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Exploring Programme Chairs' Understanding of the Integration of Sustainable Development: an Issue of Professional Identity

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Exploring programme chairs' understanding of the integration of sustainable development: an issue of professional identity?

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***Abstract**: This paper is part of a wider study addressing the level of provision of sustainable development (SD) competencies in seven engineering programmes in three Irish Higher Education Institutions. The paper explores the influence that programme chairs' professional identity has on their views of SD and their assessment of the extent to which SD is integrated in their programmes. The data for exploring this is taken from a thematic analysis of six interviews with programme chairs which shows that their assessments of the extent to which SD is integrated in their programmes are at odds with previous findings that highlight deficiencies in the integration of SD in their programmes. In exploring these issues we came to the conclusion that their professional identity is a key issue influencing their approach to EESD. The findings suggest that programme chairs' professional identity is influenced by their unique history and disciplinary knowledge which act as constraints to a holistic integration of SD in their programmes. This along with the strong commitment to staff autonomy in programme design and delivery poses the question as to how cultural change among engineering academics can lead to an improved integration that has a multi-disciplinary focus.*

Introduction

This study is part of a wider project addressing the level of provision of SD competencies (knowledge, values and skills) in seven engineering programmes in three Irish Higher Education Institutions. The programmes' disciplines are civil, mechanical, chemical, structural and building services engineering. The project has used a broad definition of SD seeing it as a concept with social, economic and environmental dimensions. It has already been established that engineering students have a narrow understanding of the concept focused mainly on the environmental dimension with significant knowledge gaps in relation to the social dimension (Nicolaou & Conlon, 2012). This is a consequence of a limited integration of SD competencies in the respective curricula which focuses on the development of transferable skills and delivery of discipline related content for SD (Nicolaou & Conlon, 2013). The programmes do not provide the broad and general education that engineers need in order to become change agents for SD (Ashford, 2010).

In light of this, we sought to gain a deeper understanding of the underlying mechanisms that impact programme design in relation to the integration of SD. Our approach was influenced by critical realism (CR). CR is an alternative paradigm to those of positivism and hermeneutics (Scott, 2007). Its distinctive features are that it sees reality as stratified consisting of the empirical, the actual and the real which is intransitive and exists independently of our knowledge of it. Bhaskar (2008) argues that the "real" domain contains

all the mechanisms and relations that although unobservable can create events and behaviors in the actual domain which may or may not be observed. The empirical domain includes all our individual experiences of those events and behaviors. Critical realists use two distinct explanatory logics in moving from the empirical to the real: abduction and retroduction. The former describes the observed in an abstracted or more general sense in order to describe the sequence of causation that gives rise to regularities in the pattern of events, while the latter seeks to ascertain what the wider context must be like in order for the mechanisms we observe to be as they are (Edward, O'Mahoney, & Vincent, 2014).

The relationship between structure and agency is a key framing devise for critical realists (Scott, 2000). This is important because of the fundamental nature of the relationship it seeks to examine: that between human beings (the source of agency in the social world) and the social relations (structures) that are generated on the basis of their interactions: “People choose what they do but they make their choices from a structurally and culturally generated range of choices – which they do not choose” (Carter & New, 2004). Therefore CR provides the basis for examining intentional human activity within its social and cultural context and the extent to which that context enables or constrains that activity. Adapting a CR approach encouraged us to retroductively explore the mechanisms at the level of the real that explain the findings of our research in relation to the inadequate integration of SD in engineering programmes. This was achieved by exploring programme chairs’ views of SD and the factors that impact programme design, in relation to the integration of SD competencies, through a series of interviews and a thematic analysis of latent themes arising from these interviews. In doing so professional identity of the programme chairs emerged as a key issue. The relevant data is presented in this paper.

Research Context

In order for SD to be effectively introduced in engineering education a system change, a so called “paradigm shift” of current practices is needed (Donelly & Boyle, 2006; Thom, 1996). However, there is strong evidence in the literature which suggest that staff, among other aspects, are acting as a barrier against a holistic integration of SD in engineering education (Dawe, Jucker, & Martin, 2005; Velazquez, Munguia, & Sanchez, 2005). Staff have a narrow understanding of SD which is limited to the environmental dimension (Djordjevic & Cotton, 2011; Reid & Petocz, 2006; Summers, Corney, & Childs, 2004). Boyle (2004) claims that many staff have inadequate knowledge of SD and therefore are reluctant or unable to incorporate it into their courses.

Staff’s knowledge and understanding of SD, as it affects the pratice of engineering and engineering education, is part of their academic and professional identity. The latter affects their views of what performing the role of an engineer entails. Anderson *et al*. (2010) have argued that engineering groups imagine archetypes that capture dependent features of group membership: “These archetypes then show what the group values and serve to distinguish the ways of doing and thinking of one group from another” (p. 157). These archetypes are produced and reproduced through engineering education. Thus, Downey, Lucena and Mitcham (2007) say, “engineering educators typically bear primary responsibility for addressing and answering the question: What does it take to become a good engineer?”

Jamison (2013) has mapped the relationship between different approaches to engineering education and different archetypes of engineering identity. He identifies three broad approaches to engineering education: science-driven; market-driven, and socially driven. These are related to three kinds of identity: academic, commercial, and hybrid with the latter entailing a fuller understanding of engineering as a social, as well as a technical, activity. However, in most societies these ideal types do not exist in a pure form. Indeed the identification of deficiencies associated with the science-driven model has led to the development of a second layer of market-driven engineering education in many countries aimed at the production of more practically trained engineers (Murphy, Chance, & Conlon, 2015). For engineering academics this, along with other processes that encourage

engagement with industry has the potential to increase the tension between their identities as engineers and as engineering educators/academics (Erez & Shneorson, 1980; Jain, George, & Maltarich, 2009; Winberg, 2008). Or to put it in Jamison's terms between their commercial and academic identities.

Quinlan (2002) has argued that the beliefs engineers hold about their profession profoundly affect their education paratices, values and approaches to knowledge production. Winberg (2008) argues that engineering academics see themselves as "experts" who always want to be in control in order to increase student throughput without lowering engineering standards. This leads to a strong disciplinary identity and to the use of traditional pedagogies associated with the discipline that makes lectures act as transmitters of information of pre-defined problems with minimum ambiguities (Quinlan, 2002). The lecture/demo is the traditional method of teaching and allows lecturers to deliver their content heavy curricula (Winberg 2008). Following Whitchurch (2009) engineering lecturers, with these attributes, can be seen as bounded professionals that act to a predescribed role which is concerned with the continuity and maintainance of professional standards and processes.

According to the literature the formation of engineers' identities is influenced by three key elements (Clarke, Hyde, & Drennan, 2013; Koogan, 2000; Kuh & Whitt, 1986)

- Staff's unique history;
- Discipline: staff's discipline influences their knowledge assumptions (about what is to be known and how it is to be known), research activities, standards and teaching. For many this is seen as the key influence on professional identity (Bourdieu, 1988; Kember, 1997; Quinlan, 2002; Winberg, 2008):
- Academic community values which transcend disciplines among which academic freedom and autonomy are prevalent (Erez & Shneorson, 1980; Holmberg et al., 2008). But these values operate within particular communities and institutions of which academics are members and which determine academic roles (Koogan, 2000)

Thus academic identity is both individual and social. In what follows we will explore aspects of the professional identity of our participants in light of their views about the integration of SD in their programmes.

Methodology

The data reported here is extracted from data from six interviews with the programme chairs of the aforementioned disciplines. The interviews were designed to explore their views of SD and the integration of the concept in their programmes as well as their views about the factors that impact programme design.

The interviews followed a structured design. Although the interviews followed a sequence of thematic areas and questions, space and time was left for further probing and clarification of issues that the participants could raise during the discussion. Our approach to designing the interview questions was driven by two considerations. We wanted to raise with the chairs a number of issues which had arisen from the previous stages of the project. In particular we wanted to explore the missing social dimension of SD including the ethics of SD, the focus on environmental and energy issues and the absence of any forms of interdisciplinary activity in the programmes. But we also wanted to explore these issues in light of key factors that arose in the literature which were deemed to have an effect on programme design. Using abduction and retroduction we wanted to "add theory to data" (Edward et al., 2014). We also wanted to encourage reflection on what the key factors shaping programme design were and how they might be constraining the implementation of EESD in the programmes under investigation. These factors included institutional policies on EESD; professional accreditation processes; commitment to EESD in programme design and staff knowledge and understanding of SD.

In light of the above considerable time was spent mapping out the key issues that had arisen to concepts and factors that had been identified in the literature. We ended up with maps similar to conceptual maps in which we were trying to link the problems we had identified with possible causal factors. As a result of this work a number of key themes were identified for the interviews. These were:

- Personal history of engagement with EESD:
- Institutional Policy in relation to EESD
- The role of professional accreditation in shaping programme design
- Commitment to EESD in programme design and other factors which shaped programme design
- Programme content and EESD
- The integration of the Social Dimension and the ethics of SD
- The role of Multidisciplinarity in their programmes
- In addition the chairs were asked to identify the key features of an engineer who wanted to contribute to SD and the key attributes that a modern engineer would need.

In order to test the design and the effectiveness of the questions a pilot study was carried out that in general did not show any significant design flaws in the questions. Small adjustments in relation to question wording and placement were made. One hour interviews were scheduled with the selected programme chair persons of the seven engineering programmes across three Irish Institutions. The interviews were audio recorded for the purposes of transcription and analysis. One programme chair did not participate despite the several attempts to get in contact and schedule an interview.

The data analysis was carried out according to Braun's and Clark's (2006) six step framework for thematic analysis of latent themes. Initially the audio recordings were transcribed which assisted with familiarisation with the data corpus. The interview transcripts were then imported into QSR's NVivo 10 where a participant-driven coding was carried out. Then the nodes generated were merged into wider categories under parent nodes which underwent further coding to support the categorisation. The underlying themes of the categories generated were reviewed; further coding was carried out to support the identification of the themes. The themes were then reviewed and further coding was conducted to further support the latent themes. Finally a report was produced that provided a detailed account of the themes supported with inferences drawn from the raw data. Thematic analysis is an iterative process of continuous coding until a satisfactory level of the review of themes is reached.

An analysis of themes led to the emergence of an overarching theme of the "identity of engineering academics" as an underlying mechanism influencing programme chairs' views of SD and their assessment of the integration of SD in their programmes. Hence, transcripts were analysed again in order to extract the characteristics of the identity of each participant based on his views of SD and philosophy of engineering education. The sections below present the findings about the engineering academics identity and how that influenced the design of their programmes and subsequently the integration of SD. Full anonymity of the participants was assured; hence quotes extracted from the interviews will be referenced as Participant 1, 2 etc.

Findings

Programme chairs' views of SD and engineering education

While some of the programme chairs acknowledge that SD is a wide concept which is difficult to define the majority describe SD as a concept that relates economic development

and environmental considerations that are mainly focused on energy, materials and resource issues. Only one participant was able to describe SD as a complex three-pillar concept.

Their views of SD influence their views, which are generally positive, of the extent to which SD is integrated into their programmes. This leads to a variance between the findings of the previous stages of the project (Nicolaou & Conlon, 2013) and the programme chairs' views regarding how SD is addressed in their programmes. There is a general agreement that the design of engineering programmes is focused on core engineering competencies, "the fundamentals" (Quinlan 2002), while any SD related content is linked to energy issues, materials and resources. According to the participants the focus on core engineering competencies is supported by accreditation processes which emphasise the development of employable graduates for industry. A similar focus was found by Winberg (2008). While their responses show that the integration does not follow a multi-disciplinary approach and a neglect of the social dimension, the programme chairs say that they do not see any weaknesses in the way their programmes deal with SD. Only one programme chair was critical about how SD is treated in his programme.

While the effective integration of SD has been associated with the use of active learning (Mulder, Segalas, & Ferrer-Balas, 2012) when the participants talked about the pedagogy that is followed in their programmes they indicate an emphasis on traditional methods. The predominant approach is a combination of lectures-tutorials with a 70-80% exams and a small 20-30% continuous assessment which is limited in scope and related mainly to laboratory work. Programme chairs claim that lecturing is an effective teaching technique. Their attitudes towards more continuous assessment are rather negative as they believe that students learn better if they sit to read for an exam. Programme chairs are skeptical about multi-disciplinary activities. They argue that is very hard to manage students' different mind frames and timetables.

Programme chairs' academic identity

Programme chairs' views of SD suggest that the majority of the programme chairs see SD as a guarding concept that is based on a sense of techno-optimism and traditional engineering practice focused on guarding exploitable resources, waste minimisation and environmental protection and supports a disciplinary emphasis in knowledge for SD (Carew & Mitchell, 2006). Their views of engineering education suggest that programme chairs' support a model of education in which SD is seen as a separate entity from engineering (Jones, Selby, & Sterling, 2010) and is treated as an added-on tool to engineering curricula (Holmberg et al., 2008). According to this model, the focus is on core engineering competencies which, the chairs claim, are supported by staff, accreditation bodies and industry. Engineering academics seem to advocate a model of engineering education located between the market (oriented towards creating employable graduates) and science (focused on disciplinary knowledge) driven approaches (Jamison, 2013). The focus is on creating employable graduates with defined disciplinary knowledge. They maintain strong links with industry and endorse an employability agenda based on the needs of industry but at the same time maintain a strong commitment to academic autonomy. Hence it can be suggested that there may be tension between their professional identity as engineers and their identity as academics.

Programme chairs claim that staff's educational role is content delivery and the preservation of engineering standards suggesting that the chairs have the characteristics of bounded professionals which, according to Whitchurch (2009), are constrained within boundaries that they have constructed themselves or have been imposed on them. Their main concern is the preservation of continuity and the maintenance of current practices and standards. Hall (1996) argues that bounded professionals are "social subjects of particular discourses" which according to Friedson (2012) represent a "standardized production" of qualities as part of a group of professionals, in our case engineering academics.

Friedson's "standardized production" is illustrated in the programmes chairs' identity attributes in relation to the pedagogy followed. The data suggest that programme chairs and the staff in their programmes have an educational role of "transmitters of factual knowledge" instead of "facilitators and advisors of active learning" (Quinlan, 2002). The passive delivery of content through the use of traditional pedagogies that use pre-defined problems as demonstrations is a major aspect of engineering academics' identity (Winberg, 2008).

What is influencing programme chairs' formation of identity?

It was suggested above that there are three key elements that shape the formation of academic identities; each individual's unique history; discipline; and academic community. The data extracted from the interviews, in relation to the formation of identity of the participants, suggest that all three elements have played an important role in the development of programme chairs' academic identity.

Being engineers, the programme chairs have a common unique history of strictly engineering education both at an undergraduate and postgraduate level. According to them SD was not a part of any stage of their education or professional development.

No, it wouldn't have been in the context of actual lecturers on sustainability no, but I did qualify a long time ago and it wouldn't be as much as an issue back then. (Participant 5)

Although Participant 3 had an engineering education like the rest of the participants, his personal interest about SD and his involvement in the design of a postgraduate programme predominately focused on SD has given him the opportunity to improve his awareness of it.

Since I have been working in the educational sphere I have been heavily involved in a master's programme, a collaborative programme with two other institutes that's focused predominately in SD, it's actually a masters in sustainability technology and innovation. So I have been bit more of an awareness based on that compared to my previous background. (Participant 3)

The data show that there is a strong commitment to a disciplinary culture across all the disciplines. This disciplinary commitment is evident in the programme chairs' views about the required attributes of engineers:

Would you like the engineer that is designing your building to get his structural calculations correct or you prefer if some of the time that the engineer would spend would be to prepare finding new untested products .I think everyone would say "oh I would certainly want the beam to stand up"(Participant 1)

As well as in their attitudes about anything they feel "does not belong" in their discipline

We don't get into anything outside the buildings. So once the drainage systems leave the building that's it in regards to us. (Participant 4)

Or an alternative teaching and assessment method:

No, again I am going to sound like a dinosaur know, I would have all exams and not continuous assessment because I saw that system working really well, continuous assessment is just used just as a methodology to raise the pass rates (Participant 5)

The academic community which staff are members of also has an impact on their professional identity and this is apparent in this study. Programme chairs in numerous instances mention the autonomy they enjoy in designing their programmes as well as the academic freedom that staff have during the design and delivery of their modules.

Programme it's very autonomous in the way of what we think we should be teaching (Participant 2)

There is a lot autonomy afforded to the individual lecturers (Participant 3)

The operation of this autonomy works to reinforce disciplinary cultures due to the absence of an overarching policy in relation to ESD in any of the institutions in the study. Indeed their autonomy is so strong that programme chairs do not want the institution having an impact on the design of their programmes and were resistant to the idea of an institutional policy to guide the integration of SD. In contrast, it can be noted that they had no difficulty with a policy emanating from their professional body, Engineers Ireland, which suggest a stronger identification with their profession as opposed to their academic institution.

Their involvement with industry also shapes their knowledge assumptions which are filtered into the programmes:

A lot of them (the staff) would be practitioners before joining the institution and some of them are still while they are here, maybe doing some external research and jobs so they would have an idea what's going on the ground outside and hopefully bring that in into their courses and their programmes (Participant 6)

Seeing themselves as members of the industry they serve as well as members of Engineers Ireland leads programme chairs to espouse a certain set of values (Koogan, 2000) that endorse an employability agenda as a criterion of the effectiveness of their programmes at the expense of SD.

It is an issue for SD but for us is also an issue of job opportunities for graduates and so this is an area that we need to integrate more content. (Participant 2)

Our guys are well respected and in demand. If there was a problem we would get that back from the employers, we do get things back but they don't have to do with sustainability, they have to do more with the basic understanding of units and calculations. (Participant 5)

Conclusions - Implications

Programme chairs' have a disciplinary identity in a culture that offers great autonomy and a set of values that support a market driven model of engineering education informed by disciplinary knowledge. It is apparent that their disciplinary identity is a constraint rather an enabler for a holistic integration of SD in engineering programmes. Programme chairs can be described as bounded professionals (Whitchurch, 2009) who offer their allegiance to traditional practices as promoted by their disciplinary communities. This makes them perceive SD as a guarding concept (Carew & Mitchell, 2006) that is treated as an added-on tool to the engineering curriculum. This allows them to claim that SD is integrated into their programme while there is evidence which suggests that there are significant omissions particularly in relation to the social dimension.

Given their commitment to disciplinary norms along with their autonomy, which allows them to preserve this identity, it is difficult for programmes to undergo radical change (Winberg, 2008). This begs the question of how change can occur at all. Some issues arise.

Firstly, we would argue, our approach, which has focused on identifying underlying mechanisms preventing the integration of SD, helps us understand why approaches focused on changing the teaching practices of individual teachers are likely to fail. Unless there is engagement with the current belief structures that maintain and support current practices change is unlikely to occur and be sustained (Quinlan 2002). This is particular so if the aims is to shift to a more socially driven model of engineering education. Splater– Roth and Meiksins (2008) point to the difficulty of universities forging "broad unifying organisational strategies" and argue that change in engineering education tends to start in the middle at school and department level. It's at this level that disciplinary cultures are likely to be engaged.

Secondly, our evidence supports the claims that cultural change will not be achieved with measures related to "teaching the teachers" as it infringes their sense of expert autonomy and may not engage staffs' concern for their discipline (Mulder et al., 2012). Instead of seeing academics as part of the problem, it is better to see them as part of the solution.

Hence, approaches such as “ask the teachers” are more favourable towards adaptations in education that may lead to a cultural change in engineering education (Holmberg et al., 2008; Mulder et al., 2012).

Finally, given their attachment to their discipline and their professional body, and the requirement for legitimating statements supporting working with SD (Mulder et al., 2012) it would be helpful if Engineers Ireland adopted a learning outcome for engineering programmes focused on SD. This though does not obviate the need to engage with the disciplinary culture as indicted above but is likely to have a greater impact, given the evidence presented here, than declarations from individual institutions. This though would need to be supported by accreditation processes that genuinely interrogate programme provision for meeting such a learning outcome (Conlon, 2013).

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