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TEACHING IS LIKE ENGINEERING: THEORISING MY PROFESSIONAL PRACTICE

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ABSTRACT
This article presents a doctoral research project in which I theorised my professional practice as an analogy that teaching is like engineering. It begins by tracing my teaching career, and highlighting how I discovered my community of practice, and subsequently how I pinpointed my professional identity. It then outlines Living Educational Theory which I adopted as the paradigm for the research project, and describes the autoethnography which I conducted to theorise my professional practice. The chapter continues by presenting the analogy that teaching is like engineering. It concludes with a discussion of the analogy and Living Educational Theory.

Keywords: Analogy, Professional Practice, Teachers, Teaching, Living Educational Theory, Autoethnography.

1. INTRODUCTION

There is no shortage of analogies for theorising the professional practice of teachers. Consider the orchestra analogy, for example, in which the role of the conductor is played by the teacher. Students are the musicians, the classroom serves as the concert hall, and the school head is the orchestra's administrator. Education, therefore, can be viewed as a kind of collaborative process in which the teacher 'conducts' — instructs, cajoles, encourages, nudges — students to perform, sometimes solo but often together as a unit, within the financial and operational constraints of the orchestra.

Perhaps the most popular analogy for theorising the professional practice of teachers, however, is teacher as gardener. In this analogy, students are seedlings (of different varietals), whose growth is nurtured by teachers. Indeed, these gardeners nourish and weed and prune the seedlings throughout the growing season, the goal of which is fully-blossomed florae. Sir Ken Robinson, who is considered a hero by cheerleaders of a more creative school curriculum, pressed the teacher as gardener analogy in his 2006 TED talk ("Teachers Are…", 2012). But countless other analogies for theorising the professional practice of teachers exist, including teacher as lighthouse, teacher as coach, teacher as water, teacher as muse, and teacher as tour guide.

In 2019, I registered for the Doctor of Professional Studies degree at Middlesex University. At the time, I had been teaching in higher education for more than 25 years, but the degree afforded me the opportunity to explore, deliberately and critically, my professional practise as a university professor (I use the term professor here to mean university-level teacher, not to indicate institutional rank.). I adopted Living Educational

Theory which, as a paradigm, provides teachers both a philosophy and method for theorising professional practice. Specifically, I conducted an autoethnography to construct a theory which describes and explains my professional practice. The result was a living educational theory which theorises my professional practice as an analogy that teaching is like engineering.

The purpose of this article is to present this analogy. It begins, however, by tracing my teaching career, and highlighting how I discovered my community of practice, and subsequently how I pinpointed my professional identity. It then outlines Living Educational Theory, and describes the autoethnography which I conducted. The chapter continues by presenting the analogy that teaching is like engineering. It concludes with a discussion of the analogy and Living Educational Theory.

2. MY COMMUNITY OF PRACTICE AND PROFESSIONAL IDENTITY

Hot for Teaching

My sister was a teacher, first at a primary school in an isolated First Nations Webequie village near Hudson Bay, then later as a teacher-librarian in Arctic Canada. My mother was also a teacher; after completing two years of training at Hamilton Teacher's College, she was given her own one-room school house not far from my hometown. My maternal grandmother's teaching tenure lasted for only three years because the teaching profession, during that period of Canadian history, was limited to unmarried women. I also have a vague recollection that her father had been a teacher, before education was deemed an acceptable job for women in Canada. It might seem, therefore, that I was destined to be a teacher.

My path to the teaching profession, however, was not straightforward. As I remember it, I had thoroughly squelched any inkling of being a teacher, having convinced myself that the teaching profession was beneath me. Instead, I pursued an undergraduate degree in engineering, largely heeding to the 'wisdom of the crowd' which was unequivocal that it was the most appropriate subject for someone with strong secondary-school results in mathematics and the sciences.

It was after four months of post-graduation engineering practice, and the requisite European back-packing trip, that I more or less fell into teaching. In late November 1990, I returned home from London, the last stop of the eleven-country back-packing trip. Prior to the trip, however, I had been offered (and I had accepted) a place in an MBA programme which was to begin nine months later. What to do until then? I was not especially eager to return to the foundry at which I had previously worked, and applying for engineering positions at other industrial companies in the area seemed unethical, knowing that I would be departing for the MBA programme in less than a year. So, again, what to do until then?

My mother still served as a substitute teacher from time to time in my home town, and she suggested that I put my name on the list. Within days, I received my first call to stand in (actually more sitting than standing) for a kindergarten teacher who was out with laryngitis, strep throat, or some other not-the-best-for-a-teacher kind of illness. Although my engineering skills were doubtless under-utilised as I played in the sandbox, laced up boots, and doled out snacks, I was smitten. I was convinced that it was more than just an infatuation during the following week, when I spent two days teaching grade-twelve calculus. By the end of the school year, I had served as a

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substitute teacher for more than one hundred days, and in almost every grade. And I knew that I would become a teacher.

At the end of the summer vacation, however, I packed up my car, and off I went — somewhat reluctantly — on a seventeen-hour drive to Fredericton, New Brunswick, for a week of MBA orientation activities. It ought not to be surprising that during the orientation week I began exploring the possibility of switching to the university's one- year Bachelor of Education (BEd) programme, the certification which is required for K-12 teaching in Canada. But another random occurrence changed my direction.

In the first semester of the MBA programme, I was fortunate to secure a research assistant position, the main activity of which was to conduct remedial marketing tutorials for three Indonesian classmates whose English-language skills were weak. I use the word fortunate because the research assistant position covered my university fees. Hooray! More importantly, the tutorial experience precipitated a decisive a-ha: that I would become a university professor. Incidentally, the research assistant position also roused my interest in marketing.

An internship in Poland after my first year of the MBA programme, during which I spent the summer teaching marketing to the employees of a newly-instituted marketing department of a former centrally-planned tyre factory, confirmed my epiphany. And it reinforced my interest in marketing. Consequently, I returned to the second year of the MBA programme with more enthusiasm (especially for marketing), with a new professional focus, and, accordingly, with a new item on my to-do list: a PhD in marketing, the certification which is usually required for university-level teaching in Canada and elsewhere.

I began my PhD research in earnest in January 1997 at the University of Cambridge, after 3½ years teaching marketing at a French business school. My research was situated within marketing. Specifically, I developed a new conceptualisation of consumer values by conducting a phenomenology within the high-fidelity audio microculture. To fund my doctoral programme, I served as an adjunct professor at various universities in the United Kingdom and abroad, often leaving Cambridge for weeks at a time to deliver intensive modules in marketing. My higher education teaching career was underway.

I submitted my doctoral dissertation for examination in October 2000, and in May 2001 I took up the position of Senior Lecturer at Washington University in Saint Louis, Missouri. My teaching load consisted of six full-term modules per year. To the outsider, therefore, it must have appeared that I had made it:

PhD degree ☑
Senior Lecturer position ☑

Who am I? I am Jean Valjean!

Ironically, despite the years of teaching experience which I had already accrued, despite the PhD degree which certified me for university-level teaching, and despite my appointment as full-time Senior Lecturer at Washington University, my professional identity — defined as a person's image

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of who she/he is as a professional (Slay and Smith, 2011), or, more elaborately, the constellation of attributes, beliefs, values,motives, and experiences which a person uses to define herself/himself in a professional capacity (Schein, 1978) — had somehow become tied to marketing … not teaching. Indeed, I saw myself as a marketing scientist, with my scholarly activities, my memberships in professional associations, and even my daily conversations with colleagues correspondingly about marketing. Doctoral programmes have a way of brainwashing you, I suppose. And according to Cuthbert and Langley (2010), the academic profession has traditionally come second to the academic discipline in a professor's identity.

Soon, however, a disillusionment with marketing began creeping in — not with marketing per se, but with the academic discipline of marketing. First came the recognition that the scientific research on which I spent an excessive amount of time had marginal impact on the quotidian practice of marketing. In other words, the academic discipline of marketing appeared to overlap very little with 'real marketing'.
Second, I observed that for many of my colleagues in the marketing department, the subject of marketing appeared to be almost entirely divorced from the students whose marketing mastery they claimed to be aiding. Student needs were seemingly of low importance, and employability factored little in curriculum design. This observation would not surprise Stoller (2017), who suggested that professors …

"largely teach what they know (content) decoupled from why they know it (values), how they know (technological processes), and who knows it (identities and social contexts). The curriculum is not only decontextualised, but also dehumanised as its center of gravity prioritizes subjects over students" (par. 10).

Third (and most jarring) was the revelation that to most of my colleagues in the marketing department, teaching was considered secondary. Indeed, teaching was viewed by them as trivial and insignificant in contrast to scientific research, the gravity of which, for them, was undeniable. I remember the Dean stating otandedly at a staff meeting that three out of five on teaching evaluations was adequate. Adequate!

This professional identity crisis was resolved when I reconnected with my former University of Cambridge carrel-mate Claus Nygaard, who had taken up a position at Copenhagen Business School in Denmark, after earning his PhD. In a similarly short period of time, Claus had likewise become frustrated with the emphasis on science over students. He thought that it was ludicrous, for example, that professors attend expensive academic conferences at which they present their scientific research in a ten to twenty minute session, receive a few comments, then head to the bar for a drink. These same professors, he noted, were often loth to spend any time refining a syllabus, reworking a lesson plan, or rendering a new classroom exercise.

Consequently, Claus launched the association LiHE (Learning in Higher Education) which, as intimated by its appellation, focuses on learning at the post-secondary level. The main activity of LiHE is a symposium which, contrary to traditional academic conferences, returns to the ancient Greek format at which co-creation is key. About six months prior to a symposium, a call for chapter proposals which has a relatively narrow theme is announced on the association's website and through various electronic mailing lists. Authors submit chapter proposals accordingly, which are

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then double- blind reviewed. If a chapter proposal is accepted, its author is given approximately four months to complete and submit a full chapter. The full chapter is then double-blind reviewed, and if it is accepted, the author is invited to attend the symposium, during which authors help polish each other's chapters, finalise their own chapters, and collaborate to assemble an anthology which is sent to the publisher a few months later.

Claus contacted me in 2008 specifically to solicit a chapter proposal for an upcoming symposium whose theme was 'Improving Student Learning Outcomes'. I submitted a chapter proposal on the use of analogies in teaching. The idea for the chapter arose one day in a conversation with a colleague who remarked that his go-to instructional tool was the 2×2 matrix. I have witnessed his teaching many times, and I testify that he can boil every management challenge down to two orthogonal dimensions. With a smile, I added that my go-to instructional tool was the analogy. Indeed, to this day I frequently find myself explaining a concept using some variation of the phrase "You know, that is like___________ .". But a number of important questions arose in my mind. Do analogies work? If so, how and why? Do they have limits? If so, what can be done to ensure their efficacy? This was the gist of the chapter proposal.

Thankfully, it was accepted. The subsequent full chapter was also accepted. And I headed off to the Greek island of Aegina, to a small one-star family-run resort, to the site of my first LiHE symposium. Claus and I were the only business-school professors; the other participants came from a variety of faculties/departments, including history, music, and medicine. Like me, each professor had her/his own subject-specific expertise. But we coalesced around the common goal of improving teaching and learning in higher education. In that moment, I realised that this rag-tag, non- denominational group of professors was my tribe. Indeed, I had found my professional home. I had discovered my community of practice.

Consequently, I was also able to pinpoint my professional identity — that seemingly elusive thing which had triggered my disillusionment with marketing. Indeed, I was finally able to articulate my professional self. I was not a marketer. I was not out there in the 'real world', practising the craft of marketing at P&G, Unilever, or other consumer packaged goods company. I was not a marketing scientist. I had yet to convert my dissertation into any scientific journal articles, and truthfully, I lacked the motivation which is necessary to be successful in the publishing game. No, I was a marketing educator!

After discovering my community of practice (professors whose goal is to improve teaching and learning in higher education) and pinpointing my professional identity (marketing educator), my scholarly activities, my memberships in professional associations, and my daily conversations with colleagues shifted immediately away from marketing, towards teaching and learning. I cancelled my subscription to the Journal of Marketing, for example, and I joined the higher education special interest group of the American Marketing Association. A kind of psychological calm replaced the anxiety which had accompanied my 'I am marketer' professional identity. And I embarked on a decade of research and writing in and around the scholarship of teaching and learning, all in service of furthering my professional practice as a marketing educator within my community of practice.

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Reflecting on this new professional identity with respect to Caza and Creary's (2019) typology of professional identity archetypes, it is clear to me that I display the professional identity archetype of dominance. Although I pinpointed my new professional identity as a marketing educator very decisively (and I continue to consider myself as such), my primary profession is as an educator, to which marketing is subordinated. Marketing is the subject which I teach most frequently, and which is my academic home. When asked "What do you teach?" by immigration officers and other officials who have noted 'Professor' in the occupation field of my completed form, I always respond with marketing. But I consider myself first and foremost an educator; marketing is not irrelevant, but it comes second to my primary profession as an educator. And consequently my community of practice is all professors, not marketing professors specifically.

3. LIVING EDUCATION THEORY

So, in support of my professional identity as a marketing educator, in keeping with a decade of research and writing in and around the scholarship of teaching and learning, and in the spirit of lifelong learning, I decided to continue my formal education. The subject: me! I registered for the Doctor of Professional Studies degree at Middlesex University, whose stated objectives fit hand-in-glove with my on-going journey of self- discovery:

"As a candidate for this award you would undertake a critical reflection upon your practice and then design and undertake a doctoral level practice–based research project in your own work within your own organisation or community of practice" ("Doctor of…", 2022).

I began the Doctor of Professional Studies research project with an exploration of professions. Indeed, the first thing which I wrote was a section on professions, which simply made sense to me at the time, because the title of the degree itself suggested that a grounding in the professions was warranted. I then embarked on a professional

'walkabout', meandering through the literature on professional identity, professional practice, professionalism, and professionality. This meandering also led to a detour into the literature on communities of practice.

Serendipitously, while reading about action research, whose tenets and traditions appealed to me as a possible methodological approach for the Doctor of Professional Studies research project, I happened upon Living Educational Theory. It is attributed to Jack Whitehead, who spent the majority of his career as a professor of education at the University of Bath. It was born in the early 1980s from Whitehead's critique of traditional scientific research in the academic discipline of education. And its clarification, formalisation, and propagation as a paradigm solidified throughout his more than four-decade career.

From a theoretical perspective, Living Education Theory specifies the rationale for the contributions to knowledge which a teacher can make by researching her/his own professional practice. Whitehead (1983) explained:

"This [research] is then extended into theory in the form of an explanation for one's own practice. This process has ensured that the theory generated from

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such research is grounded in the important area of the classroom; it ensures that explanations and theoretical observations and analyses remain linked closely with what has actually proved to be of value in the school environment: it ensures that the theory evolving out of the personal research programmes is tailor-made for the individual who is putting it into practice. The personal explanation which constitutes an individual's personal educational theory grows out of his own practical experience" (p. 175).

At a more pragmatic level, Living Educational Theory entreats a teacher to theorise her/his professional practice, through reflective research on her/his educational values, and on the practice-solutions which were developed therefrom. The outcome is a living educational theory which describes and explains her/his professional practice. The teacher substantiates this living educational theory by demonstrating how the educational values are embodied in her/his professional practice.

For my Doctor of Professional Studies research project, I conducted an autoethnography, which, as intimated by its moniker — auto (self), ethno (culture), and graphs (description) — is a research method which aims to furnish an account of a social group, from and by an insider (Heider, 1975). Indeed, as summarised by Hayano (1979), autoethnographers "conduct and write ethnographies of their 'own people' " (p. 99). They exercise both "autobiography and ethnography to do and write autoethnography" (Ellis et al., 2011, p. 1).

More specifically, I conducted an evocative autoethnography, whose aspiration is to re- enact the experience by which an autoethnographer finds meaning (Bochner and Ellis, 2006). In doing so, it aims to open conversations among, and evoke emotional responses from, its readers. Evocative autoethnography foregrounds the autoethnographer's experience, and focuses "on life as 'lived through' in its complexities" (Adams et al., 2017, p. 8). In evocative autoethnography, therefore, autoethnographers immerse their readers into "the kinds of experience we might not ordinarily talk about publicly … [they] take the reader into the private cultural world of the author" (Turner, 2013, p. 213).

I began by writing my autobiography of sorts. I qualify with of sorts because I did not chronicle my entire life from first memories up to the present day. Instead, I described specific events in my life which have been instrumental in my development. Indeed, following Ellis et al. (2011), I keyed in on 'epiphanies':

"remembered moments perceived to have significantly impacted the trajectory of a person's life, times of existential crises that forced a person to attend to and analyse lived experience, and events after which life does not seem quite the same … When epiphanies are self-proclaimed phenomena in which one person may consider an experience transformative while another may not, these epiphanies reveal ways a person could negotiate "intense situations" and "effects that linger" — recollections, memories, images, feelings — long after a crucial incident is supposedly finished" (p. 3).

An autobiography also shows "people in the process of figuring out what to do, how to live, and the meaning of their struggles" (Bochner and Ellis, 2006, p. 111). Consequently, autobiography can be regarded as "a method of inquiry, a way of finding out about a topic … form and content

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are inseparable" (Richardson, 2000, p. 923). By writing my autobiography, therefore, I was able to begin discerning my professional practice.

I wrote the autobiography over a two-month period in summer 2019. I drew on some earlier autobiographical work which I completed as part of a Master of Arts in Education degree with which I graduated in 2003. My autobiography includes both descriptions of specific events in my life which have been instrumental in my development (the epiphanies), and my reflections on these events. The rhetoric is informal and conversational in tone, consistent with both Living Educational Theory and autoethnography.

In the reflections, I attempted to re-frame the specific events in my life in a new context, which enabled me to view them from a different perspective — a methodological sleight of hand which Schön (1983) called a frame experiment. The reflections were necessary because, as suggested by MacLure (1996), an interpretive researcher must move "backwards to the past and forward again in order to try to make sense of the present" (p. 273). In other words, the reflections precipitated movement from my autobiography being simply a description of the specific events which were instrumental in my development, to my autobiography also being an explanation of why these specific events were instrumental in my development. Indeed, the reflections, to some degree, helped me transform the specific events of the autobiography into specific meaningful events.

Now, in order to theorise my professional practice, I employed a hermeneutic analytical procedure. Broadly speaking, hermeneutics is the science of interpretation (Allen and Jensen, 1990). As a mode of understanding, hermeneutics keys in on the 'meaning-full forms' (Betti, 1980) which are bound up in the "contextualized personal expressions of an individual" (Arnold and Fischer, 1994, p. 61) — known in hermeneutics as the text (Ricoeur, 1981). To re-experience, re-cognise, and re-think these meaning-full forms through an interpretation of the text is to achieve hermeneutic understanding (Bleicher, 1980).

Consequently, I treated the autobiography (both the events and the reflections) as a 'Ricoeur-ian' text. I began with an interpretive reading of my autobiography to yield an initial understanding of the meanings which were embedded in it. I then started breaking down my autobiography into meaning-full elements, using a paper-based coding and indexing system. Specifically, I developed codes for different meanings, and indexed all instances of these meanings by tagging the textual units in my autobiography which demonstrated the codes. An example of a code was technology, which I tagged to ten textual units in my autobiography. I then reconstructed these codes in a new way, thereby yielding a new understanding of my autobiography as a whole. This process of coding, indexing, and theorising continued until I believed that I had resolved the contradictions among and between the elements of the autobiography and the autobiography as a whole. The final result of this hermeneutic procedure was a fresh description of my autobiography — specifically, a living educational theory which theorises my professional practice as an analogy that teaching is like engineering.

You Can Take the Kid Outta Engineering, But …

A recent study was published in the New York Times which found that a person's musical preferences are, by and large, fixed by the age of 13 for girls and 14 for boys. The author of the

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study, Seth Stephens-Davidowitz (2018), arrived at this finding after cross-referencing chart-topping songs from 1960 to 2000, with the age data of listeners who subscribe to the Spotify streaming music service. The song 'Creep' by Radiohead, for example, was found to be the 168th most popular song among thirty-eight year old men. They were fourteen years of age in 1993 when the song was released. Creep did not even make the chart, however, for people who were born one decade earlier or one decade later. Stephens-Davidowitz's cheeky conclusion was that "[t]he study adds one more piece of evidence to the growing scientific consensus that we never really leave middle school and high school" (p. 9).

In a similar way, it seems that my professional practice also established itself early on … before that year of substitute teaching in my hometown in Canada, and long before I became a professor. Indeed, it is influenced, if not moulded entirely, by specific events in my life — the epiphanies — which have been instrumental in my development. In short, despite identifying myself as a marketing educator, I remain an engineer at my core.

Accordingly, my professional practice as a marketing educator is akin to the professional practice of an engineer. When tasked with a new module, for example, I plan and execute it like an engineer. I view a ninety-minute classroom session as if it were an engineering problem. And each case study or exercise which I intend to use is engineered with precision, down to the board blueprint and the pedagogical 'pastures'. Of course, it is no coincidence that I use an analogy to theorise my professional practice, considering that my go-to instructional tool is indeed the analogy.

To begin the analogy, engineering is defined as the use of "scientific principles to design and build machines, structures, and other things, including bridges, roads, vehicles, and buildings" ("Engineering.", 2020). It is derived from the Medieval French word ingenium which meant machine or engine, and which itself stems from the Latin combination of in and gignere (to beget), a rough translation of which is the 'product of ingenuity' ("Engine.", 2020). In plain English, engineering is about making new technologies, with the help of science.

According to the New World Encyclopedia, technology, in its broadest sense, refers to "the entities, both material and immaterial, created by the application of mental and physical effort in order to achieve some value" ("Technology.", 2020). Technology, therefore, can be viewed as the output of engineering. Indeed, to engineer means to engineer something. Technology is the tangible or intangible manifestation of engineering. It is the stuff of engineers.

Julie Andrews and Christopher Plummer cautioned us, however, that nothing comes from nothing. Consequently, technology must also be considered as an input to engineering. That is to say, a new technology always owes its existence to previous technologies, a notion which is sometimes captured by the cleverly-worded concept of combinatorial creativity (Popova, 2012). Even so-called disruptive innovations have antecedents in some shape or form.

Similarly, technology serves as an instrument of engineering. Engineers employ technology in the act of engineering; it supports their application of mental and physical effort in order to achieve some value. Engineering and technology, therefore, are inextricably linked, and technology functions as the input, the instrument, and the output of engineering. Engineers, for example, might use a hammer to design and build an improved version of a hammer.

One aviso is that engineering creativity is not unbounded. On the contrary, engineers must operate within prescribed or self-imposed constraints: temporal or financial limits, for example, government regulations, or user demands. Consider the challenge which engineers face when developing solutions for the base of the pyramid —n the approximately 1 billion people who live on less than 1 USD per day. Or what about the 'Nano', the diminutive and spartan result of TATA's goal to build the world's least expensive automobile? Both of these examples allude to the very real constraints with which engineers must grapple.

Returning to the definition of engineering, when designing and building machines, structures, and other things — when making new technologies — engineers use (or apply) scientific principles, thereby giving rise to the idea that engineering is an applied science, as distinguished from the pure or basic sciences. These scientific principles include first principles — the elementary ideas from which a concept, theory, or system is derived. Indeed,

"[I]n every systematic inquiry (methods) where there are first principles, or causes, or elements, knowledge and science result from acquiring knowledge of these; for we think we know something just in case we acquire knowledge of the primary causes, the primary first principles, all the way to the elements" (Aristotle, Physics 184a10–21, as quoted in Irwin, 1988).

Not to be confused with first principles, however, are what might be termed engineering principles: the rules, standards, or guidelines which shape engineering practice. A generally-agreed list of characteristics of engineers is relatively easy to assemble. Engineers are detail-oriented, for example. Engineers are good problem- solvers. And engineers are strong in logical reasoning. But a similar list of engineering principles is difficult to find. Both keep it simple stupid (KISS) and keep the user in mind which were suggested by EngineerGirl.org seem reasonable engineering principles to follow ("Engineering Principles.", 2020). But at the end of the day, it appears that engineering principles rest with the individual engineer.

Now, to flesh out the analogy that teaching is like engineering, I regard teaching (paraphrasing the Cambridge English Dictionary definition of engineering) as the use of scientific principles to design and build knowledge. Technology and knowledge, therefore, are analogous; just as technology is the output of engineering, so knowledge is the output of teaching. Indeed, to teach means to teach something. Knowledge is the intangible manifestation of teaching. Knowledge is the stuff of teachers.

Truthfully, my instinct as a constructivist was that, in my role as a professor, I actually design and build learning opportunities, because knowledge is beyond my direct control. After some reflection, however, I concluded that learning opportunities are the means to the ends, and not the ends in themselves. Indeed, learning opportunities are the mechanisms by which knowledge construction is facilitated. Knowledge, not learning opportunities, is the objective of teaching … hence the term learning objectives.

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In parallel with the definition of technology, new knowledge always relies on extant knowledge. Indeed, knowledge is cumulative, with new understandings of the world not so much replacing, but subsuming, their predecessors. To learn means to revise and reform the cognitive schema which represent the concepts and theories of reality. This is the crux of the constructivist philosophy.

Similarly, knowledge serves as an instrument of teaching, like technology serves as an instrument in engineering. To design and build knowledge, I use my own knowledge of educational psychology, curriculum design, and classroom management, for example, to support my mental and physical effort in order to achieve some value. Teaching and knowledge, therefore, are inextricably linked, and knowledge functions as the input, the instrument, and the output of teaching. Accordingly, teaching, like engineering, is an applied science.

As an applied science, teaching has its own first principles. Indeed, in the words of Aristotle, teaching has its own elements or causes which form the basis from which it is known. In other words, these first principles are the laws of physics to which teachers ought to appeal, when they design and build knowledge. We know, for example, that students continue to work diligently if praise for their academic success is tied to effort rather than intelligence (See Gable et al., 2009, for example.). Any teaching activity, therefore, would do well to strengthen this tie.

It ought to be obvious that any teaching activity is also subject to constraints. The university year, for example,

"… has (somewhat arbitrarily) been divided into trimesters or semesters or other circumscribed periods of time. A committee somewhere, sometime might have decided that, irrespective of their focus and content, all courses in a degree programme will be standardised to 3 credits. Or maybe the department chairperson has restricted enrolment in a course to students who have met certain pre-requisites, has already written the course's learning outcomes, and has even mandated a specific course textbook" (Nygaard et al., 2015, p. 2).

Constraints are unavoidable. And teachers, like engineers, must incorporate them when they design and build knowledge.

Finally, teachers, like engineers, do not have a definitive and universal list of teaching principles (rules, standards, or guidelines) which shape teaching practice. On the contrary, teaching principles rest with the individual teacher. My professional practice as a marketing educator within my community of practice is intentional action which is shaped by my teaching principles.

4. DISCUSSION

The analogy that teaching is like engineering provides a novel perspective on, and interesting insights into, teaching as a professional practice. Its focus on knowledge as the output of teaching, for example, emphasises the centrality of the learner, and reinforces the constructivist nature of learning. It acknowledges that teaching is an applied science with its own set of first principles on which teachers (as engineers) ought to draw. It not only accepts that teaching is subject to constraints, but also that teachers account for them in their professional practices. And it underlines the notion that teachers bring their own teaching principles to bear on these professional practices.

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Living Educational Theory served as an effective paradigm for guiding my exploration of the dynamic nature of my professional practice as a marketing educator within my community of practice. Indeed, it helped to reveal the constitutive relationship between my professional identity and my professional practice, thereby affording a richer understanding of the way in which my professional identity shapes my professional practice, and, in turn, of the way in which my professional practice re- shapes my professional identity.

Autoethnography proved useful as a research method, enabling me to theorise my professional practice, and subsequently to clarify and build on my existing sense of who I am as a marketing educator within my community of practice. By theorising my professional practice, I have also become a more conscious professor, aware of how my teaching principles shape my professional practice. Consequently, I am now vested in my scientific research and writing in and around the scholarship of teaching learning, beyond the publications themselves, because I recognise that they are not only the output of my scientific research and writing, but also an embodiment of both my professional identity and my professional practice. And I am doubtless more cognisant of the agency which I possess as a professor to influence the perception of my professional identity within my community of practice.

This Doctor of Professional Studies research project has been a very worthwhile and rewarding exercise. Through it, I have come to know my professional identity as a marketing educator within my community of practice. I have uncovered and articulated the teaching principles which undergird my professional practice. And I have described and explained my educational practice as a marketing educator. I encourage other teachers to explore their own professional practices in this kind of autocritique, subjecting their own living educational theories to public scrutiny. In doing so, I am confident that they will become more conscious teachers, aware of the interplay between their professional identities, their teaching principles, and their professional practices.

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