis will examine three topics that correlate to the sections with the majority of responses and that thus reflect and align with the focus of the students' attention.

The engineering student gaze is positioned as a legitimate perspective to engage critically with the Code from the periphery of the profession. This supplements the expert input on the formulation and revision of the document that takes place at intervals to fulfil the regulation requirements of ECSA (see the Engineering Professions Act (Act No. 46 of 2000).

The research applied for and received ethics approval to undertake the study and to publish student responses with their consent. Students had been approached at the beginning and again at the end of the course for permission to quote from their assignments. All quotes included have the required permission of the student. All the groups that submitted work were included in the analysis bar one

group whose assignment in pdf format cut short some of the responses. Although the full document had been requested, this was not yet received when the analysis was done.

Assumptions

The paper assumes that the items the students refer to or query are those that appear significant to them. Evidence to support this assumption is the fact that, with a wide range of responses, no student commented on the sections including the definitions (Section 2), section 5 (Repeal of laws) or section 6 (Short title). These sections are explanatory rather than requiring critical engagement, and, as such, require no comment. Though important constituents of the document, these sections do not ostensibly affect the student's understanding of the content of the Code of Conduct.

Results

This section will present the results of the analysis of student responses submitted in their group assignment where they were required to annotate the ECSA Code of Conduct so as to "familiarize [themselves] with the contents of the ECSA Code of Conduct and to identify interesting or important areas of the legislation that will impact [their] understanding of [themselves] as an engineering professional" (Annotated Code of Conduct Assignment instructions, Vula site CIV4041C 2021). The assignment was seen as a preparatory exercise in advance of the students making contact with the professional engineers involved in a specific construction site and in anticipation of the more formal development of an ethics essay connecting their understanding of what it is to be a professional with their experience of a specific site.

In terms of the student responses in the assignments, all the 20 group submissions, bar group 16, were loaded on Nvivo resulting in 612 responses being captured. These responses were coded in three ways, in terms of:

- the relevant major section (1-6)
- the specific numbered item of the document which elicited comment from the students (effectively 50 alternatives) and
- content themes including "Norms of the Profession", "Accountability"; "Conflict of Interest", "Engineering Responsibility", "Public Interest"; "Corruption"; "Whistle-blowing"; "Triple bottom line" and "Sustainability". These were identified both apriori and as a result of students' comments and identification of issues – such as "Whistle-blowing" or "Triple bottom line".
- types of response including "Questions", "Responses" and "Proposed revisions to Code".

The following graph provide detail of the responses in terms of the six major sections of the Code of Conduct – where only sections 1, the Objective; 3, the Rules of Conduct and 4, Administrative, were commented on. The other sections, including 2, that provides definitions of key terms; 5, involving a repeal of the rules and 6, containing the official short title for the document, were not commented on. The second smaller pie graph shows the distribution of comments in terms of the five major sections of the Rules of Conduct, covering Competence, Integrity, Public Interest, the Environment and the Dignity of the Profession. These sections have clear links to the Objectives.

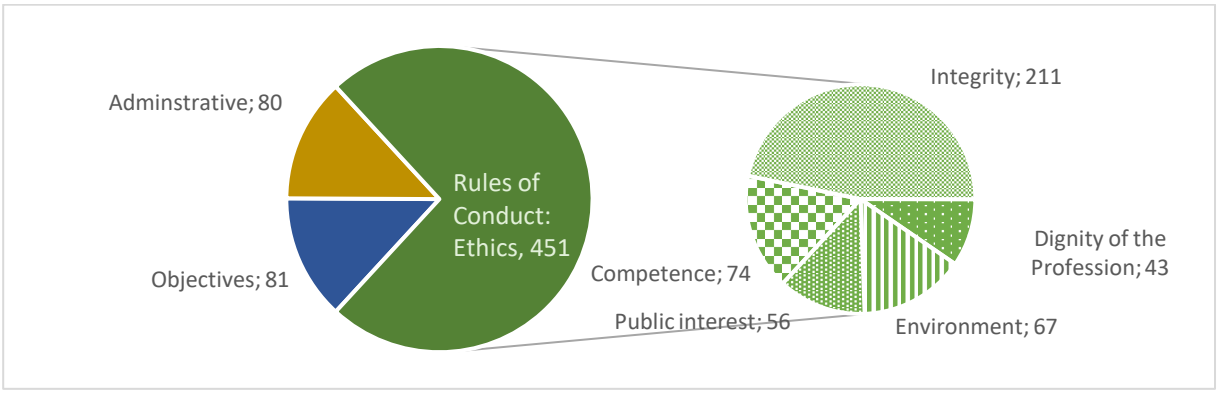

Figure 1: Number of student responses to major sections of the ECSA Code of Conduct with breakdown of the five distinct areas of the Rules of Conduct

The graph provides a full breakdown of the individual numbered items of the Code of Conduct, down to third level headings and covering 50 possible items. Students had freedom to choose what appeared relevant or required clarity. While there were some groups who passed over entire sections (in addition to sections 2, 5 and 6), without any comments or questions – sections such as the Objectives; Dignity of the Profession and Administration – in general there was a fairly even spread of comments across the sections, with a significant, sustained attention on the items in the Public Interest and Environment sections.

This paper will analyse three topics that correlate to the sections that comprise a significant number of responses and that form the focus of much of the student exchanges. The first of these topics is the first objective (1(1)), that received more attention than the other objectives, requiring engineers to "apply their knowledge and skill in the interest of the public and the environment". This objective links to the sections on Public Interest (section 3(4)) and the Environment (section 3(5)) and confronts the responsibility of an engineer beyond that of responsibility to the client or employer.

The second topic that will be analysed is the "norms of the profession". This term appears in the third objective as "norms of professional conduct" (1(3)) and links with two other formulations: 3(1)(c) requiring that Registered Persons, "must, when carrying out work, adhere to the norms of the profession" and 3(2)(b) which specifies the Registered Person's responsibility is "to assess the conditions or terms of the work as potentially affecting their responsibilities in accordance with the norms of the profession".

The third topic that will be analysed is that of 3(2)(f) that requires that Registered Persons "must avoid situations that give rise to a conflict of interest or the potential for such conflict of interest". In this analysis, this will be examined as a stand-alone topic, although it would be possible to link it to the second objective (1(2)) and to items that profile bribery and corruption (3(2)(c/d/e) and that require the Registered Person to disclose to their employers and clients … in writing, any interest, whether financial or other … related to the work for which they may be or have been employed."

All three of these topics stood out in terms of having scored a significant proportion of student responses and representing more than one section of the Code. Consequently, the focus on the three selected themes that students profile as significant is presented so as to provide a fresh and complementary view to the familiar authority and "voice" of the document as constructed by experts.

Format of student responses

Student reflection is a type of discourse that engineering students may not expect to be assessed in as it falls outside of rigorous scientific method. In addition, the format may be unfamiliar to engineering educators, used to the discourse of engineering science that values objective and factual language. The analysis of the student responses examined the comments that students contributed to distinguish variations in form and function. The following forms of response were identified:

1. Providing information or additional elucidation on a specific item – an example of this would be this response to item 3(1)(b):
   16- Inexperienced professionals are a risk in the professional world. Likely to make major mistakes and not know the knowledge required to perform according to their title. In a job scarce country, nepotism is thriving in industry, often leading to inexperienced professionals who do not have the correct education necessary to fulfil duties accordingly.
2. Showing an understanding of the significance of the item in the Code of Conduct, requiring the exercise of judgment (**bold** emphasis added by the author), as in:
   55- After reading the [O]bjectives, **I think it's important** that any professional's purpose within the industry is made clear just so that they are able to reflect on whether they have met their primary objectives in a particular project as these ensure that no aspect is left behind when undertaking a project.
3. *Questioning* what the specific item means or asking for information as in 3(1)(a) (*italics* added by the author)*:*

22- "*How does the ECSA ensure the competency of a registered person*?" or in 3(4)(a):
35- "*How do you quantify "avoiding or minimising" impact on the environment? Are there specific guidelines?"*

4. Answering a peer's earlier question, involving **exercising judgment or formulating an opinion.** This may involve agreeing or disagreeing with a team-mates formulation or *questioning* a team-mate's explanation
   36- "**It is extremely lenient**. …. **I believe** every engineer in South Africa would rather take a R40 000 fine than the supposedly equivalent year in jail."
   Or in 3(3)(a):
   28- "**I agree** with your analysis. The engineering profession is entrusted to prioritize not only the improving the quality of life through sustainable development but also provide for a safe, rapid, efficient, comfortable, convenient, economical society and environment."
5. Providing a practical example of the conduct that was referred to:
   In relation to 3(2)(c), that is, "must not engage in any act of dishonesty, corruption or bribery" -
   33- "One of the engineers found guilty of breaching this clause was merely reprimanded, cautioned, and fined R40 000, according to ECSA's Disciplinary Action page… Do you believe this is a lenient punishment for the crime?"
6. Critiquing an item, or suggesting an addition or amendment to the current formulation of the code, such as in relation to 4(d) (recommendation underlined):
   33- "Since advanced electronic signatures (AES) are authenticated via a face-to-face authentication procedure, ECSA should amend this clause to state that only electronic signatures approved by the South African Accreditation Authority are accepted."

Combinations of these forms of response contributed to the level of critical engagement that were achieved. It was significant to see that groups who varied the format of their comments generally developed a more cohesive inter-action, developed from the rephrasing of the item to an extended discussion on issues impacting the relevance of the Code in a particular context. Without the posing and answering of questions, and the contribution of practical examples to illustrate points, comments remained very fixed to the specific wording of the item and did not develop the critical energy that characterized exchanges where the responses shifted through different formats. This demonstrated a difference between engagement in the form of a debate, where a specific point dominated or gained eminence at the expense of other contributions, and a discussion, where different voices contributed, expanding on understanding and relating it to experience.

The significance of this scaffolded discussion had not been anticipated. The requirements of the assignment provided a space where the different voices were encouraged to find a space to contribute to the discussion. In the discussion, a tentative reaching for meaning is evident, requiring student agency and the exercising of judgment. This can be positioned in contrast to the more formal lecture approach where authority was vested in an individual whose contribution was expected to dominate. In the lecture environment, the contribution of the student as recipient of knowledge rather than as maker-of-meaning can contribute to a giving up of power and agency – a passivity which may be seen to counter the journey to professional autonomy.

Table 1 below shows a cross section of comments from students responding to the first objective of the Code, that of "applying their knowledge and skill in the interest of the public and the environment". Responses to group members is shown in the right-hand column. This objective received significant attention in terms of comments and student comments generally affirmed the prominence of this objective within the document. The students' ability to integrate different aspects of the objectives of the Code and to apply the objective to their experience is evident. *Italics*, emphasis and **bold** are added by the author to show *questions*, examples and the **forming of opinions or judgments**. Individual pronouns that show the students identification with the professional community are ***bold italic***.

This extract of different responses effectively demonstrates the students engaging with Objective 1(1) in the light of the requirements of Graduate Attribute 10, "showing awareness of the need to act professionally and ethically and to exercise judgment". Collaboratively, the students make connections and exercise judgment. Whereas the graduate attribute avoids requiring the student to demonstrate the actual exercising of judgement in a practical engineering context (which they are not

effectively entitled to do independent of supervision until they are registered as an engineer), engaging critically with the Code of Conduct allows students to begin to exercise professional judgement in a theoretical environment and to learn to formulate opinions and argument in a way that may not have been a requirement of the degree thus far.

What may have been difficult for individuals to do on their own, is more easily demonstrated in the record of the group interaction and thus makes it possible for group members to undertake and achieve within the collaborative environment.

Table 1: Extracts from student comments annotating the first item (1.1) of the Objectives section of the ECSA Code of Conduct

55- After reading the objectives, **I think it's important that** any professional's purpose within the industry is made clear just so that they are able to reflect on whether they have met their primary objectives in a particular project as these ensure that no aspect when undertaking a project is left behind.	57-**I agree with you**. Objectives act as a guide to ensure professionalism in ***our*** work field and offers ***us*** a time to reflect on ***our*** shared goal as engineers.
39- It must be noted that the interests of the individual are not mentioned. There are many things that affect the decision making and ethics of an individual including upbringing, education and religion. But as stated here, an engineer's skills should be used to further the interests of the public and the environment, and not their own individual interests, and so their duty to society should be of greater influence than their personal gain.	
44-With the name "Civil" it is indicated that ***our*** profession is related to advancing civilization or humans. The component of taking care of the environment is not highlighted as much it needs to be - even in the teachings of the degree. The attitude in industry has to shift, especially, to emphasising that we have to protect the environment while ensuring we are completing our projects. Protecting the environment ensures that our future is protected which advances humanity.	46- **I agree with** the issues raised in this statement. In extension of this statement, it is important to note that the resources on Earth are finite and need to be used in a renewable and efficient way in order to maintain areas of conservation and reduce the negative environmental impacts that accompany construction and new projects. In terms of protecting the public, engineers can make sure that they adhere to all construction codes and do not cut costs with respect to public safety.
58-**I feel** like this is especially important for the environment. Currently, all the sources of pollution have placed the environment in a bad position so I believe that although the interest of the public is important, impacts on the environment should be considered even if it means that the public's interest may be slightly compromised (of course not compromising it too much).	55- **I think** this is where the triple bottom line comes into play and when it is achieved*. How do **we** bring social satisfaction when it is at the detriment of the environment? But surely nothing that harms the environment would be good for the public long-term?*
64- This is one skill that most engineers in both the public and private sector need to have. This is because at most basic level, there is a need to interact and engage with the public/community in order to understand their needs, otherwise as an engineer you will design an infrastructure that cannot be used by the public. (e.g designing infrastructure that does not accommodate people with disabilities).	61- **It is crucial** that professionals realise that their work will impact the public and environment. To have some amount of foresight in this regard would be beneficial so that short and long-term outcomes can have the greatest positive impact and any negativity can be minimised.
69- *How do we deal with a situation where the interests of the employer conflict that of the public and the environment?* i.e. There is an issue in Philippi Horticultural area where the public (community) wants to preserve the area and not allow any development due to that the area provided them with near jobs, and there is an aquifer that can be damaged when the development takes place in the area. However, the City of Cape Town wants to turn the area into a mixed developed area and in a case where the city wins the case and I work for the City of Cape Town as an engineer, *how do I integrate such [a] challenge?*	72- **I believe** that this is a conflict of interest as ethics as an individual and professional ethics are in disagreement. Even though it is a very challenging decision professional ethics often override personal morality.

What is evident is that the very requirement of a Registered Person to "apply their skill in the interests of the public and the environment" inherently requires both the exercising of judgement and the negotiating of vested interest in a way that contrasts with the neatly defined item in 3(2)(f) where a

Registered Person is required simply to “avoid situations that give rise to a conflict of interest or the potential for a conflict of interest”.

The second theme to be examined relates to the “norms of the profession” referred to in 3(1)(c). In table 2 below, showing student responses, **bold** and *italic* highlights have again been added.

Table 2: Extracts from student comments annotating 3(1)(c) that a Registered Professional must, when carrying out work, adhere to norms of the profession”

5- *What are the "norms of the profession"? Does it refer to engineering guidelines given in books or is it referring to how work is meant to be performed?*	6- In this case, **I'm assuming** the latter**. I think** it has to do with remaining professional in the work environment.
(Continued) 2- **I** honestly **think** it's both. Standard guidelines and social behavior patterns basically.	28- *Initially this first sparked questions within me of what are the norms of profession when it comes to engineering? How does duty, due diligence and ethical responsibilities marry professional responsibilities and conduct in executing their legal obligation to society?*
80- *What do they mean by “norms”? Professional conduct like being on time?* An example would be useful.	79- **I agree**, the clause could do with more precise language. **My assumption is** that they mean that codes of practice should be adhered to. If my assumption is correct then I feel they should state that they are referring to codes of practice.
59- The norms are to be adhered because practicing professionals have an obligation to ensure their work is not detrimental to the public, employers, clients and the environment. *However, does the strict conformity to the norms not hinder or stunt innovations?*	55- **I think** that anything that is detrimental to the above parties you mentioned should not be worth executing despite being innovative. *What excellence is there in something that harms when it should aim to inspire?*
Continued) 59- Well all innovations aren't necessarily detrimental. Engineers hold multiple lives at stake. …. So there should be no exceptions for the competency of an engineer, however, norms are generally a barrier for innovations of any kind. Innovation, now so more than ever, is important for the path to sustainable development.	

These examples demonstrate the way that the expression “norms of the profession” caused difficulty for the students. It raises questions of whose norms? And who decides on these? And whether there might be explicit and different, implicit norms that can complicate what is intended to clarify. Many groups queried this formulation and several made the connection with “norms” contrasting with “innovation” in a way that may not be in the interest of the profession. It is interesting to look back at the history of the document and to see that the 2013 version changed the wording from “engage in and adhere to acceptable practices” (ECSA, 2006), to: “adheres to the norms of the profession” (ECSA, 2013). The expression is not one of the terms defined in section 2 of Definitions in the Code. In the current 2017 version of the document, the 2013 formulation stands. Here the overriding impression of the student comments and exchanges is of considered and responsible opinion and reflection.

The third theme that is examined, is that of conflict of interest, profiled explicitly in section 3(2)(f) of the ECSA Code. In table 3 below, a selection of student responses are profiled.

Table 3: Extracts from student comments annotating 3(2)(f) of the ECSA Code of Conduct that requires that a Registered Person “must avoid situations that give rise to a conflict of interest or the potential for such conflict of interest”.

36- *What happens if the conflict of interest results in complications within the project. Who would be held liable for these complications. Would it be the employer if he/she made the final decision as to try "resolve the conflict of interest", or would the onus still fall upon the engineer in question?*	37- Any form of conflict in the workplace adds unnecessary stress and tension to the working environment, which is detrimental to productivity of the company. The engineer **has a duty** toward their business or employer to act in their best interest. Once the engineer decides to undertake work or activity motivated by personal gain, their work is deemed unethical.
38- This statement is true with regards to unethical behaviour, and how this behaviour can have severe consequences to the employee and employer. Conflict of interest violates the ECSA code of conduct and possibly that of the company. The engineer **must exercise**	

judgement on possible conflicts of interests and must not choose to be naïve towards it.	
52- As we all know, our moral compass is influenced by various factors, and if one reaches a point those factors conflict each other, ***we*** as engineers should find a way to prevent that from happening or if its too late step down from the responsibility if that helps prevent the conflict.	72- I've heard of cases where the conflict of interest arises during the course of work (such as a project). *How does one go about reporting this? Who is it reported to?*
79-Very important, especially early in my career. **I can imagine** being put in a situation where I'm in charge of a site and the client requests me to construct a lucrative structure under impermissibly dangerous geotechnical conditions. This would put my value of public safety against that of my fiduciary responsibility to my employer. This would be an ethical dilemma.	81- *What if you can't avoid the situation? Are there guidelines to assist the Engineer in a case where such situations can't be avoided?*
100- It is always good to understand this principle as due to complexities in the modern firms, this is likely to occur. Whenever this happens, it really good to report this to both party's employers as this will protect both parties in case of corruption accusations if there aren't any. *However, what happens when both parties from different firms working in the same project find out at a later stage and one does not wish to accept this situation?*	102- I had exactly the same question. *What if a situation resulting in a conflict of interest is unforeseen or is unavoidable? Also, do you think that the conflict of interest should be dealt with by the registered person alone, or is there perhaps a formal code where guidance is provided to handle common conflicts of interest?*

"Conflict of interest" is identified as a potential danger lurking wherever the application of judgement is required. Students pick up on potential contradictions in terms of responsibility and effectively anticipate issues which are presented more explicitly in the Rules of Conduct, issues such as a dilemma between competing priorities and how to choose in a situation where both are important but apparent alternatives. Conflict of interest is envisaged by students as more prevalent than the specific challenge of financial interest. It is seen to be something that potentially biases decisions that engineers need to be equipped to deal with.

Discussion

The sample responses provided in the three tables above by no means exemplify a summative engagement with the ECSA Code or with engineering responsibility. Responses show instead a searching for meaning and a progressive building of meaning. Referencing context is seen to be necessary to gain clarity about potential meaning. Subsequent to this assignment and to their engagement with professionals on a construction site, students were once again required to engage with this document, building on their reflections to construct an essay relating their on-site experience to their understandings of their professional and ethical responsibilities in terms of the Code. In both the commentary on the Objectives and the section on Rules of Conduct, a major focus of student comments was the engineer's obligation to consider the interests of the public and the environment in both the design of projects and the implementation of projects. Student comments reflected both their appreciation of the prominence given to this aspect and concern that this focus was lacking in real-life projects where cost was seen to be a concern affecting decision-making.

"Ethics", "norms of the profession" and "conflict of interest" are terms that are not defined in the Definitions section of the Code of Conduct, but that are assumed to be self-evident in a way that student reflection and critical engagement with the code suggests may not be the case. Student engagement suggests that there is a need for these terms to be more clearly defined.

The requirement to demonstrate judgment and reasoning requires a different skillset from that of the mastery of technical process and theory. Students need to be provided with the opportunity to develop these skills. Exercising these skills in a low-risk formative assessment task, provides a valuable space to develop these skills in a way that builds the confidence and agency necessary to exercise judgement.

In this paper, in terms of Lave and Wenger's (1991) concept of legitimate peripheral participation, engineering students have been positioned as peripheral participants to the profession of engineering. Interesting things happen at the periphery. It is evident that student reflection on the professional Code of Conduct is generative and builds a clear sense of identity as part of the community of engineering professionals. Student reflection on the professional Code provides

students with the opportunity to articulate their thinking using the discourse of the profession. Paying attention to the periphery of a community shifts the focus of the gaze from that of the familiar insider to those on the boundary. It prompts the question as to what can be seen from the periphery that cannot be seen from the centre? This research makes a space to examine what is familiar from a new position, thus allowing the professional engineering community to see better. Student vision thus contributes a valuable perspective complementing the existing understanding of professional responsibility and building onto what is already there.

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