Polytechnic education in Singapore: An exploration of pedagogies for a polytechnic

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எழுத்தாணி கரத்தானை
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ABSTRACT

Polytechnic education in Singapore is currently going through a watershed period. The redesign of economic development in Singapore is necessitating changes to many institutions and establishments within the county. Polytechnic education that nurtures 45% of each school-going cohort to be job-ready upon graduation is emerging as a critical player in these changes. The establishment of SkillsFuture Council and various national level reports with particular reference to polytechnic education are signposts of the watershed period.

Polytechnics, with an astute focus on applied study orientation since their inception, have served the needs of the Singapore economy well. Over the past five decades, polytechnics have gained a reputation of preparing job-ready graduates for industry. Pedagogy plays a crucial role in the process of nurturing polytechnic graduates for the demands of the industry. However, the scarcity of published research on polytechnic education and pedagogies indicates a need for research in this area. Hence, my research is focused on reviewing current pedagogical practices and clarifying the developments required for the impending changes affecting polytechnic education in Singapore.

Adopting a constructivist conceptual framework, the study sought evidence for Polytechnic pedagogical needs through interviews with staff, i.e. the key stakeholders.

The principal findings from my study highlights a need: (i) for clarity of definition and the principles underpinning pedagogy for Polytechnic; (ii) to emphasise the role of constructivist principles in aiding future pedagogy development for the polytechnic; (iii) to prepare students for workplace learning; (iv) to do an in-depth profile of polytechnic students; (v) to renew the graduate profile of polytechnic graduates; and (vi) to encourage educational research and the establishment of professional learning communities within the polytechnic.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

GLOSSARY

ASPIRE	- Applied Study in Polytechnics and ITE (Institute of Education) Review
CFE	- Committee on Future Economy
DGP	- Desired Graduate Profile
DPs	- Deliberated Professionals
FAST	- Flexible Academic Structure
IHLs	- Institutes of Higher Learning
ISO	- International Standards Organization
ITE	- Institute of Technical Education
KPI	- Key Performance Indicator
LE	- Learning Enterprise
MOE	- Ministry of Education, Singapore
PBE	- Practice-based Education
PBL	- Problem-based Learning
RQ	- Research Question
SIP	- Student Internship Programme
TA	- Thematic Analysis
TE	- Themes
TLLM	- Teach Less Learn More
TSLN	- Thinking Schools Learning Nation
WBL	- Work-based Learning
WPL	- Work place Learning
WRL	- Work-related Learning

CHAPTER ONE
INTRODUCTION

Polytechnic education in Singapore is going through a watershed period now. Five polytechnics established from 1954 to 2002 with a similar mandate to train para-professionals for industry, are currently undergoing major changes. The establishment of ASPIRE (Applied Study in Polytechnics and Institute of Technical Education (ITE) Review) in 2014, SkillsFuture Council in 2016 and Committee on the Future Economy (CFE) in 2017 with recommendations and initiatives for the polytechnic sector is creating massive pressure for change (CFE, 2017; Ministry of Education, August 2014). Underlying these initiatives is the focus on nurturing a workforce that is prepared for the world of work in the future economy of Singapore. The broad requirement of such preparation includes skills mastery, flexibility in adapting to changing industry practices and a quest for continuous growth and improvement i.e. lifelong learning.

Polytechnics are classified as Institutions of Higher Learning (IHLs) in the Singapore educational parlance. Polytechnic enrol about 45% (Varaprasad, 2016) of every cohort of school-going students each year. These sizable numbers of students are trained as para-professionals in specific professions and are intended to be 'job-ready' for industry on graduation. The mandate for Polytechnics, as Chan (2008) states, is to "train manpower with the right type of knowledge and skills and to retrain the existing workforce to sustain growth" (p. 138) for the Singapore economy. This urges the need for polytechnics to be closely aligned and work in tandem with industry. Industry's role within the polytechnic is also prominent. It provides internship positions, advises on potential growth areas, suggests details on skills and knowledge required for curriculum planning and other pertinent information about industry for polytechnic education. Polytechnics in Singapore are intended to be adaptive and nimble in changing to the needs of industry and ever eager in establishing new diploma programmes to suit the

growing needs of the economy. This nicely fits the applied study orientation adopted by Polytechnics since their inception. The need for balance between practice and theory in the nurturing of graduates is the focus of applied study orientation. The applied study focus requires pedagogy tuned to the needs of the Polytechnics.

One of the objectives of the newly formed SkillsFuture Council, in 2014, was primed to move polytechnic education in Singapore towards meeting the developing needs of the future economy. Gopinathan (2015) discerns that the prevalent pedagogy in schools, dominated by 'transmissive content' learning and 'teacher-centredness,' would be only suitable for the industrial-age economy and not for a knowledge-based economy. As Gopinathan (2015) explains, there were explicit intentions in the introduction of 'Thinking School Learning Nation' (TSLN) and 'Teach Less Learn More" (TLLM) initiatives to the Singapore educational landscape. These two initiatives are the bedrock on building Singapore's educational landscape to be suitable for the future knowledge-based economy. Such a shift requires the support of teachers and changes to pedagogy. Change in pedagogy as Gopinathan (2015) states, "requires ownership and capacity on the part of schools and teachers. It requires changes in long-held assumptions about everything, from purposes of policy change, student ability and motivation, to the aims of instruction and changes to practice" (p. 79). This, in turn, propels a change in pedagogical thinking and in educational processes. A paradigm shift is required.

The teaching situation within the polytechnics in Singapore is slightly different from that of the primary, secondary and junior college education. Staff teaching at the Polytechnics come with industry experience and learn about pedagogy primarily on-the-job. They have to adopt pedagogy that suits an applied study orientation to teaching. Staff have to learn about pedagogy, curriculum and assessment in designing their applied study focus on educating students on their subject. As a new polytechnic lecturer, two decades ago, I faced this

same predicament. The pedagogy that I was exposed to as a student is not congruent with the requirements of polytechnic education. As a teacher, I had to explore and design fruitful means of nurturing students for industry. My search for guidance through the literature on polytechnic education in Singapore and its pedagogy drew very few returns. The uniqueness of the applied study orientation of polytechnic education and the pedagogy for such an educational process remained a concern for me. This eventually became the focus of my research.

Research Focus and Questions

My aim is to explore pedagogy for polytechnic education in Singapore. Recent developments (i.e. SkillsFuture and ASPIRE in particular) have iterated a shift in focus in the polytechnic educational landscape, and many changes abound within the polytechnics. These changes are rationalised to suit the needs of the emerging knowledge-based economy of the 21st Century. In this regard, my research aims are:

- To review current pedagogy practices within the Polytechnic
- Clarify the changes required to the pedagogical approaches given the impending changes to polytechnic education in Singapore

The Research Questions (RQ) that I have crafted to assist with the research focus are as follows:

RQ1. What pedagogical approaches are commonly practised in the polytechnic?

RQ2. Who are the key stakeholders and what is their influence on the pedagogies practised in the polytechnic?

RQ3. What are the pedagogies that the key stakeholders wish to see practised in the polytechnic?

RQ4. How can the Polytechnic accommodate the key stakeholders' expectations on pedagogies?

These four RQs will aid my exploration of pedagogies for future polytechnic education in the Singapore context. My approach in addressing them will be both descriptive and critical.

Significance of the research

The significance of the research is discussed from two perspectives: staff teaching at the Polytechnic and me. The research will contribute to the literature on polytechnic education especially on the pedagogical approaches deployed in a local context. It is an appropriate time now to review and explore changes to pedagogical approaches to polytechnic education with the impending changes from government initiatives. As custodians of teaching at the Polytechnic, staff will also benefit from rationalising the changes required of pedagogy by revisiting their teaching approaches to suit the future needs of the Polytechnic. Staff will be empowered to make changes in alignment with shifts in curriculum and polytechnic education at large. From a personal perspective, the research will address some pedagogy issues that I have been grappling with as an academic staff of the Polytechnic for some time. I hope and expect that the research will (i) inform my practice as a polytechnic teacher developer; (ii) clarify areas of need for teacher development in the light of current pressure for change; and (iii) enable me to facilitate epistemologically-informed change in pedagogy, as opposed to imposing top-down change on teaching colleagues.

Signposting for the thesis

Following this chapter, I will be discussing the conceptual framework for my research. The discussion will explore different paradigms and my preference for the constructivist-oriented approach to research. The chapter will also list evaluative criteria that I have identified as appropriate for my research. Chapter three narrates my positionality and the reflexivity I wish to instil in the process.

Literature review for my research is captured in the subsequent three chapters i.e. four to six. The main themes of discussion in chapter four

are polytechnic education, applied studies and practice-based education. These themes are closely aligned to polytechnic education in Singapore especially with the new initiatives from external bodies. Chapter five reviews the focus on constructivism and education in a polytechnic setting. Chapter six is devoted to the discussion of pedagogy. I've allocated a chapter to review the topic of pedagogy, as I deem the subject central to the research focus.

Methodology, chapter seven, provides a critical account of the research framework I have adopted for the study. It also details the research design and the methods used for the study. Chapter eight provides the profile of the participants in the study, the details on how evidence was produced from interviews and how coding of the transcript is done. Chapter nine captures the analysis and findings of evidence generated for the research. Various themes are produced from the evidence. The method of analysis is also elaborated in chapter nine.

The implication of these analyses and findings to polytechnic education is discussed in chapter ten through a list of recommendations. These recommendations encapsulate the research outcomes I have generated concerning Polytechnic pedagogy in Singapore. The concluding chapter summarises the main arguments of the study. In addition, the chapter reflects on and evaluates the research done, discusses the limitations of the research and identifies future research possibilities.

CHAPTER TWO
CONCEPTUAL FRAMEWORK

Introduction

My conceptual framework underlies the beliefs, expectations, concepts and theories that support my research (Maxwell, 2005; Miles & Huberman, 1994; Robson, 2002). Miles and Huberman (1994) define a conceptual framework as a written or visual product that "explains, either graphically or in narrative form, the main things to be studied – the key factors, concepts, or variables – and the presumed relationships among them" (p. 18). Research studies explicitly state their research questions, but this does not complete the research design. As Maxwell (2005) clarifies, a conceptual framework has to be constructed for the researcher to provide a holistic understanding of the research, the context and positionality of the researcher. In addition, it is also useful to indicate the criteria that can be used to evaluate the quality of research.

In the following section, I will discuss the conceptual framework of my study through an exploration of the notion of a worldview or paradigm (Guba & Lincoln, 1989, 1994), my own worldview or paradigm and the criteria for evaluating the quality of my research that is compatible with my worldview. The aim is to provide a coherent conceptual framework for my research.

Worldview or Paradigm

Guba and Lincoln (1989) defined paradigm "as a basic set of beliefs, a set of assumptions we are willing to make, which serve(s) as touchstones in guiding our activities" (p. 80). Hence, the researcher's paradigm of research as stated by Guba (1990) (cited in Denzin & Lincoln, 2011) refers to "the net that contains the researcher's epistemological, ontological, and methodological premises" (p. 13). These components outline the basic set of beliefs that guides the action (Guba, 1990) of a researcher. Denzin and Lincoln (2013) concur and

acknowledge that all research is interpretive and embodies the researcher's "beliefs and feelings about the world and how it should be understood and studied" (2013, p. 13). The ontological question of "what is the nature of 'reality'?" and the epistemological question of "(w)hat is the nature of the 'knowable'?," (Guba, 1990, p. 18) expresses the defining dimensions of the researcher's worldview. Hence, the epistemological domain is framed by the nature of the relationship between the researchers and researched. The ontological and epistemological premises would define the methodological process of how the researcher will establish the knowledge that s/he seeks (Guba, 1990). As Denzin & Lincoln (2013) prescribe, these three components frame the research design in the empirical world. The researcher's worldview or paradigm is not merely a perspective that changes with time but one that is rooted in the belief system of the researcher (Denzin & Lincoln, 2013). McMilian (2015) in more practical way describes worldview as the process that "determines what gets studied, how it gets studied, how the data gets interpreted, and what counts as valid findings" (p. 16). I will take the terms worldview and paradigm to be synonymous in this study.

According to Guba (1990) the answer to the question of what entails reality differentiates the worldview held by researchers. Amongst other categorisations, Guba (1990) divides worldview into the positivist, post-positivist, critical theory and constructivist traditions. The next section will discuss these categorisations and elaborate on the constructivist paradigm that will form the conceptual framework for my research.

Positivist ontology rests on a realist worldview and would hence focus the research on a search of 'true' reality. This is based on the belief that "there exists a reality out there, driven by immutable natural laws" (Guba, 1990, p. 19) that has to be uncovered. Such positivist's ontology, Guba (1990) explains, deems it possible to predict and control natural phenomena. The belief that "there exist a reality out there" (Guba, 1990, p. 19) drives this paradigm. In this case, the research

design would adopt a process of unravelling the natural laws of what is being investigated.

The positivist paradigm views the real world and its objects to be separate from the people. This perspective hence advocates for researchers to observe occurrences objectively. Researchers can investigate and report on the real world, and this can be verified based on neutral, objective means, as researchers can stand apart from the research. This paradigm establishes values of neutrality, reliability, and validity to be part and parcel of the research.

Although experimentation, control processes, mathematical models, statistics and graphs are used within the positivist research, these methods are not solely the confines of the paradigm. Interpretivist, constructivist and researchers adopting other paradigms would also be able to use the methods in constructing evidence for their study. The difference is in the way in which the analysis of the evidence is constructed (for constructivist paradigm) or collected (for positivist paradigm) and interpreted (Guba & Lincoln, 1981; Lincoln, 2010; Lincoln & Guba, 1985). In the case of the constructivist, the analysis is done through the construction of facts and evidence produced by the researcher via the methods. The research account is thus the researcher's story. The positivist would analyse the data by looking for the causal relationship and hypothetically aligning it to an existing rule or reality. In this case the research account can be thought of as reality's story. Hence, the methods used are not necessarily confined to any paradigm.

Post-positivist's ontology is one of critical realism. This paradigm holds the notion of objective reality, like the positivist, but acknowledges that apprehending the reality would be through imperfect means. Dualist epistemology is maintained with a belief that reality can never be fully known (Guba & Lincoln, 1994). A modified experimental methodology is normally adopted for research within this paradigm.

The third categorisation by Guba (1990) is the critical theory. Schwandt (1990) groups critical theory, critical inquiry, critical social science and feminist research into what he terms critical science. He defines critical theory as a form that "seeks to recover the function of critical reflection in the social disciplines and in the practice of social inquiry" (Schwandt, 1990, p. 268). Schwandt (1990) characterises critical theory as a systematic way of investigating lived experience and how this experience may be "distorted by false consciousness and ideology" (p. 268). An understanding of knowledge requires value mediation, which implies that researcher and those researched are interactively linked, and they influence one another. This requires the mediation of data generated in such research (Guba & Lincoln, 1989).

The next categorisation (Guba, 1990), the constructivist worldview, is one that I subscribe to and will form the core of the conceptual framework for my research. A more detailed account of constructivism, its origins and its place in education can be found in my literature review (Chapter Five).

Knowledge, from a constructivist worldview, is viewed as "a human construction, never certifiable as ultimately true but problematic and ever changing" (Guba, 1990, p. 26). The constructivist paradigm views reality as being constructed through the person involved in the process. In referring this to a research context, the participant's perspective would be the 'reality' that the researcher is trying to understand. As Cohen & Crabtree (2008) state, "(w)ho we are and how we understand the world are linked" (p. 333). Denzin & Lincoln (2013) proclaim that "all research is interpretive, guided by a set of beliefs and feelings about the world and how it should be understood and studied" (Denzin & Lincoln, 2013, p. 26). According to Cohen & Crabtree (2008), the constructivist perspective on research is "that realities are multiple, fluid and co-constructed, and knowledge is taken to be negotiated between the observer and participants" (p. 336). They maintain that methodology is

a matter of eliciting different peoples' construction and generating a substantial construction that builds consensus with all involved in the research (Cohen & Crabtree, 2008).

Wheatley (1991) offers a summation of the epistemological core of constructivism by pinning it on two main principles. Firstly, "(k)nowledge is not passively received, but is actively built up by the cognizing subject" (1991, p. 10). The second principle, he adapts from Glasersfeld (1988) as follows: "the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality" (Wheatley, 1991, p. 10).

To Wheatley (1991), a constructivist perspective is not about establishing the truth but rather about people constructing viable explanations of their learning through experiences. This is congruent with the idea "that knowledge is constructed in the mind of the learner" (Bodner, 1986, p. 873). Bodner (1986) expresses this as "knowledge to 'fit' reality the way a key fits a lock, we find ourselves in a very different position because many keys, with different shapes, can open a given lock" (pp. 876-877).

Within a constructivist worldview "(r)eality exists only in the context of a mental framework (construct) for thinking about it" (Guba, 1990, p. 25) and hence, the inquiry is not value free. Such perspective underwrites a relativist worldview that there are multiple mental constructions of reality based on the experience and social circumstances of the person.

The constructivist discards the view that something " 'really true' exists" (Guba, 1992, p. 19) and this provides an ontological challenge. As Guba (1992) explains, "(i)t is because constructivists take a relativist position at the ontological level that they must also take a relativist position at the epistemological level" (p. 19). Constructivists continues Guba (1992),

> assert that the findings of any inquiry are literally created [!], relative to the particular inquirer and to the particular context in which the inquiry was carried out. If either inquirer or context is changed different findings are created. The different findings are neither more or less true than the first, but only different. (p. 19)

Glasersfeld (1995b) avoids this epistemological issue in research by dropping the usage of the term i.e. epistemology or theory of knowledge. Glasersfeld (1995b) explains this as follows:

> I now try to avoid the terms 'epistemology' or 'theory of knowledge' for constructivism, because they tend to imply the traditional scenario according to which novice subjects are born into a ready-made world, which they must try to discover and 'represent' to themselves. From the constructivist point of view, the subject cannot transcend the limits of individual experience. (pp. 1-2)

This radical constructivist viewpoint involves the construction of knowledge from individual experiences instead of searching for an existing reality out there in the world. Hence the constructivist research accentuates constructing details on the research rather than in proving or ascertaining (or otherwise) an existing reality. The use of ethnographic prose, narratives, first person accounts, pictures, life histories and autobiographies (Denzin & Lincoln, 2013) is commonly deployed in constructivist research.

The constructivist paradigm paves the way on how researchers would conceptualise and design their path of inquiry. A detailed discussion of the methods, approaches and tools that will be used in my research is found in the methodology chapter (Chapter Seven).

Constructivist and Interpretivist Worldview

With the constructivist worldview as the conceptual base for my research, the process of constructing the narrative for the research will adopt an interpretivist stance. Schwandt (1998) explains the link between constructivist and interpretivist process as follows:

> (t)he constructivist or interpretivist believes that to understand this world of meaning one must interpret it. The inquirer must elucidate the process of meaning construction and clarify what and how meanings are embodied in the language and actions of social actors. To prepare an interpretation is itself to construct a reading of these meanings; it is to offer the inquirer's construction of the constructions of the actors one studies. (p. 222)

As Denzin (1992) states, subjectivity and objectivity, engagement and objectification are constant struggles for the interpretivists. Interpretivists to Schwandt (1998) "celebrate the permanence and priority of the real world of first-person, subjective experience" (p. 223).

Radical constructivism, developed and elaborated by Glasersfeld (1995b), states that knowing is based on experience and knowing "is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience" (Glasersfeld, 1995b, p. 1). In research, to know what these experiences are, the researcher will have to understand and interpret these experiences in the context of the research. This process of understanding and interpreting the research experience is encapsulated in the interpretivist perspective.

Schwandt (1998) asserts, "(c)onstructivist, constructivism, interpretivist, and interpretivism are terms that routinely appear in the lexicon of social science methodologists and philosophers. Yet, their particular meanings are shaped by the intent of their users" (p. 221). Schwandt (1998, 2007b) reiterates that the constructivist understands the complex world of lived experience from the viewers' perspective. Constructivism and interpretivism are unique in searching for answers to questions like "(W)hat is the purpose and aim of human inquiry…? How can we know about the world of human action?" (Schwandt, 1998, p. 222)

The interpretivist, according to Schwandt (1996), has not gone away from "the third-person point of view i.e. taking into account the

interpretation of activities from the participants' point of view" (p. 62). Yanow and Schwartz-Shea (2009) concur with this view stating:

> an interpretive methodology holds that there is no direct, unmediated access to reality (a basic claim in interpretive epistemology), and this, in turn, means that humans' interactions with their external worlds are always already mediated by the historical, cultural contexts in which they find themselves. (p. 34)

Hence, my research in interpreting and constructing my account of the pedagogical needs of polytechnic education from stakeholders' interview will adopt a constructivist and interpretivist perspective as its conceptual framework. I will use the term constructivist and interpretivist interchangeably in my discussion henceforth.

Evaluating Constructivist Research

Wrapping up the discussion on the conceptual framework for the research, the next section will discuss criteria for monitoring the quality of research that is designed in a constructivist paradigm. As various authors state (Guba & Lincoln, 1989; Lincoln, 1995; Schwandt, 1996), the constructivist paradigm is in no way second rated to the positivist and post-positivist paradigm in terms of quality and rigour of research.

Discussion on evaluative criteria in the interpretivist domain has moved away from the positivist and post-positivist dogma of the consensually agreed fixed criteria of evaluation. Smith (1993) states it succinctly, " (t)he task for interpretivists is to elaborate what lies beyond epistemology and beyond the idea that there are special, abstract criteria for judging the quality of research" (cited in Lincoln, 1995, p. 275). The movement away from established criteria for evaluating research quality, Lincoln (1995) notes, is not to 'side step' the need to differentiate between good and poor research. In fact, Lincoln (1995) underscores three commitments of research as:

> first, to new and emergent relations with respondents; second, to a set of stances---professional, personal, and political---toward

> the uses of inquiry and toward its ability to foster action; and finally, to a vision of research that enables and promotes social justice, community, diversity, civic discourse, and caring. (pp. 277-278)

Schwandt (2007b) demarcates three underlying epistemological issues related to evaluating interpretivist research. Firstly, “interpretation is an omnipresent feature of all human attempts to understand” (Schwandt, 2007a, p. 11) and the act of construing evidence is in itself an interpretation. Secondly, “interpretivists’ claim that every interpretation is made in some context or background of beliefs, practices, or traditions” (Schwandt, 2007a, p. 12) . This does not make all interpretation subjective. But there are inter-subjective biases, for interpretations are based on beliefs, practices, perspectives and lived experiences. Thirdly, interpretations are individual cognitive acts but always made in the context of shared social beliefs and practices. Interpretations are in an important sense, to Schwandt (2007a), “infused with political and ethical implications related to matters of power and authority” (p. 12).

Schwandt (1996) in his earlier article calls for ‘practical rationality’ whereby the research focus is “not a form of inquiry on human action as much as it is inquiry with human actors” (p. 63). The quality of research in this case is deliberated by a community on the ‘rightness’ elaborated by Lincoln (1995) as a process that

> has a ‘rhetorical’ and ‘persuasive’ character, which in turn suggests that listeners and dialogue participants have some standards (criteria?) by which they can judge the power or persuasiveness of various conversational and deliberative partners. (p. 276)

Carr (1995) supports this stance in stating that interpretivism is not focused on developing social theory but rather “improving the rationality of a particular practice by enabling practitioners to refine the rationality of the practice for themselves” (p. 118).

Schwandt (1996) lists three ideas that fulfil the social practice, which underlie the interpretivist paradigm. These three ideas are:

a. search for a better understanding of praxis; [in the case of my research, the characteristics of Polytechnic pedagogy]
b. the kind of investigation required here must attend to both ethical and political concerns
c. the rationality of everyday life (and the rationality of social scientific practice itself) is regarded as intrinsically dialogical and communicative. (Schwandt, 1996, p. 62)

Criteria for Evaluating Constructivist Research

The constructivist perspective for research requires an evaluative process that is reflexive, in other words that is compatible with the perspective itself. As Lincoln (1995) asserts, "interpretivist inquiry requires as serious a consideration of systematic, thorough, conscious method as does empiricist inquiry" (p. 276). The next section will briefly discuss the criteria for evaluating the quality of research from a constructivist perspective. Guba and Lincoln (1989) draw attention to two strands of quality evaluation criteria for constructivist research. They term these the parallel criteria (trustworthiness) and the authenticity criteria (fairness) (Guba & Lincoln, 1989; Lincoln, 1995). These criteria are articulated by Guba and Lincoln (1989) to be "meaningful within a constructivist inquiry" (p. 236) against a backdrop of existing criteria of the positivist paradigm. The parallel or trustworthiness set encompasses four criteria namely credibility, transferability, dependability and confirmability (Guba & Lincoln, 1989). Authenticity criteria are primarily rooted in the principle of fairness and view criteria of educative, ontological, catalytic and tactical authenticity as sufficient conditions for evaluating quality of interpretive research.

Parallel or Trustworthiness Criteria

Trustworthiness

As Scaife (2004) states, one's worldview informs one's research design. The emphasis of most research is to be "conducted rigorously and contribute to robustly useful knowledge" (Atkinson & Delamont, 2006, p.

749). Lincoln and Guba (1985) lay out the issue of trustworthiness in a series of questions: “How can an inquirer persuade his or her audiences (including self) that the findings of an inquiry are worth paying attention to, worth taking account of? What arguments can be mounted, what criteria invoked, what question asked, that would be persuasive on this issue?” (p. 290). The constructivist emphasises the inevitably value-laden nature of inquiry and seeks answers to questions based on the experiences from those involved and studied as part of the research. This is in contrast to the positivist tradition, where the emphasis is on measurement, analysis of causal relationships and claims to be working from a value-free framework (Denzin & Lincoln, 2013).

Credibility

Credibility demands that research findings and interpretations are trustworthy and dependable and this is done through techniques such as prolonged engagement, persistent observation, peer debriefing, negative case analysis, progressive subjectivity, triangulation and member checks (Guba & Lincoln, 1989; Lincoln & Guba, 1985). Prolonged engagement ensures substantial time is invested in the inquiry while persistent observation is to search for the most relevant and pertinent sources for the research and to get into the details of these observations.

Progressive subjectivity entails monitoring the construction of the researcher and in not giving the researcher’s construction more privilege than those engaged in research. The process can be administered, as Guba and Lincoln (1989) suggest, by the researcher recording at regular intervals “his or her a priori construction – what he or she expects to find once the study is under way” (p. 238).

Peer debriefing is done to expose the researcher to be questioned by a protagonist in the spirit of bringing out hidden assumptions that the researcher might be holding. The next technique in maintaining credibility is negative case analysis. This refers to revisiting the research hypothesis or focus, continuously during the production of

evidence stages. The continuous process of re-visiting the focus of the research enhances credibility. These techniques, taken together, allow the researchers to match their 'constructed realities' to those of the participants as closely as possible.

The next technique, triangulation, according to Eisner (1998) is a process of achieving structural corroboration through pitching multiple sources of data and carefully scrutinising the emerging assertions made from the research process. This process of triangulation allows for the construction of evidence by the researcher based on inputs from the research participants. Triangulation discussed as a technique by Lincoln and Guba (1985) was later dropped by the authors (Guba & Lincoln, 1989). Two reasons for dropping it are, firstly, the positivist overtone of triangulation and secondly, the process of member checks captures more of what triangulation entails. Guba and Lincoln (1989) differentiate between triangulation and member checks as follows:

> (m)ember checking process ought to be dedicated to verifying that the constructions collected are those that have been offered by respondents, while triangulation should be thought of as referring to cross-checking specific data items of a factual nature. (p. 241)

Guba and Lincoln (1989) place much emphasis on member checks as a criterion for evaluating quality of the research. To Guba and Lincoln (1989) member checks entail the following functions:

- evaluator to assess the intent of a given action
- give respondents a chance to correct facts or errors of interpretations
- review the interview or information provided from the standpoint of new participants and bring forward what may have been forgotten
- agree with the transcription done by the researcher and its interpretation
- summarise information for the respondent and as a first step in analysing the information
- judge holistically the interview content or information shared in light of the situation and research

The criterion of credibility is incorporated in my research design.

Transferability

The next criterion, transferability is not a substitute for external validity used in the positivist tradition. In the interpretivist tradition, transferability showcases how findings in one study can be applied in another context. This is provided through provision of thick description in the context of the research matter. The generalisation of such findings to a different context or situation is left to the reader and their inferences from the present research.

Dependability

The proviso that there is no validity without reliability can be applied to state in parallel that there is no credibility without dependability. Guba and Lincoln (1985) argue that dependability can be achieved through a replication process of dividing the research task with two teams or persons and evaluating the outcomes through discrete investigation. This builds dependability on research findings. They also suggest the use of audit methods of verifying the process of inquiry and an examination of the product assures dependability of research findings. Morse et al. (2002) note that audit trails maintained by researchers can be included as evidence of decision, process and path taken throughout the duration of the research. But this does not identify the quality of the decision made which is of significant importance to the quality of the research. In research undertaken by one researcher, like mine, the process of verifying interview transcripts with interviewees provides for dependability.

Confirmability

The availability of records or audit trails is a technique used to build confirmability that is drawn from the financial practice where evidence leading up to a transaction is available for verification. A similar practice of availing audit trails leading up to the final analysis of the research findings builds confirmability (Lincoln & Guba, 1985).

There is criticism on the trustworthiness criteria discussed thus far. Morse et al. (2002) challenge Guba and Lincoln's (1989) claim on

trustworthiness as the criteria to be adopted in establishing quality of the research. Morse et al. (2002) argues that the value for establishing rigor “must be built into the qualitative research process per se” (p. 17) and view Guba and Lincoln's (Guba & Lincoln, 1981, 1989; Lincoln & Guba, 1986) trustworthiness criteria as ‘post hoc criteria' i.e. in evaluating completed research. Morse et al. (2002) summarise their criticism of Guba and Lincoln's evaluation criteria as follows:

> (r)ather than relegating rigor to one section of a post hoc reflection on the finished work (such as stating that an audit trail was maintained, that member checks were done, or that the researcher was ‘reflective’) verification and attention to rigor will be evident in the quality of the text. (p. 20)

However, Lincoln (1995) clearly articulates that the evaluative criteria are applicable at any stage of the research. This may be in response to the criticism made. These are the parallel or trustworthiness criteria on evaluating constructivist research proposed by Guba and Lincoln (Guba & Lincoln, 1989; Lincoln & Guba, 1985).

Authenticity or Ethical Criteria

The authenticity or ethical criteria were formulated as alternative to the parallel criteria. These criteria are as Guba and Lincoln (1989) state, the basic assumptions of constructivism and would satisfy any constructivist evaluation of research. The authenticity criteria include the following: fairness, ontological, educative, catalytic and tactical authenticity. This section will elaborate briefly about each of these criteria.

Fairness

By fairness, Guba and Lincoln (1989) “refer to the extent to which different constructions and their underlying value structures are solicited and honored within the evaluation process” (pp. 245-246). Elaborating on the authenticity criteria later, Lincoln (1995) states:

> new criteria were highly reflective of the commitment of inquiry to fairness (balance of stakeholder views), to the learning of respondents as much as to the learning of the researcher, to the open and democratic sharing of knowledge rather than the concentration of inquiry

> knowledge in the hands of a privileged elite, and to the fostering, stimulation, and enabling of social action. (p. 277)

The researcher has the role of communicating the differing constructions that participants in the study bring forward and showcasing the value system inherent within these constructions and any inherent conflicts as well. As construction of evidence occurs with individuals of differing value systems, researchers will have to confront a situation of value pluralism and address these value differences. Lincoln and Guba (1986) suggest the fairness criteria can be met through two means. Firstly, "ascertaining and presentation of different value and belief systems represented by conflict over issues" (Lincoln & Guba, 1986, p. 20) and secondly, the need for "negotiation of recommendations and subsequent action" (Lincoln & Guba, 1986, p. 21) at the evidence construction and analysis stages.

Ontological authenticity

The ontological authenticity (Guba & Lincoln, 1989; Lincoln & Guba, 1985) criterion is however, not reflected in Lincoln's (1995) later article. Ontological authenticity refers to "improvement in the individual (or group's) conscious experiencing of the world" (Lincoln & Guba, 1986, p. 81). This can be achieved through the following two techniques:

1. testimony of selected respondents attesting to the fact they can understand and appreciate issues they have previously failed to understand
2. audit trail of all participants construction recorded at various stages of the study (Guba & Lincoln, 1989)

Educative authenticity

The third criterion is educative authenticity described by Guba and Lincoln (1989) as "the extent to which individual respondents' understanding of and appreciation for the construction of others outside their stakeholding group are enhanced" (p. 248). Hence, providing stakeholders with an opportunity to know others' construction is the educative criteria.

Catalytic authenticity

The next criterion, catalytic authenticity requires an action to be stimulated and facilitated as a means of the understanding achieved by the respondent. The objective is to prompt action to be taken by respondents. Such an evaluative criterion is very different from the parallel criteria in its focus on initiating action.

Tactical authenticity

Lastly, tactical authenticity refers to the degree of empowerment of respondents and participants. The techniques of achieving these are, soliciting testimony of selected participants and stakeholders; follow-up is undertaken to investigate which group participates in the action and the degree of empowerment that can be ascertained by participants. Lincoln (1995) clarifies that criteria for interpretive work have to be "locally usable, … permit criteria to grow indigenously as a natural consequence of the inquiry effort" (p. 286). This criterion is also very much different from standardised or uniformed criteria for interpretive research.

Yanow (2006) discusses the improvisational quality inherent in interpretivist research and how this has to be considered in evaluating the research. Yanow (2006) exhorts, "the rigorousness of the presentation of the argument – its analytic rigor – is one of the criteria against which interpretive research is judged within its own epistemic communities" (p. 72). Interpretive research does not follow a strict process like that demarcated for positivist research. Yanow (2006) describes this as:

> (n)ot only can human responses not be controlled, but the interpretive researcher does not seek to control them, beyond pointing conversations toward explicating that which the researcher is assaying to understand. (p. 70)

Lincoln (1995) concurs that criteria for interpretive work have to be contextualised to local usage and allowed to grow naturally as part of the inquiry effort. The move is very much away from standardised or

uniform criteria for interpretive research. Lincoln (1995) advocates that the authenticity criteria apply differently to different research studies and within the research as well. Not all criteria listed i.e. fairness; educative, catalytic, tactical and ontological authenticity can be applied to all research and all stages uniformly.

The authenticity criteria bring to fore the naturalistic construction that occurs in the research process. Hence, the use of these criteria, both the parallel and authenticity criteria, are evaluative means of showcasing the rich narrative resonating within the research arena i.e. in my study the pedagogical characteristics within the polytechnic.

Evaluation Criteria for My Research

Schwandt (1996) concludes in his article on 'Farewell to Criteriology' that "(w)hat once was the critical problem of the correct criteria becomes the problem of how to cultivate practical reasoning" (p. 70). Criteriology, as Schwandt (1996) elaborates, is "founded in the desire for objectivism" (p. 58) that parallels evaluation in the interpretivist's paradigm to that of the positivist's paradigm. Schwandt (1996) defines criteriology as the "quest for permanent or stable criteria of rationality founded in the desire for objectivism" (p. 58). This is not congruent with the constructivist paradigm and as such Schwandt (1996), dispels the search for criteriology for research to one that seeks to create criteria for practical reasoning.

Lincoln (1995) professes a radical shift in the way interpretivist research is being looked at. The issue is towards "what the research is; what it is for, and who ought to have access to it" (p. 278). All of the authenticity criteria, urges Lincoln (1995), are relational, "a research grounded in the recognition and valuing of connectedness between researcher and researched, and between knowledge elites and the societies and communities in which they live and labor" (p. 278). Recognising the relationship between the researcher and the researched and constructing the narrative is the focus of constructivist research.

Lincoln (2010) in discussing the issue of rapport, eloquently states the challenge of constructivist research. She states:

> (w)e need to find something that does not ignore differences; that takes account of vast deviations, conflicts, and contradictions between individuals and their lifeways, and even within individuals themselves; and that gives rise to new, richer, more complex, more authentic representations of those with whom we work. (p. 5)

The nature of my research underlines the stakeholders' contribution to pedagogical character appropriate for polytechnic education. This requires stakeholders' personal construction of what polytechnic education entails and their preferred pedagogy that will substantiate the education in the polytechnic. Such elaborations establish stakeholders' value positions on the matter.

I will use the parallel or trustworthiness criteria of credibility and confirmability and the fairness criterion from the authentic and ethical listing as criteria to evaluate the quality of my research. The credibility criterion focus on evaluating the trustworthiness and dependability of research findings is a reason for its inclusion. Confirmability criterion expresses the connection between data generated and the analysis done. The fairness criterion would balance the interpretation of the narrative with my own positionality biases, inherent in the research.

My conceptual framework will hence, adopt a constructivist worldview for the research and I will use the credibility, confirmability and fairness criteria to monitor the quality of the study.

CHAPTER THREE
POSITIONALITY & REFLEXIVITY

Introduction

This chapter outlines my positionality and relates it to my research. This chapter follows from the preceding discussion on the constructivist position that the research will adopt as its conceptual framework. The chapter will detail my arguments on why I think a constructivist position best suits my positionality. I will do so by looking at three segments of my life journey i.e. my educational journey, career and beliefs. I will also discuss the role of reflexivity in the research process in the chapter.

Positionality

Sparks (2009) narrates the value of writing a chapter on positionality and reflexivity so that readers have a clear idea of where the researcher is coming from. As Sparks (2009) argues,

> the researcher's positions were significantly related to the purpose of the research, the methodological approach chosen, and the knowledge produced in the study. (p. 6)

As a researcher adopting a constructivist conceptual framework for my research, I will constantly be constructing interpretations from evidence and experiences, and explain this in the context of my epistemological bearings and values. This is in line with Hung and Hyun's (2010) definition of positionality:

> the perception of one's contextualized self-identities in affecting how one positions himself or herself and thus directs the ways one participates and engages in a particular social or learning context. (p. 341)

Qualitative research is primarily based on evidence generated from participants and their interactions, experiences and perspectives of what is being researched. Denzin and Lincoln (1998) view that such constructed analysis and findings from evidence generated from participants are the researcher's perspective. From a constructivist worldview this is inevitable. Hence, a discussion on the researcher's

positionality gives readers an idea of where the research is coming from and helps them to interpret the researcher's narrative.

Sparks (2009) concurs and identifies the researcher as the 'instrument' in the evidence generating process within an interpretivist research setting. As the researcher's experience, comfort, discomfort, belief have an impact on the research process, Sparks (2009) argues for the reader to be aware of the researcher's positionality. Sparks (2009) details three reasons why researchers need to discuss their positionality as part of their research process. The three reasons are to:

1. reflect on potential biases that could have crept in during the research and writing process.
2. provide interesting and important insights into the experience the researcher had during the research process
3. acts as a 'productive force' in bringing new understandings and knowledge to the research. (2009)

Sparks (2009) adds that positionality provides the reader with ideas about the values, background, history, preferences and other pertinent personal nuances about the researcher. Jon A Scaife (personal communication dated 3 Aug 2017) concurs that

> the researcher presents her or his writing to readers and invites them to interpret it. An account of the writer's positionality offers insights that may inform and enrich readers' interpretations. Discussion of positionality acknowledges that the research account is not objective but is informed by the writer's values and beliefs.

This also enhances the credibility of the research. Such vivid reporting of the research process is a hallmark of interpretivist research.

Reflectivity and Reflexivity

The Oxford English Dictionary (OED) defines reflexivity as "(t)he quality or condition of being reflexive" (Reflexivity, 2017). Reflexive in turn is defined generally as "(c)apable of, inclined to, or characterized by reflection or serious thought. However, OED also states the definition of reflexive from different fields of study. For example, from a social science perspective, the term is defined as "a method, theory … that

takes account of itself, or of the effect of the personality or presence of the researcher on what is being investigated. From a philosophical and psychological perspective the term is defined as “a mental action, process,… turned or directed back upon the mind itself, involving intelligent self-awareness or self-examination” (Reflexive, 2017).

Sparks (2009) raises the need for reflective and reflexive action from qualitative researchers. He espouses a philosophical and psychological perspective that “being reflexive about our positionality, critically self-reflecting on the ways it is significant to our research, is fundamental to the research process” (p. 1). Wellington and Szczerbinski (2007) adapt the general perspective of reflexivity and view it as a subset of the reflective process. The authors differentiate these two terms as follows:

> (b)eing reflective involves thinking critically about the research process; how it was done and why, and how it could have been improved. … reflexivity … involves reflecting on the self, the researcher, and the person who did it, the me or the I. (Wellington & Szczerbinski, 2007, pp. 52-53)

I prefer the social science definition of being reflexive as it takes account of the researcher’s presence on what is being studied.

The reflective and reflexive processes highlight a pertinent usefulness in constructivist-oriented research that informs readers on the interpretation and constructions being made by the researcher. Jootun, McGhee and Marland (2009) go on to state that reflexivity is a pillar of qualitative research as it showcases the degree of influence researchers place intentionally or otherwise on their research findings. Finlay (1998) adds that qualitative research findings are co-constituted and hence have the involvement of not only the participants (as epitomised in positivist paradigm) but also the researcher. The process of reflexivity pushes the researcher to ask constantly the ‘what’ and ‘how” questions and to showcase personal nuances that underline the construction of findings in the research. This scrutiny of the research through reflexivity attests to the rigour required for qualitative research.

Jootun et al. (2009) believe that a “systematic reflexive process can unfold a new understanding of the phenomenon under study” (p. 45). It is hence appropriate for me to state my positionality through a narration of my education, career and beliefs that will have a bearing on my perception and interpretation in this research.

My Educational Foray

My introduction to the world of research started when I attended the first lecture in a Sociology 101 module as part of my undergraduate study. The lecturer interestingly introduced research as the curiosity of a person who wants to know what’s behind a closed door (making reference to a closed door at the lecture theatre). This sparked an interesting chain of thought in my mind on the nature of investigation that research entails. I found the quest to understand the ‘whats’, ‘whys’ and ‘hows’ of social phenomena intriguing. This naturally developed into a keen interest and although I did not have an opportunity to undertake any systematic research during my undergraduate studies, I had opportunities of doing so elsewhere. My social work involvement introduced me to a social psychology lecturer who was undertaking research work with a large pool of teachers and required a silent observer and someone to transcribe the different focus group sessions. I was also asked to provide my interpretations and views on the discussions that were shared at those sessions. Those sessions gave me first hand experience and impressions on what research work was about. The social psychology researcher was also eliciting my interpretation from the sessions, I assume now, as another means of generating evidence from her findings. My interest in research grew and I did a few small research tasks related to community work. These were presented and discussed at local conferences within the community. These little studies gave me many opportunities to participate in serious discussion on generating evidence and the analysis of the evidence with findings. In these discussions and in some arguments, discussants were frequently looking for statistical proofs. Numbers somehow made a strong impression and had persuasive power on people. There was

magical power in numbers. Even at these stages of my research journey, I was keen on establishing the feelings and experiences of individuals involved in the study. This interest was primarily sparked by the introduction of an anthropology module that I had to do as part of my Sociology major. At that point in time, most anthropological discussions were centred primarily on Margaret Mead's ethnographic account of a remote village, on the male and female role reversal within the society. Although this is being refuted lately, an in-depth understanding of society and people through their lived experiences always fascinated me.

I built on my interest in establishing evidence from individuals at the next major research opportunity. My dissertation for the Masters in Information Studies (MSc (Info Studies) required a research task. I took the opportunity and ventured to deploy the Delphi method in generating the evidence for my research topic. I used the Delphi method to triangulate opinions and justifications made by several senior librarians on the future role of reference librarians in academic libraries. This method required me to consolidate and re-circulate opinions and justification to the experts and to work towards a convergence of ideas. Experts were commenting on the issue without knowing who the others were in the grouping. The method allowed me to calibrate the ideas of experts in the field to arrive at a 'convergence' on an understanding on the subject matter. This can be considered my first venture into the realm of qualitative research.

My career path changed and I ventured into the polytechnic environment upon completing my MSc. My foray into education opened up possibilities of qualitative research, as I became interested in why students had difficulties in comprehending lessons and learning in general. Understanding individuals became useful and provided impetus to my curiosity. This propelled me to do a Masters in Education (MEd) where I was further introduced to the realms of quantitative and qualitative research. The MEd programme also introduced

constructivism to me. I took a module that compared the different paradigms of understanding learning and found the constructivist idea enlightening. It also resonated with my ways of learning and living. The sociology and political science modules that I did at undergraduate study had strong inclinations in cultivating a constructivist orientation in my thinking. For every aspect of study, tutorial or assignment, I had to articulate a coherent argument on what I thought were issues that were being discussed. I had to articulate my own thoughts based on philosophies, models, theories, and frameworks. The MEd programme in Learning Sciences and Technology introduced me to the idea of knowledge building. Works by Carl Bereiter and Marlene Scardamalia enlightened my understanding of learning issues and induced further investigation on the concept of knowledge building. Knowledge building as clearly articulated by both the pioneering authors is based on the principles of constructivism (Bereiter, 2002; Scardamalia & Bereiter, 2006).

My backdrop of interest in understanding individual interest continued, and I did a mixed method research study for my dissertation. The mixed methods allowed me to compare both quantitative and qualitative evidence in my research. My personal position on the value of each of these methods of generating evidence in projecting an understanding on issues was getting clearer. Numbers did not dominate me anymore. The EdD programme provided further insight into the different ontology and epistemology of different approaches and paradigms and allowed me to explore further on my quest for understanding individuals' perspectives.

Belief

As a Hindu, my religious worldview has a great bearing on my thoughts. Hinduism as I know it is pluralistic. It allows for individuals to establish their understanding of faith through their experiences. Hinduism "is the union of reason and intuition that cannot be defined but is only to be experienced" (Hindu Centre, n.d., p. 2). As a Hindu, I need to seek who

I am and establish my role for my self. I am the only one who can ascertain my needs, and this is, I believe, congruent with the constructivist epistemology.

Educational Career

As a new lecturer at the polytechnic, I had much difficulty in internalising the pedagogical needs and requirements of teaching. I have the professional expertise and had lots of industry case examples and practice-based ideas to prepare students for industry. But teaching was a different thing altogether. Knowing something was not sufficient. I had to design a lesson or an activity to engage students in the learning experience through which the students construct their own knowledge. There were no prescribed means of doing so at the polytechnic. I had to establish my own pedagogical understanding 'on-the-job' while wrestling with all other duties of a polytechnic lecturer. The nagging feeling of not getting a grip on what learning entails continued for a long period of time. The foray into educational literature and later through the MEd and in the EdD programmes has given much clarity and confidence to me. The struggle that I faced has a big part in the research focus of my thesis. The lack of clarity on the pedagogical underpinning that was deployed in teaching is a key concern to me. The underpinning of most pedagogical approaches and teaching practices that I had used such as self-directed learning, problem-based learning, project-based learning, case-oriented instruction, experiential learning, and independent studies has strong constructivist orientation. However, I did not know these when I started my teaching journey.

This chapter provides my constructivist inclination and how my education, career and beliefs have shaped it. I have also explained the need for reflective and reflexive thinking throughout the research process.

CHAPTER FOUR
POLYTECHNIC EDUCATION IN SINGAPORE

Introduction

Polytechnic education in Singapore was set up with the mission of nurturing middle-level professionals to support both technological and economic development. Lee et al. (2008) mention that Singapore's educational policies have always been tailored to meet the needs of the economy. One of Singapore Ministry of Education's (MOE) aims for polytechnics is to "train students with relevant and specific skills for the workplace to give Singapore a competitive edge as we move into a knowledge-based economy" (Ministry of Education, 2016 1st para).

Polytechnics, as Chan (2008) highlights, have a unique role within Singapore's education system. They enrol about 45% of the students from each cohort of school-going students who have completed secondary education, aged between 17-19 years (Varaprasad, 2016, p. 62). This is based on their performance in a standardised examination (GCE 'O' level), which is taken after completing 10-11 years of education in primary and secondary schools. At the polytechnic, students are trained to become paraprofessionals - to be technologists and middle-level professionals for the emerging and growing industry. Thus, the polytechnic curriculum is industry-focused. As Chan (2008) notes, most of these students are aware of this and they enrol in a polytechnic as they prefer a "practice-oriented education to an academic one at a junior college" (p. 136). Another unique feature of the local polytechnic education is its alignment to Singapore's economic priorities. Chan (2008) highlights that this is evident through the nimble and responsive changes polytechnics make to their courses in order to meet the demands for suitably trained manpower by the Singapore economy. Hence, the polytechnic educational landscape is distinct from the academic pursuit seen at tertiary institutions.

Tan, Gopinathan and Ho (2001) emphasise that the dual role of Singapore's educational focus has been in "enhancing national economic competitiveness in the global economy, and fostering social cohesion" (p. ix). MOE website avows that, "polytechnic graduates are valued as practice-oriented and knowledgeable professionals, much sought after by industry" (Ministry of Education, 2016 1st para).

Globalisation of Educational Policy

The 1980s economic crisis sparked policy makers and educationalists' thinking about how students will be able to meet the challenges of an emerging service and knowledge-based economy. As Gopinathan (2001) notes, this triggered a study and hence a report in 1987, 'Towards Excellence in Schools' (Ministry of Education, 1987), that made independent schools focus on sparking creativity and innovativeness and diversifying curriculum options to improve pedagogical practices and strategies in schools. The recommendations made in this report are viewed as an investment in human resource, which is scarce despite being the only available resource in the island republic.

Education policies in Singapore have been crafted for the benefit of the national economy since independence in 1965. Tan (2000) notes that the focus has shifted over the decades, towards a globalised world economy and the changing needs of the future workplace. The justification of pursuing educational policies in line with future world requirements such as knowledge economy, new media and lifelong learning are common rhetoric in Singapore (Chan, 2008; Economic Development Board, 1999; Gopinathan, 2015; Gopinathan & Mardiana, 2013). Tan (2000) notes that the establishment of such a policy orientation seems logical and rational from the predictive globalised economic perspective.

Polytechnic Pathway in Singapore

Students, upon completion of their secondary school studies in Singapore, have the option of going to either a Junior College or polytechnic or ITE. Junior colleges are orientated towards preparing students for university and have an academic focus. On the other hand, polytechnics are skill focused and are mandated to prepare graduates for work in the industry. Students enrolling into the polytechnic choose a specific professional focus such as Games Development, Food Science and Nutrition, Retail Management and Marketing etc. These students graduate with a diploma after a minimum of three-year studies. Almost all of these graduates gain industry experience through various teaching approaches that include projects, practicum, and internships. This is done to groom graduates to be 'job-ready.'

There is a strong government presence in directing and designing the curriculum, which has a strong focus on economic and international competitiveness. This ties in with the description of one of Biesta's and Priestley's (2013) models of curriculum, where, the "curriculum belongs to the jurisdiction of governments, rather than, say to schools or teachers" (p. 231). Thus far, this is similar in Singapore whereby the government undertakes all major reviews on education policy. A case example is the ASPIRE review (Applied Study in Polytechnics and Institute of Technical Education (ITE) Review) chaired by Ms Indranee Rajah, the Senior Minister of State for Education (Ministry of Education, 2014). As Gopinathan (2012) astutely states, the government takes the lead in educational matters and keeps a close watch on developments at all times.

Various authors (e.g. Chan, 2008; Gopinathan & Mardiana, 2013) have narrated on the close alignment of educational policy to economic needs in Singapore. The emphasis of Singapore's vulnerability, due to its lack of natural resources other than its human resource, places a huge importance on education as a key leverage for the economy and

the ‘survival’ of its people. The recent ASPIRE committee echoes this sentiment while stating its purpose as to enhance,

> career and academic progression prospects for Polytechnic and ITE graduates through the strengthening of industry linkages to provide work-relevant training for students, enhanced educational and career guidance, and pursuit of industrial research, innovation and enterprise activities that support the Polytechnics’ and ITEs’ academic mission. (Ministry of Education, 2014)

Having discussed the place of polytechnics in Singapore’s educational landscape, I will now focus on the polytechnic curriculum and, in particular, the polytechnic where my study will be situated.

Polytechnic curriculum

Chan (2008) notes a strong industry input and participation on the curriculum and academic aspects of polytechnic education. Each Polytechnic primarily governs the curriculum development process within its own organisation. An advisory panel, made up of industry leaders, generally guides and monitors the curriculum process. The Ministry of Education (Singapore) establishes policy guidelines and controls the funding of diploma programmes. Validation of curriculum, which differs across the different polytechnics, is normally done through industry feedback, the appointment of external examiners, industry scanning, and internal review processes. A detailed review of one polytechnic’s curriculum will be discussed next. I will refer to the polytechnic as Poly T.

Flexible Academic System

Poly T introduced a new curriculum framework called FAST (Flexible Academic System) for all diplomas in 2002. This framework incorporates a three-pronged strategy namely Institutional Fix; Industry Fit and Individual Flexible as a basis for the curriculum. The rationale for the three ‘IFs’ and subject classifications associated with this in the curriculum are presented in figure 4.1 below.

FAST Curriculum Framework

	Rationale - 3 'IFs'	Subject classifications
Institution **F**ixed	To foster holistic development of the individual as envisioned in the Poly T Desired Graduate Profile	Poly T Core subjects
Industry **F**it	To prepare graduates for the workplace	Diploma Core subjects
Individual **F**lexible	To maximise the individual's potential via more flexible curricula that allows study in areas of interest outside the students' own area of specialization	Cross-Disciplinary subjects and Electives

Figure 4.1 FAST Curriculum Framework of Poly T

The polytechnic curriculum encapsulates the desire to nurture graduates in an applied study process of academic and technical competencies that prepare them for the industry. Adopting a competency outcome approach, the polytechnic has listed nine intended exit outcomes as its Desired Graduate Profile (DGP) that applies to all diplomas offered by the polytechnic. The nine elements of the DGP are:

- Integrity
- Relevant Knowledge and Skills
- Service DNA
- Communication Skills
- Interpersonal & Team Skills
- Problem-Solving Skills
- Digital Literacy
- Future Orientation
- Transnational Mindset

The polytechnic's curriculum is further guided by three core principles for all diplomas, namely Character, Competency and Change Readiness, commonly referred to as the 3Cs, which are infused within the curriculum.

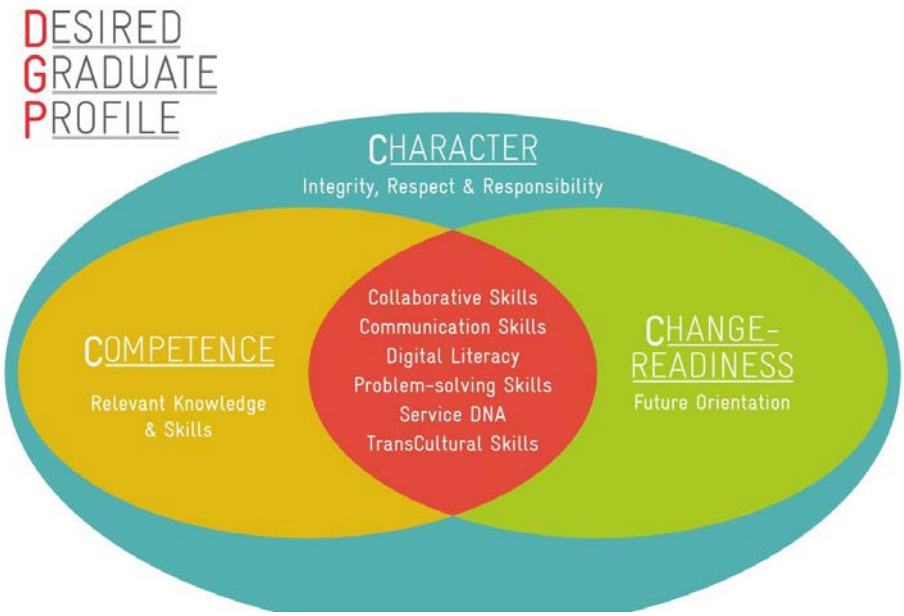

Figure 4.2 Desired Graduate Profile and the 3Cs of Poly T

The curriculum design process adopts an outcome-based approach with a 'design down' process that links to its specific alignment to the polytechnic's DGP. All the nine elements of DGP are clearly mapped into the 3Cs (Figure 4.2). Character maps on to one element i.e. Integrity and Change Readiness maps on to two elements i.e. Future Orientation and Transnational Mindset. The remaining six elements are captured within the Competency core principle. This reflects the weighting of the curriculum's focus on competency as well. The Competency attributes encompass all the skills, knowledge, techniques and expertise that graduates should possess for the industry.

This clearly indicates the drive to nurture graduates who are industry-ready. The approach of aligning educational outcomes to industry needs is referred to as applied study.

Applied Study

Polytechnics are mandated to nurture graduates with specific skills, knowledge and practice, so as to be 'job-ready' upon graduation. This demands the need for the polytechnic curriculum to have a good

balance of theory and practice. Polytechnic graduates have to be exposed to industry norms, practices, latest processes and technological and practical know-hows about the industry. Various studies explicitly draw reference to the polytechnic curriculum being driven through an applied study framework (Chan, 2008; Gan, 2005; Ministry of Education, 2014, August 2014; Varaprasad, 2016).

Various authors (Gilbert, 2010; Lupton, 1979; Wilkins & Walker, 2011) have widely regarded applied study as the process of integrating classroom learning and industry or work attachment. Gilbert (2010) and others (Boud & Symes, 2000; Lawson, 2007; Roodhouse, 2007) correlate applied study methods to medieval apprenticeship practices and maintain that it has not evolved much over the centuries. As Gilbert (2010) reasons, a core objective of the applied study approach is not only to provide experience and know-how but also

> to be embedded in an organisation to both apply and extend skills already developed *[at the educational institution]* and develop new skills in situ. (p. 84)

Lawson (2007) observed that such practices have played a key role in the curricula of schools of medicine, education, engineering and some natural sciences but had not been deployed in other areas as yet.

Recently, in Singapore, the establishment of a Ministerial level committee – ASPIRE – to review academic and industry attachment curricula within the polytechnic took the title of applied study as well. The Prime Minister of Singapore, in announcing the establishment of the ASPIRE committee, did underline the role of applied study in Polytechnics and ITE (Institute of Technical Education) as follows:

> we have to focus more on applied learning – to integrate classroom learning with real life applications on-the-job, and to encourage students to creatively apply concepts to practical problems, … Hence we facilitate internships and work attachments and help students to acquire deep skills and to integrate theory and practice – to apply what they learn in ways which will be useful to them in their jobs. (Lee, 2013)

Gopinathan (2015) notes that since the 2010s, globalisation has steadily increased unemployment and underemployment in Singapore. This is a result of an emerging skills gap between what graduates possess and what the industry requires. Gopinathan (2015) continues, "the deepening of skills that Singapore's policymakers deemed important for success in the increasingly technology-driven job market" (p. 85) was not occurring. Applied learning and its value had to be enhanced. The ASPIRE (Ministry of Education, August 2014) report concurs and notes the value of applied study as follows:

> (t)he value of applied learning lies in its relevance to the real world, which benefits students, employers, and employees. A successful applied education system requires close collaboration between education and industry, particularly in developing valuable work and life skills in students and meeting employer needs. This nexus will also serve to alert us to imminent industry changes, and enable our education system to adapt and respond in a timely manner. This will be critical in the future, as the world and our economy, continues to evolve rapidly, driven by technological progress and innovation. (August 2014 para 1.16)

The ASPIRE committee released its report in 2014 and highlighted the need for applied study features to be enhanced from their current status in polytechnic education. Of the ten recommendations made by the ASPIRE committee (details in Appendix 1), seven relate to the increasing need for applied study focus at educational institutions.

Also in 2014, Singapore established the SkillsFuture Council which is chaired by the Deputy Prime Minister, Mr Shanmugaratnam (Ministry of Finance, 2014). The SkillsFuture council is tasked to embark on developing skills mastery in every job and for Singaporeans to be nurtured as life-long learners. The tripartite SkillsFuture Council consisting of government, employers and union representatives has set its mission to building the Singapore workforce to be ready and adaptive to the changing needs of the future economy.

SkillsFuture

The tagline for the 'SkillsFuture Council: Your Skills. Your Assets. Your Future.' drives the skills mastery focus clearly. This is in line with the current government's focus on moving Singapore to the next phase of development i.e. to be an advanced economy and an inclusive society. These are implicated in the four key strategic thrusts of SkillsFuture initiatives:

- Help individuals make well-informed choices in education, training and careers;
- Develop an integrated, high-quality system of education and training that responds to constantly evolving industry needs;
- Promote employer recognition and career development based on skills and mastery;
- Foster a culture that supports and celebrates lifelong learning.

(SkillsFuture Council, 2016)

Other than the third key thrust listed above, the others are closely aligned to polytechnic education. The SkillsFuture Council (2016) outlines skills mastery as more than merely getting the necessary paper qualifications and being proficient in a skill. The Council strives to nurture a "mindset of continually striving towards greater excellence through knowledge, application and experience" (SkillsFuture Council, 2016 para 2) for skills mastery. This is entrenched within the lifelong phenomenon that is permeating the entire climate of education and skills mastery in the country now. In addition, there is also a need for graduates to be prepared for an ever-changing demand on learning and adapting to new requirements.

Dewey (1938) in his book 'Experience and Education' argues that knowing and doing are intertwined and cannot be separated. Extending this argument to applied study, Lawson (2007) classifies Dewey's notion of learning as supporting the applied study process. This argument is further extended by Billett (2004) and others (Hodkinson, Biesta, & James, 2008) who claim that applied study is broadly conceptualised as either an individual learning process or a socially dependent process. Papert (1998) clearly addressed the needs of 21st century learning stating that "(w)e need to produce people who know

how to act when they're faced with situations for which they were not specifically prepared" (Papert, 1998, para 24). This aptly underlines the needs of the applied study focus of polytechnic education in Singapore.

Learning in the 21st century is not likely to be straight forward, nor a smooth journey. As Barnett (2010) argues, "(t)here is no stable world of practices to which higher education could 'correspond' even if it so wished" (2010, p. 19). Trede and McEwen (2013) concur and state that "(a) standardised and rational professional education curriculum does not encourage students to critically engage with liquid times" (p. 2). Here 'liquid times' refers to the volatile and constantly changing employment and economic contexts. The need here, as Trede and McEwen (2013) argue, is to prepare students for uncertainty and rapid change.

The applied study model has over time evolved within the polytechnic educational landscape in Singapore. The initial orientation was to establish various types of industry-stimulated settings to enhance learning of skills and work practices. Students are then deployed on industry attachment (referred to as Student Internship Programme - SIP) and to engage students in industry projects. Further expansion of this trend was to incorporate enterprise-based education by establishing learning enterprises (LEs) for students' engagement within the institutions (e.g. restaurant, café, bakery, retail outlets and service centres). The latest trend is the push for practice-based education (PBE) within the curriculum. The next section will briefly discuss simulation, LE and industry attachment before venturing into PBE in more detail, as the latter is growing in prominence especially with the SkillsFuture directives for Singapore's polytechnic education.

Simulation

Simulation is signified as a pedagogy that bridges the classroom and real work environment. Within a simulated environment, learners gain access to real-world work situations, scenarios, material and equipment

to practise their skills and learn through the process. As McGaghie, Issenberg, Petrusa and Scalese (2010) state, simulation refers to any process, device or means of bringing an element of reality into another form. As the authors state, the use of simulation is not new to education as it has been in use for the study of medicine since the 17th Century. Such simulated environment also provides for learners to make mistakes and Gonczi (2013) terms this as 'safety of experience', which does not have 'real consequences' as if such mistakes were to happen in a real world situation. Gonczi (2013) adds that simulation pedagogy also allows for variations to be made to the situation to meet the learning needs of each cohort or individual learners. Simulated sessions also facilitate the provision of immediate feedback on practices undertaken by learners. Hence, simulation based pedagogy is a means of preparing learners for the world of work. Simulation pedagogy also provides, as Gonczi (2013) elaborates, the opportunity for curriculum integration. The learning of different subjects in silos is usually brought together in a simulated environment and provides for learners to integrate and put their skills to practice.

Simulation done in the comforts of the educational institution and in providing 'safety of experience' makes it removed from the real work environment. Learning Enterprise (LE) could help us move a step closer to learning through work in an authentic environment at academic institutions.

Learning Enterprise (LE)

LE encapsulates two broad categorical terms: Learning and Enterprise. Enterprise, as Down (2010) states, "denotes an orientation: a way of doing things that is active, creative, positive, and occasionally dangerous" (p. 5). A BBC (2014) educational series adds that enterprise entails the willingness of an individual or organisation to take risks, show initiative, 'make things happen' and undertake new ventures. When a learning enterprise is established within an educational

institution, it functions similarly to an enterprise in the industry, but is also used as a learning centre, hence, the term learning enterprise (LE).

LE enables students to learn while being actively engaged in a real work setting. At the polytechnic, there are many examples of LE. Restaurant, café, retail outlet and IT service support are some examples of LE established at polytechnic in Singapore. These enterprises provide students with authentic experiences and are guided by faculty and practitioners. LE serves the needs of its customers and operates as an enterprise in the industry catering to all operational details as in the real world. LE also adheres to regulations, checks and audits as established for the industry within the country. Such authentic experience provides very useful opportunities for students to hone their skills in a slightly safer environment.

Ford (cited in Kaizen Institute India, 12 Nov 2013) narrates LE as a process "where individuals, teams, and the enterprise itself are continually learning and sharing the development, transfer and use of knowledge and skills to produce continual improvement and the creation of a dynamic competitive advantage" (cited in Kaizen Institute India, 12 Nov 2013 para 6) within an educational institution.

LE nurtures capabilities such as adaptability, taking initiative, communication, managing & leading, and problem-solving (Victorian Curriculum and Assessment Authority, 2011) skills all within a real-life industry environment. LE provides experiential learning opportunities. Student ownership within an experiential learning context facilitates deep learning. This process internalises the working experience into skills mastery over time and cultivates a passion for the profession. LE embodies the constructivist view of education where learning is internalised and constructed by the learner through her or his own experiences gained from the tasks done. This process is facilitated by the 'more knowledgeable other (MKO)' (a Vygotskian term) who need not be a teacher but an experienced practitioner in the field.

LE essentially frees the teacher from the confines of a specific curriculum and a classroom. LE allows for learning to be integrative and holistic in its focus while being enacted in a real life environment of competitive demands and needs. Generally, LE's educational objectives, as reflected in various reports and articles (Kaizen Institute India, 12 Nov 2013; Rae, 2007; The Quality Assurance Agency for Higher Education, 2012; Victorian Curriculum and Assessment Authority, 2011) are:

- Grow learners' self-confidence, self-awareness and motivation for the industry;
- Enhance learners' knowledge, understanding, appreciation and skills mastery of the industry and world of work;
- Develop the aptitude and attitude for learners' future role in the industry

Simulation and LE provide students with an authentic environment to practice their skills for the real world of work. ASPIRE (Ministry of Education, 2014) urges a reconsideration of how skills can be acquired. As stated in the ASPIRE report "some skills are better acquired through work experience or actual industry projects, rather than in the classroom" (Ministry of Education, August 2014, p. 16). The ASPIRE report (Ministry of Education, August 2014) highlights the achievements of some countries, "where on-the-job learning in the workplace has produced highly-skilled workers with great expertise and best-in-class craftsmanship. Learning through work can also help in the development of soft skills" (Ministry of Education, August 2014, p. 16 para 1.20). The next section will review industry attachment that places students in a real work environment.

Industry Attachment

Industry attachment or Student internship Programme (SIP), lasting from 12 to 25 weeks, focuses on providing final year students with authentic work experiences. Students are attached to an organisation and specifically, to a work task that aligns with the skills that they are trained in. Students on SIP function as full-time staff in the organisation

and follow all protocols of the organisation. There is minimal contact with academic faculty other than a requirement to maintain a reflective log to record their learning. Faculty members act as liaison officers between the organisation and the polytechnic as they keep an eye on students' learning from a distance. Faculty members only get involved when there is a misalignment of task to student expertise; otherwise, students are expected to function within the organisation as full-fledged staff. This is part of the 'job-ready' graduate nurturing process. Students' learning from this critical exposure is determined through their reflective reasoning of experiences at the organisation. Cultivating and honing their skills in technical, social and communicative areas are very much determined by the students. It also provides an opportunity for employers to ascertain the employability of the interns and it is not rare to see organisations offering employment opportunities to interns.

SIP relates to students learning in a workplace setting. The literature has a few terminologies on how learning and work can be integrated for the benefit of all parties involved. Workplace learning (WPL), work-related learning (WRL) and work-based learning (WBL) are three commonly cited terminologies in the literature. The next section will briefly review the difference between these three terms and their places in polytechnic education in Singapore.

Workplace, Work-related and Work-based Learning

Workplace Learning (WPL) as defined by Bound and Lin (2011), from the Institute of Adult Learning (IAL), Singapore, is learning occurring

> when employees, teams, organisational and cross-team work, knowledge and experience are developed through engaging in daily work activities. Receiving guidance and support in the work environment enhances these learning opportunities, adding considerably to employee confidence and effectiveness. (p. 1)

The focus of WPL is on training, upgrading and learning that is closely associated with the organisation and can be classified as internal training for its employees.

Work-related Learning (WRL) as described by Virolainen and Stenstrom (2013) encompasses a variety of learning activities that take place both within the polytechnic and workplace. The main thrust of WRL is that learning is aligned to the polytechnic's broad-based curriculum. Although Virolainen's and Stenstrom's (2013) perspective of WRL comes from the Finish polytechnic's practices, these practices are also similar to what has been in practice within the polytechnics in Singapore. WRL is closely aligned with the deployment of simulation and short stints at the LEs in the polytechnics.

Work-based Learning (WBL) has been well defined by Boud, Solomon and Symes (2003) with a series of characteristics that frame the term. According to these authors (Boud, et al., 2003), work is the curriculum for WBL as "exigencies of work do not commonly map on to the disciplinary and professional structures of educational institutions" (2003, p. 5). The characteristics listed by Boud, Solomon and Symes (2003) eloquently capture the essence of WBL and these are:

- Learners are employees
- Partnership between external organisation and educational institution
- Work is curriculum
- Learners start to study at different points depending on their educational attainment, work experiences, opportunities for training and aspirations
- Learning projects are undertaken at the workplace
- Educational institution assesses learning outcomes based on a transdisciplinary framework of standards and levels. (Boud, et al., 2003)

WBL hence is situated in the workplace and the learners are employees. As described above, the curriculum for WBL tends to be flexible, as the demands of work cannot be readily aligned to institution's needs easily.

In Singapore's current context, especially with the Committee on Future Economy (CFE, 2017) and SkillsFuture initiatives, all three of these

practices are emphasised. Within the polytechnic setting in Singapore, WPL is undertaken by the Continuing Education Training (CET) that focused on upgrading or renewing working adult's skill sets. The move towards PBE and the support given by SkillsFuture initiatives has propelled new schemes along the WRL framework to be applied to the polytechnic. A new scheme introduced by SkillsFuture recently, entitled "Earn & Learn" has WRL features inscribed in it. Employers are financially supported by government grants to release employees to attend skills upgrading programmes at the polytechnics. This may be the first step in integrating PBE processes to incorporate WRL into polytechnic curriculum.

The learning and skills development objectives of each of these processes (WPL, WRL & WBL) are important and showcase the different learning orientation for each. The defining characteristics of these different terminologies help set the focus of the learning possibilities when such practices are adopted at the polytechnic. However, for full-time diploma programmes at the polytechnics, WRL and WBL are emphasised. WRL is done through providing students industry based authentic projects, short stints of work with industry or LEs and simulation for curriculum fulfilment. WBL is done through student internship (SIP) that attaches students to an organisation for an extended duration (12 - 25 weeks). The prevalence of WRL and WBL are due primarily to their alignment to fulfilling the polytechnic's mission of applied study focus in its curriculum.

Billett (2015) spots an educational trend, at least within higher education, over the past three decades, which has seen a gradual shift from a knowledge, content focus in the 70s to that of an outcomes-driven focus in the 80s and 90s. The new millennium has ushered in a push towards competency and skills mastery, i.e. the orientation towards practice-based education, which is closely aligned to workplace practices within the specific professional domain. Billett (2015) states this trend has gained prominence within the 'massification of higher

education.' The pressure and expectations traditionally placed on the vocational education system are now being applied to higher education in many countries. The currency of practice-based education and its skills mastery focus drives the national educational policy mandate in countries like Singapore and Australia.

Practice-based Education (PBE)

PBE is emphasised at polytechnics today as it aligns with the mission of graduating 'job-ready' graduates for the industry. As Billett (2015) notes "(t)his occupation-specific focus brings with it heightened expectations that students from these programs will be directly employable upon graduation and enjoy smooth transitions into professional practice (i.e. they will be job ready)" (p. 28). A variety of terminology is used to describe these forms of learning arrangements such as practicum, placement, internship, fieldwork and cooperative education, to mention a few.

Practice

Before venturing into understanding PBE, it would be useful to have some clarity on what is practice. Practice entails a complexity of activities. Higgs, Barnett, Billett, Hutchings and Trede (2012) narrate the different practices that are possible within the field of medicine, which illuminates the complexity of practice well:

> "How may we interpret medicine: as the art of healing, as a field of applied science, as a range of Indigenous cultures' natural or faith healing crafts, or as a variety of health care practices? Does the field of medicine deal with cure and prevention, illness and wellness, self-management and delivery? If I enter one of these paths of medical practice what is the nature of my practice? What do I need to learn to practise well? Who are the guardians of the field of medicine? Who are the people who engage with my services? (p. 3)

Hence, practice differs based on specialisation, context, environment and more. Kemmis (2009) and Trede, Mischo-Kelling, Gasser, & Pulcini (2015) describe practice as being contextualised in activities. To Kemmis (2009) practice is conceptualised as the 'doings', 'sayings' and

‘relatings’ that happen while practitioners carry out their professional duties and responsibilities. To Kemmis (2009), ‘sayings’ refers to what those involved in the practice say it is, as well as what is said while doing it and about what is done. ‘Sayings’ reflect the practitioner’s ways of thinking about their practice. ‘Doings’ refers to the different kinds of activities and work done by those involved. And ‘relatings’ refers to the relationship between professionals and clients and in the “complex characteristic patterns of relationships between different kinds of people involved and affected by them” (Kemmis, 2009, p. 25).

On the other hand, to Trede, et al. (2015) “(p)ractice is the application of knowledge and skills in a certain time in a given place in complex interwoven relationships with other people and objects” (p. 1003). Higgs et al. (2012) define practice in a much broader term. She and her colleagues refer to “practice as activities, models, norms, language, discourse, ways of knowing and thinking, technical capacities, knowledge, identities, philosophies and other sociocultural practices that collectively comprise their particular occupation” (p. 3). Practice, hence entails a complex set of activities that has to be contextualised to the setting of the profession. There are nuances in practice within the same profession. Such practices are also contextualised to the region further adding to the complexity of practice.

Higgs (2013) refers to practice as the “customary activities of a profession, and the chosen ways individual practitioners implement their practice or profession” (p. 6). She further differentiates practice as either a collective or individual process (i.e. profession or practitioner perspective). As a collective process, the practice entails ethical considerations, professional decision-making, client-practitioner relations and interdisciplinary team processes. The individual practice process is shaped by the views of the practice community and by individual interests, preferences, experiences and more (Higgs, 2013).

Boud (2016) explains practice as that which is said and done by individuals that have existence beyond their engagement. This relates to Kemmis's (2012) description of practice as 'doings', 'sayings' and 'relatings.' Boud (2016) also emphasises the 'relatings' aspect of practice and states that "(p)ractices connect material conditions with people and with work. They cannot be thought of separately from the conditions in which they exist – abstracting a practice from its context is to no longer have a practice" (Boud, 2016, p. 160). Practice remains a dynamic process as it evolves with the changes in the profession, be it situational, contextual or between different regions.

Features of Practice

Hence, what is a practice? This requires careful consideration as it entails how the concept can be used within an educational context. Some authors discuss the features of practice within a PBE framework (e.g. Boud, 2012, 2016; Hager, Lee, & Reich, 2012). Boud (2016) lists six features that summarise the literature discussion on the nature of practices:

- (t)hey are embodied, that is the location of practice is within persons. A practice requires persons who enact it.
- (t)here is material mediation. The material conditions are a key influence.
- (t)hey are relational. Practice occurs in relation to other people as well as things.
- (t)hey are situated. The context of a practice matters.
- (t)hey are emergent. That is, they cannot be fully determined in advance of particular circumstances and they change in accordance with them.
- (t)hey are co-constructed. They are socially constructed in conjunction with others. (Boud, 2016, p. 161)

These characteristics provide a challenge in preparing students for practice in a classroom-based structured curricula educational environment. These features also provide challenges in preparing students for practice. Boud (2016) draws out the tension these features of practice have in the traditional classroom environment. He elaborates that traditional classrooms "take a disembodied and decontextualized

view of knowledge and may use practices as illustrations of how ideas are applied" (Boud, 2016, p. 161). However, in a constructivist-oriented classroom, which I will describe in the next chapter, the features of practice mentioned above could be coherently integrated.

The complexity of practice raises a plethora of questions on how to teach. There are also questions on curriculum design for a practice-based educational setting. According to Reich, Rooney and Boud (2015), two types of epistemology may be able to unpack the dilemma faced in understanding practice in a learning context. The two epistemologies are nomothetic and idiographic.

Epistemology of Practice

Nomothetic epistemology, according to Reich, Rooney and Boud (2015), holds "that the world can be known through generalisations derived from systematic investigation" (p. 134). Nomos in Greek refers to 'The body of law' that governs human behaviour. So it is common in a nomothetic epistemology for a list of competencies, skills and knowledge to be created from a generalisation provided by a sample of professionals at a relative point in time.

An idiographic epistemology, on the other hand, Reich et al. (2015) states, "focuses on the unique and contingent opportunities available to practitioners" (p. 134). Idios in Greek refer to private and personal. In this perspective, knowledge of professional learning is construed from empirical investigations of professionals' practices, often through ethnographic studies, interviews and others. How professionals navigate their daily professional practice, overcome challenges and face new problems are the empirical information that feeds practice information. Such practice information is not generalised but, as Reich et al. (2015) state, provide "context-specific features, collective activities and the complexity of practice" (p. 134) involved in the profession.

Nomothetic and idiographic epistemologies of practice have parallels to that of positivist and constructivist perspectives respectively. This might be crucial to how practice is viewed by polytechnic stakeholders and would provide a good understanding of how these beliefs are translated into implementation and action.

The demand is to prepare graduates for specific occupations and for the graduates to have a smooth transition to the workplace. Billett (2015) notes the need for knowledge of the profession in stating that

> there is a need to develop the canonical knowledge of each profession (i.e. the knowledge required by all who practice that occupation), and also a requirement for this knowledge to be learnt in ways that make it adaptable to the practices that graduates will encounter during their courses and directly upon graduation. (p. 15)

However, Billett (2015) highlights the difficulty posed by such practice orientation as, “this expectation is difficult to fulfil, because performance requirements for professional practice can differ quite widely across circumstances where occupations are enacted” (p. 14).

Billett (2015) notes the common consensus in nurturing practice-based learning is to take into consideration the:

> need for graduates to have practice-based experiences structured and embedded within their programs of study whose timing and duration has been carefully considered in order to meet the specific educational goals they are enacted to achieve. (p. 15)

Henderson and Alexander (2011) concur with this viewpoint and add that such formative and constructive experiences will have to be integrated within the curriculum and not dealt with as add-ons.

Learning Through Practice-based Education

Billett (2015) outlines three needs that are fulfilled by the growing trend of practice-based learning globally. These are: nurturing individual competency, improving workplace productivity with practice-ready

graduates and contributing to the national 'well-being' i.e. growth via economic imperatives. This growing trend, as Billett (2015) expresses:

> focused on outcomes that are related to students' employability upon graduation, i.e. enjoying a smooth transition to work, being effective in their selected occupation and having the kinds of capacities and interests to sustain that employment and secure advancement in working life. (Billett, 2015, p. ix)

Boud and Solomon (2003) cautioned that such experiences should not be seen as opportunities for practice and rehearsal of what was learnt in school. Rather, such opportunities should be taken as rich and legitimate learning experiences in their own right for students. Billett (2015) continues that the challenge for PBE is to go beyond curriculum and pedagogy concerns and focus on how best to nurture students' capacity to become active and agentic learners.

Students need to nurture their capacity of being self-initiating and interdependent learners in order to optimise their learning during their practice-based learning opportunities. Billett (2015) continues that "it is these kinds of capacities that will be central to their retaining their professional currency as work requirements change, and securing advancements in their careers" (p. 6).

Billett (2015) mentions that one of the changes required for practice-based learning is the "emphasis on learning over teaching" (p. xi). The role of teachers in the knowledge construction process, within a practice-based learning environment, aligns with the constructivist epistemology. The facilitation process in inculcating skills and knowledge through practice and experience can be done through constructivist-oriented pedagogies.

Based on my teaching experience at the polytechnic, the process of engaging in practice-based learning goes beyond the curriculum and pedagogy alone. The student's personal epistemology, models of practice, intentions of practice and principles of practice are just some

of the concerns that need to be considered in the process. Billett (2015) feels the mandate of 'job-ready' graduates "is a very demanding, possibly unreasonable and unrealistic goal for higher educational programs and institutions" (p. 7). He also argues that practices differ even in the same occupation in differing situations and localities. Nevertheless, learners can be prepared for PBE experience. These are in my view, real and practical issues that confront teachers at the polytechnic.

Preparing Learners for PBE

Billett (2015) demarcates the different requirements in nurturing students for PBE into three stages namely, before, during and after. Table 4.1 below showcases the nurturing required of students at each of these stages.

Before	During	After
• Orientate learners on requirements for effective workplace engagement • Establish bases for experiences in practice settings such as developing capacities for the workplace. • Clarify expectations and purposes, roles of different parties involved. • Prepare students to engage as agentic learners • Develop procedural capacities to effectively engage in practice • Prepare learners for contestations	• Guidance from experienced practitioners • Sequencing and combination of activities at workplace for learning practices • Active engagement in work activities or interactions • Effective peer interactions • Active and purposeful engagement as learners in workplace settings	• Development of understanding and procedural capacities • Identify what comprises robust knowledge • Reconciling students' experiences • Using post-practicum experiences for transformational learning experiences

Table 4.1 The Before, During and After requirements for students engaged in Practice-based Education (Adapted from Billett, 2015, pp. 203-218)

Billett (2015) notes the 'highly effortful' nature of PBE that requires individuals to identify and understand the causal links and associations in their working experiences. He argues that such development does not easily arise from teaching or facilitation alone. According to Billett (2015), "it is a product of individuals' effortful engagement and learning" (p. 100). The preparation and facilitation required through the PBE

process, as highlighted in the Table 4.1 above, clearly indicates the magnitude of the task. Careful consideration is required in rolling out PBE for learners and in preparing them for the experiences that practice will avail. I can state, based on my experience of teaching at the polytechnic that such a clearly articulated framework on preparing students for PBE is lacking within the polytechnic curriculum.

Pedagogic Practices for Practice-based Education

A variety of pedagogies can be incorporated to harness the benefits of PBE at the polytechnics. Higgs (2013) highlights eight key implications for pedagogy for PBE:

1. Supervised workplace learning
2. Independent workplace learning & experience
3. Simulated workplaces
4. Simulated practice-based learning
5. Distance and flexible practice-based learning
6. Peer learning
7. Independent learning
8. Blended learning (pp. 9-10)

These approaches to teaching are more likely to develop 'agentic' learners who are engaged and critical practitioners. For example, PBE requires learners who are agile and adaptive to their learning environment, responsive to their learning needs and able to seize opportunities where possible. Such attributes are found in the discussion on 'agentic learners' and 'deliberate' professionals by various authors (Richards, Sweet, & Billett, 2013; Smith, 2005; Trede & McEwen, 2013). A brief discussion on both these concepts will be done next.

Agentic Learner and Personal Epistemology

Both Schommer (1994) and Boden (2005) believe that epistemological beliefs have a great impact on learners' engagement in learning (cited in Richards, et al., 2013). Schommer-Aikins and Easter (2006) describe personal epistemologies to encompass individuals' beliefs on what is knowledge and how it is justified. Richards, Sweet, & Billett (2013) reason that the "meaning students make of their experiences influences

how they learn, and subsequently shapes the outcomes and understandings of their practice" (p. 253). Such attributes are associated with agentic learners. Agentic learners as defined in the glossary of Billett (2015) are:

> (l)earners who are proactive and engaged in making meaning and developing capacities in way [sic] that they are intentional, effortful and are actively criticality [sic] in constructing their knowledge. (p. 253)

Smith (2005) describes agentic learners as those who participate, negotiate, and learn through engagement with the opportunities offered to them in workplace settings. Malle et al. (2001) inform us that "the more motivated, directed and intentional the students' engagement, the more likely the learning outcomes will be richer because the constructive process is stronger" (cited by Billett, 2015, p. 212).

Richards et al. (2013) discuss from the thematic analysis of research done with medical students, five factors describing how students learnt to engage effectively in their medical studies. These factors are:

i) understanding how to use and extend their personal epistemology;
ii) maximizing opportunities in self-directed learning environments;
iii) developing a positive sense of self;
iv) employing assertive communication; and
v) resilience through peer collaboration. (Richards, et al., 2013, p. 253)

These factors are interdependent and call for students to become learners with agentic personal epistemology. Such an epistemology will allow students to successfully negotiate, engage and learn from their practices for both their personal and professional achievements.

Richards et al. (2013) suggest that the best way to engender agentic learners is by cultivating a self-directed learning environment. He notes from research that,

> successful agentic students developed a sense of awareness of their epistemological beliefs to set appropriate learning goals and guide their learning process. These students were able to develop self-directed learning strategies which eased the integration of new knowledge with their existing knowledge through reflection on, and justification of that knowledge. This was achieved when they perceived a positive self-concept, maximized learning opportunities, employed assertive communication and possessed coping strategies. (p. 260)

Deliberate Professionals

A Deliberate Professional (DP), according to Trede and McEwen (2013), "is someone who consciously, thoughtfully and courageously makes choices about how to act and be in the practice world. The conduct of the DP is informed by moral consideration of the interests and actions of self and others" (p. 2). The core aspect of deliberate professionals (DPs) is to question professional activities rather than to stick with the traditional practices of the profession. Traditional notions of seeking the 'what' and 'how' of practices, are deemed insufficient for PBE and its related skill mastery. DPs are nurtured to raise questions on why such practices are in place, with whom and for what purposes are these practices done, in the effort to raise the profile of DP to be on top of their skills mastery.

Trede and McEwen (2013) argue for the presence of DP skills set in education for two reasons. They feel the current system does not adequately nurture learners for future practices and in being global citizens. Secondly, the focus on nurturing 'job-ready' graduates, may forsake, as Trede and McEwen (2013) state, "the higher and more enduring capability-enhancement goals of stimulating creativity, fostering courage, critiquing stifling systems and providing alternatives to the norm or status quo" (p. 2).

In my view, nurturing agentic learners to become DPs is congruent with the polytechnics' mission especially with the current SkillsFuture emphasis. The need for learners to seize the learning opportunities at

work and throughout life, to build the skills mastery over a lifetime is in tandem with lifelong learning attributes of the 21st century (Pellegrino, 2017) and to the SkillsFuture thrust as well.

Issues and Concerns on Practice-based Education

Introducing a note of caution to the growing trend of practice-based learning, a parallel can be drawn to Faure et al.'s (1972) argument. Faure et al. (1972) point out that in the 70s, with high youth unemployment, UNESCO suggested that post-school education should not prepare individuals for particular occupations but provide broad-based skills training. Billett (2015) notes, "much of the rationale behind the formation of vocational education systems in modern times was to secure an adequate skill base for the workforce, and for individuals to be able to secure paid employment" (p. 10). Similarly, polytechnics in Singapore are driven in nurturing 'job-ready' graduates with skills mastery for the particular industry. This can be counter-productive in the next major unemployment situation or a sudden change in technological development.

Another concern is the relative newness of the practice-based education model. Boud (2012) notes that the practice-based educational changes being implemented have left the curriculum relatively untouched. The lack of knowledge in integrating practice into curriculum is another concern. Boud (2016) argues that courses:

> are far from exemplars of good educational practice for the professions. This is not primarily because of teaching quality, but because they tend to have a poorly conceptualised view of what it is that their graduates do in their professional practice. They are too often governed by what is involved in teaching within academic disciplines rather than on how learning occurs within professional work. There is a continuing risk that students will be trapped in current knowledge without the capacity to move beyond what they have been taught. … courses need to be actively designed and redesigned to produce graduates that will be deliberate professionals. (Boud, 2016, pp. 157-158)

Many authors have also noted (Illeris, 2011; Malloch, Cairns, Evans, & O'Connor, 2011) that in reality, much of the learning that takes place at work is done without any prompts from teachers, or a delineated educational curriculum. Boud (2016) succinctly captures this essence in stating, “learning is an intrinsic part of work” (p. 159). Boud (2016) and others (Price, Scheeres, & Boud, 2009) believe, that very little of the learning that happens at work is systematic, structured or planned. Learning arises from the experiences of work and how practitioners face up to the challenges. Hence, the relative newness of the practice-based educational model raises concerns on the way forward for its implementation at polytechnics.

In discussing challenges in conceptualising PBE and workplace learning, Boud (2016) raises pertinent issues that have to be taken into consideration in undertaking these pedagogies. Workplace tasks often involve complex situations and such practices have their own dynamics. It is also common for practices to be emergent in nature. Learners engaged in such situations will have to take “greater responsibility for managing and organising their own learning than is the case in conventional courses” (Boud, 2016, p. 169). Boud (2016) continues in stating that:

> (t)his raises the issue of how day-to-day learning is to be facilitated given that neither workplace supervisors, nor indeed teachers themselves are continually present or are in a position to intervene at strategic moments. This is the perpetual challenge of student learning in placements. (p. 162)

These concerns have to be addressed in bringing PBE to the polytechnics. McEwen and Trede (2014), in discussing the focus on nurturing job-ready graduates, highlight the necessity for institutes of higher education to maintain their core tradition of educating graduates with lifelong skills. These authors also argue in their various works (McEwen & Trede, 2014; Trede & McEwen, 2012; Trede & McEwen, 2015) the need for universities and higher education to continue the cultivation of critical thinking, social interdependencies, learner autonomy, and more to face up to a future of uncertainty and ambiguity.

Conclusion

Billett (2015) describes that studies done on practice-based learning have highlighted five key imperatives that higher educational institutions must nurture. Firstly, the interpretation of learning experiences needs to go beyond the physical and social settings. Learners need to reconcile their learning experiences of all their learning opportunities. Secondly, students' personal epistemology needs to be considered. How students engage in practice and learn from their experience is crucial. Thirdly, there is a need to prepare students for practice. Fourthly is the importance of nurturing of agentic learners for the future world of work. Lastly, there is the need for students to become critical, reflective practitioners and engage in professional practice. These five imperatives adequately summarise the discussion on applied study model in the polytechnic context.

CHAPTER FIVE
CONSTRUCTIVISM AND EDUCATION

Introduction

Constructivism is a theory of knowing that explains how people construct their understanding and knowledge of the world through their experiences. Glasersfeld (1989a, 1995a) points to the first articulation of constructivist ideas by Giambattista Vico, an early 18th century Italian philosopher. A basic tenet of Vico's ideas as quoted by Glasersfeld (1989a) "was that epistemic agents can know nothing but the cognitive structures they themselves have put together… 'to know' means to know how to make" (p. 123). The ideas of constructivism are visible in various thinkers' works over time from John Dewey in early 1900s, to Jean Piaget from the 1960s, to Vygotsky's work discovered from the 1970s, Ernst von Glasersfeld from the 1960s to early 2000 and many others. From the constructivist perspective experience is central to learning. The implication for education is clearly expressed by Dewey (1938):

> education in order to accomplish its ends both for the individual learner and for society must be based upon experience – which is always the actual life-experience of some individual. (p. 89)

Chapter outline

The chapter begins with a broad account of constructivism and education; discussing the definitional aspect of education from the constructivists' perspective. Knowledge and the process of knowing are then explored. An understanding of how constructivists define and construe knowledge will be discussed, as the implications are integral to the educational process. The discussion then shifts on to how learning is construed within the constructivist perspective. The debate between constructivists' and cognitivists' viewpoints on learning is appraised. The challenges of creating a favourable environment for constructivist-oriented classrooms and the challenges faced by teachers in their day-to-day task make up the next sub-theme of the chapter. The process of facilitating learning rather than teaching through transmission or

delivery and the challenges these have for education is also discussed. The chapter then focuses on providing key principles that have been proposed by various authors on practising constructivism in the educational setting. As the study of this thesis is situated in an Asian cultural context, a look at Asian educational thinking and the comparability of these ideas on education to constructivism is next discussed. Confucius's and Vivekananda's thinking on education is contrasted as a conclusion to the constructivist literature review.

Trivial and Radical Constructivism

Constructivist theories point to individuals construing knowledge through reflecting on their experiences and infer that this active process is the only means of how individuals learn.

Glasersfeld (1995a, 1995b), professes that his ideas about constructivism were primarily derived from the works of Piaget. Glasersfeld (1995b) wanted to differentiate his account of constructivism, i.e. radical constructivism from other forms of constructivism especially 'trivial' constructivism. Trivial constructivism to Glasersfeld (1989b) is the adherence to only one principle of constructivism i.e. "knowledge is not passively received but built up by the cognizing subject" (Glasersfeld, 1989b, p. 162). Trivial constructivism, according to Glasersfeld, is practised by:

> those who merely speak of the construction of knowledge, but do not explicitly give up the notion that our conceptual constructions can or should in some way represent an independent, 'objective' reality. (Glasersfeld, 1991, p. 16)

On the other hand, the radical constructivist argument is that the knower cannot demonstrate a link or resemblance between their thoughts and an independent external reality. This severance between individual thought and an external 'reality' is a pivotal principle of radical constructivism. Hence, the second principle stated by Glasersfeld (1989b; 1995b) is:

> the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality. (1995b, p. 18)

Constructivism as such resonates differently from a realist perspective. The epistemological basis and the lack of ontological premises of constructivism have been discussed in the conceptual framework chapter (Chapter Two). The present chapter will build on the conceptual framework and focus its discussion of constructivism in education.

Some authors (like Solomon, 2000; Tobias & Duffy, 2009) have commented that constructivism has remained a philosophical framework and, in the words of Tobias and Duffy (2009), has not adequately developed into "a theory that either allows us to precisely describe instruction or prescribe design strategies" (p. 4) for the classroom. The difficulty in comprehending and finding appropriate applications, congruent to the constructivist perspective in the classroom, is a practical concern faced by educationalists currently.

Aims of Education, Experience and Constructivism

Glasersfeld (1995b), whose radical constructivist arguments are discussed in the conceptual framework section of the thesis, views education as a process of nurturing learners' construction of knowledge through their own experiences. The facilitation of this process with the learner is the task of teachers. As Glasersfeld (1995a) asserts, "(c)oncepts cannot simply be transferred from teachers to students – they have to be conceived" (p. 5). Glasersfeld (1995a) and constructivists generally reject the notion that learning is "a stimulus-response phenomenon" (p. 14). However, they emphasise the importance of self-regulated learning in the knowledge creation process.

The aim of learning is not to look for the right answer (Glasersfeld, 1995a) but to be prepared and skilled to solve problems that the individual will face in future. As Glasersfeld (1995c) states in discussing 'constructing know-how', "we [teachers] want them [learners] to construct knowledge they do not seem to have because we think it would be good and useful for them to have it" (p. 370). In a constructivist-oriented educational setting, the role of the teacher is to elicit the learner's current experience on the subject matter and to guide learners in contextualising their learning and the construction of their knowledge (Glasersfeld, 1995a)

Glasersfeld and others (Dewey, 1938; Glasersfeld, 1989a; Glasersfeld, 1990; Glasersfeld, 1995a, 1995b, 2001, 2010; McCarty & Schwandt, 2000; Poerksen, 2004), holding a non-positivist view, dissent from the view of knowledge acquisition as being the primary aim of education. As McCarty and Schwandt (2000) summarise, the traditional aim of education as knowledge acquisition, is seen by constructivists as passive learning. To a constructivist, as Glasersfeld (2001) states, the concept of education

> comprise(s) training and formation, coaching in specialized competencies, fostering the ability to think, promoting manners, culture, taste, and other accomplishments. (p. 1)

Glasersfeld (2001) continues that whatever is conventional, like dates in history, names of chemical elements, days of the week and more, should be learned verbatim and "what is based on rational operations, should be understood" (p. 2). Two critical aims of education, Glasersfeld (2001) emphasises are to foster independent thinking and cultivating conceptual learning. Glasersfeld's (1995b) call for education is well captured in his concluding statement in his book, Radical Constructivism, "the art of teaching has little to do with the traffic of knowledge, it fundamental purpose must be to foster the art of learning" (p. 192).

There are opposing viewpoints to the constructivist notion of education. Mayer's (2004) meta-analysis, reports that learning, using "discovery has been replayed many times in education but each time, the evidence has favoured a guided approach to learning" (p. 18). Kirschner, Sweller & Clark (2006) purports constructivism to the hypothesis that people learn best in an unguided or minimally guided environment. The authors define minimal guidance as where "learners, rather than being presented with essential information, must discover or construct essential information for themselves" (p. 75). The authors rightly stated that constructivist-oriented teaching does not support transmissive teaching. However, their association of constructivist-oriented teaching to unguided or minimal guidance approach does not represent constructivist principles. These are weak arguments that show a lack of understanding of what the constructivist epistemology narrates.

Hmelo-Silver's & Barrows' (2008) rebuttal of Kirschner et al.'s (2006) viewpoint defends the value of problem-based learning in education. Kirschner et al.'s (2006) criticism of constructivist perspective of learning and the rebuttals will be discussed later in the literature review.

Dewey (1938) succinctly links education to experience in his description of the philosophy of education. He advocates that learners' experience is a critical factor in making all pedagogical decisions. Dewey (1938) exemplifies this by stating that:

> education is a development within, by, and for experience, the more important it is that there shall be clear conceptions of what experience is. Unless experience is so conceived that the result is a plan for deciding upon subject-matter, upon methods of instruction and discipline, and upon material equipment and social organization of the school, it is wholly in the air. (p. 28)

The pinnacle role of learners' experience underpins Dewey's (1938) notion of education. This link between the learner's experience and the processes of learning and teaching is fundamental to the constructivist notion of education. This aligns to Scaife's (2012) suggestion of diagnosing " 'where learners are coming from,' namely their current

knowledge, understanding and feeling of confidence and motivation" (p. 97) in designing teaching. Such an approach would align with the constructivist approach in building on learners' experience.

Such a shift in the paradigm of teaching has its consequences. Glasersfeld (1989b) highlights these as follows:

1. There will be a radical separation between education procedures that aim at generating understanding ('teaching') and those that merely aim at the repetition of behaviors ('training').
2. …the educator's interest will be focused on what can be inferred to be going on inside the student's head, rather than on overt 'responses'.
3. The teacher will realize that knowledge cannot be transferred to the student by linguistic communication but that language can be used as a tool in a process of guiding the student's construction.
4. The teacher will try to maintain the view that students are attempting to make sense in their experiential world. Hence, he or she will be interested in students' 'errors' and, indeed, in every instance where students deviate from the teacher's expected path because it is these deviations that throw light on how the students, at that point in their development, are organizing their experiential world.
5. … aims not only at inferring the student's conceptual structures and operations but also at finding ways and means of modifying them. (pp. 162-163)

If current active knowledge, infused with individual experiences, is how learning starts, then as Glasersfeld (1995b) states, "the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience" (p. 1). Constructivists' notions of knowledge and knowing differ from other paradigms. The next section will discuss the constructivist understanding of knowledge and knowing. As constructivist ideas are introduced into education, an understanding of what knowledge and knowing entail within this perspective will provide clarity on the discussion.

Knowledge and Knowing in Constructivist Education

A constructivist would view knowledge as being individual and not replicated or mapped on to a learner (Glasersfeld, 1995a, 1995b; Peggy

& Timothy, 1993). As Glasersfeld (1995b) declares, constructivists do not deny the existence of the real world, but claim that one's knowledge of it comes from an individual's experience and their interpretation of that experience.

To Lincoln and Guba (2013) knowledge is an "organized remembrance of experience; it is based in the first instance on the 'realization' of primitive experiences and on the sense made of those experiences" (Lincoln & Guba, 2013, p. 55). In summary, these perspectives accentuate that knowledge is constructed and not acquired. Hence, no two individuals will construct identical understanding or knowledge.

Glasersfeld (1995a) is unappeased with the traditional epistemology, that knowledge should represent a real world that exists out there, independent of the knower and that knowledge is considered true only if it reflects the independent world. Glasersfeld (1995a) defines the "meaning of 'to exist' only within the realm of our experiential world and not ontologically" (p. 7). Glasersfeld (1995a) reasons that an ontological world loses its meaning and would not make sense in the construction of knowledge. He draws on Piaget's notion of adaptive activity (i.e. assimilation and accommodation) to showcase the construction of knowledge in an individual. Discussion on adaptive activity will be included later in the literature review.

Poerksen (2004), in relating to Piaget's theory and knowledge construction declares, "the acquisition of knowledge no longer appears to be a passive reception of information but a creative activity. The outcome is that teaching someone will only be successful if it is oriented towards the reality of that someone" (Poerksen, 2004, p. 26) . Hence, the credo, "(k)nowledge is seen as something dependent on the learner" (Proulx, 2006, p. 2).

Knowledge and knowing, to Glasersfeld (1995b), are based on the assumption that the learner has to use her or his own experience to

construct knowledge of the subject. Glasersfeld (1990) drawing on Piaget's work states that "knowledge is not a picture of the real world" (p. 14). The positivist's view spells out that knowledge represents a real world that is independent of the knower and, that knowledge should reflect the independent world. In contrast, Glasersfeld (2001) asserts that language ceases to be a means of conveying concepts to learners when it is clear that learners construe knowledge based on their understanding through their own reflection.

Glasersfeld (2001) cites Ferdinand de Saussure's fundamental insight that "words do not refer to things of a real world, but to concepts in the heads of those who use language" (p. 3). However, as Glasersfeld (2001) states, people do cling to the "tacit assumption that words refer to things, conditions, and events that are fundamentally unquestionable because they exist in a world that is independent of any experiencer" (Glasersfeld, 2001, p. 3).

It is pertinent for us to understand how Davis and Sumara (2002, 2003) differentiate the terms 'to construct' and 'to construe.' The authors express that the term 'to construct' has a connotation of a building project, a structure or scaffold – a physical and manual construction in the architectural sense. On the other hand, the term 'to construe' refers to an ecosystem. 'To construe' has the attributes, as Davis and Sumara (2003) explain, of a biological sense of an ecosystem which is impermanent, ever-evolving, and in a continuous process of re-organising instead of having a pre-determined state. The term 'to construe' identifies closer with the constructivist epistemology than the term 'to construct.' I will, hence, use the term 'to construe' where appropriate in my research writing as it connotes constructivist epistemology clearly.

McCarty and Schwandt (2000) explain that radical constructivists prefer the verb 'knowing' rather than the noun 'knowledge' in explaining their views on learning. The authors further elaborate that; " 'to know' is not

to possess true ‘representations’ of reality, but rather to possess ways and means of acting and thinking that allows one to attain the goals one happens to have chosen” (McCarty & Schwandt, 2000, p. 45).

To Proulx (2006), “(k)nowledge is an ever-evolving process” (p. 6). Constructivists see knowledge this way and hence drop the traditionalist notion of knowledge being somewhat fixed. Glasersfeld’s (1995b) choice of referencing his ideas of knowledge, as a theory of knowing rather than a theory of knowledge explicates this notion. The connotation of knowledge evolving in the mind of the person resonates with constructivism. As McCarty and Schwandt (2000) succinctly state, knowledge extends no further than the edge of the individual mind.

However, there is criticism of this view of construing knowledge. McCarty and Schwandt (2000), critique Glasersfeld’s claim of knowledge being local i.e. “holding good only within the limits of the individual constructing mind” (p. 73). These authors claim that Glasersfeld would accept the slogan “So you say! What you construct as knowledge may be viable or felicitous for you, but has no *prima facie* claim to validity for me” (McCarty & Schwandt, 2000, p. 73). *Prima* facie implies that “unless good evidence is brought forward that would cause relevant persons to call the claim into question” (McCarty & Schwandt, 2000, p. 74) it has no relevance to them and as such, all claims can be seen to be acceptable. These authors deride Glasersfeld’s account of knowledge as epistemic relativism where two ideas may be possible amongst two contrasting minds.

McCarty and Schwandt (2000) find it tough to appreciate the fact that knowledge is localised. As they state,

> (t)he *prima facie* binding power of a knowledge claim over those who did not originate the claim or who are not in a position to construct it for themselves, is unintelligible within the constructivistic worldview where the power of knowledge is always local. (McCarty & Schwandt, 2000, p. 74)

McCarty and Schwandt (2000) seem uneasy that in the "claims to knowledge, there is no implicit assumption at work that the knowledge in question pertains to objective or extramental situations" (p. 74).

McCarty and Schwandt (2000) firmly stick to their perspective on knowledge having universal attributes rather than the claim by constructivists that the individual constructs knowledge. The draw of 'objective', external reality seems to be camouflaging these authors' understanding of the constructivist epistemology.

However, constructivist concerns are very different. Students who were able to provide 'right' answers on standardised assessment that require application of formulas were however, unable to showcase conceptual understanding. This was visible in subjects such as mathematics and science (Driver, 1995; Wood, Cobb, & Yackel, 1995). The situation is similar at the polytechnic where I teach. Students, who do well in examinations, sometime struggle to apply the same knowledge to real-life situations. Glasersfeld (1995a) argues that it was this growing awareness about the need for conceptual development that the constructivist epistemology was addressing. Glasersfeld (1995a) continues that "(t)hese are questions about knowledge – questions that concern its structure as well as its acquisition" (p. 5) that constructivist epistemology distinctly answers.

Phillips (1995) accuses Glasersfeld of paying "scant attention to the social processes in knowledge construction" (p. 8). However, Glasersfeld (1995a) does not ignore the social processes but rather views it as part of the individual's construction of knowledge. Glasersfeld (1995a) explains this as follows:

> you construct 'others' out of elements of yourself, and soon these others contribute to the image of your self. … we must generate an explanation of how 'others' and the 'society' in which we find ourselves living can be conceptually constructed on the basis of our subjective experience. (p. 8)

Cogito ergo sum

Drawing on Descartes famous phrase '*cogito ergo sum*' – 'I think, therefore I am' (cited in Phillips, 2000, p. vii), Phillips (2000) challenges the traditionally held view that knowledge is out there. Phillips (2000), accentuates that "knowledge can be produced by the rational individual thinking alone" (Phillips, 2000, p. vii). Glasersfeld (2001) cites 18th century philosopher, Giambattista Vico's statement that only "God knows the world, because He created it, human beings can know only what they themselves have made" (p. 4) as the first manifesto of constructivism. On the other hand, the wider scientific community has perpetuated the notion that there is a stable, external reality, out there. In refuting this notion, Glasersfeld (2001) cites Albert Einstein, a 'giant' and stalwart of the positivist community to reinforce his point. Einstein and Infeld (1950) (cited in Glasersfeld, 2001) state that physical concepts are not determined by external 'reality' and that

> (p)hysical concepts are free creations of the human mind, and are not, however it may seem, uniquely determined by the external world. (Glasersfeld, 2001, p. 5)

This statement by Einstein reverberates the uncertainty of an external reality, which is central to the positivist community's epistemology.

To the constructivists, the construction of a concept involves reflection. Reflection shows the connection between the various parts in the construction of a concept. Piaget (1952) attributes this to coordination, in stating that "(e)very schema is thus coordinated with all the other schemata and itself constitutes a totality with differentiated parts" (p. 7). Glasersfeld (1995b) attributes this to the process of the mind and maintains that these concepts, over time, turn to habits and are carried out without conscious awareness. As Pelech and Pieper (2010) remark, "knowledge … is not a single entry; rather it is a network of connections" (p. 38).

This is congruent with the idea that knowledge is construed in the mind of the learner (Bodner, 1986; Glasersfeld, 1995a). Glasersfeld (1995a)

goes further to state that the construction of knowledge is a “link to reality and is opposed to a ‘match’ of knowledge to reality” (Bodner, 1986, p. 4). Succinctly, as Wheatley (1991) states, constructivists are not keen on claiming the truth but rather on nurturing the means of learners to construct viable explanations (i.e. knowing) of their learning through experiences.

Viability

In managing the match of knowledge to reality and its implication to the concept of ‘truth’, Glasersfeld (1981) introduces the concept of ‘viability.’ Poerksen (2004) states in an interview that Glasersfeld

> replaced the classical realist concept of truth by the idea of viability: theories need not and do not correspond with what is real, he says, but they must be practicable and useful, they must be viable. (Poerksen, 2004, pp. 25-26)

Glasersfeld, in the same interview, links the concept of viability to Piaget’s notion of adaptation. Glasersfeld (cited in Poerksen, 2004) explains:

> I have taken the concept of viability, which is closely related to the concept of adaptation, from the theory of evolution. It replaces, in the world of experience, the classical philosophical notion of truth, which assumes an exact representation of reality. An organism is viable, my definition would be, if it manages to survive under given constraints and environmental conditions. And I call modes of action and thought useful or viable if they help to achieve a desired goal by overcoming all given obstacles. The assessment of the viability of a construction is, however, dependent on one’s values. It contains a subjective element and requires a personal judgement. The choice of values, any ethical choice, cannot be justified by constructivism: we deal with decisions and rules that are not questionable. (pp. 30-31)

By substituting viability for truth, constructivism does not discount the need for certainties, regularities and an ordered world of existence. However, Glasersfeld (cited in Poerksen, 2004) warns that the “mistake is to consider such regularities as truths and to equate them with the understanding and the comprehension of the ontic world” (p. 34).

Poerksen (2004) terms such day-to-day certainties and regularities as ‘pious hope.’ He poses a question to Glasersfeld about how radical constructivists rationalise routine daily occurrences and assumptions though these are not absolute knowledge. Glasersfeld (cited in Poerksen, 2004) clarifies as follows:

> as far as everyday life is concerned, it is undoubtedly an advantage to be able to rely on assumed regularities and long-established arrangements. It is not as if I would open the door of my house to check whether the balcony is still there before I step out. I simply take for granted that it has not vanished, I open the door and step out without hesitation. It has worked all right so far – but it is not absolute knowledge. (pp. 34-35)

Hence, a doubt levied on Glasersfeld’s concept of viability, is that it is not necessary for the construction of knowledge to be true. McCarty and Schwandt (2000) argue that a viable solution that students derive need not be true and hence, this weakens the radical constructivist position. Phillips (2000) concurs with the criticism on viability and states that constructivist ideas “entrap individuals in worlds of their own making, which leaves little room for the influence of parents, teachers, and peers (who are part of the world that the individual knower has personally constructed)” (p. 18)**.** As Jon A. Scaife (personal communication, August 28, 2016) states, “a constructivist would reply that nobody can know the truth in a correspondent sense and so any requirement to be ‘true’ can never be verified.

Glasersfeld (1995a) disagrees with this criticism. He instead advocates that teachers should nurture students to construe viable conceptualisation of the subject being learned. He emphasises the teachers’ role in eliciting an explanation or a hypothesis of how the learners arrive at such a viable mode. The need for learners to be able to construct their knowledge and articulate it coherently based on their own value system would suffice for the concept of viability (Glasersfeld, 1995a).

Piaget's Concept of Equilibrium & Learning

Another concept in learning according to constructivists is that of equilibrium. Piaget (1952) introduced this concept and states that disequilibrium prompts the learner to learn. When a learner is faced with a contradictory or incoherent experience, disequilibrium occurs. Disequilibrium is hence, a misfit between what the individual expects and what they actually experience. The need to equilibrate the experience drives learning. Confrey (1999) elaborates that:

> perturbations play a very significant role in learning and knowledge construction. A perturbation is experienced when one encounters an event or set of events that do not seem to be accounted for by one's theory, yet seem very significant to understanding the phenomena at hand… it is often through struggling to resolve the disequilibrium caused by perturbations that one comes to a resolution that deepens and revises one's world-view. (p. 10)

The process of establishing equilibrium is through assimilation and accommodation. Piaget introduces these two concepts as they naturally flow from the process of equilibrium. Glasersfeld (1990) describes assimilation through an example:

> (t)he living creature, be it fish, fowl, or human, thrives by abstracting regularities and rules from experiences that enable it to avoid disagreeable situations and, to some extent, to generate agreeable ones. This 'abstracting of regularities' is always the result of assimilation. (p. 24)

Previous experiences are used as filters for current experiences. This drives the constructivist pedagogy to be based on learners' experience. The need to facilitate learning starting from a learner's current active knowledge is fundamental to constructivist pedagogy.

Accommodation according to Glasersfeld (1990):

> …takes place when a scheme does not lead to the expected result. This produces a perturbation, and the perturbation may lead either to a modification of the pattern that was abstracted as the 'triggering situation' or to a modification of the action. (p. 24)

Glasersfeld (1990) views Piaget's notion of assimilation and accommodation as forces that are constantly neutralising each other.

Piaget's (1952) concept of equilibrium is, hence, the end goal for radical constructivists on cognition. The role of equilibrium in constructivist pedagogy will be discussed next.

Constructivist Pedagogy

Dewey, as cited in Phillips (2000), classifies knowledge gained from rote learning or acquired passively as 'cold storage knowledge'. Glasersfeld (1995a) finds passive learning unacceptable. McCarty and Schwandt (2000) concur with Phillips (2000), that learners are "intrinsically motivated to learn … (as) they wish to make sense of their context through a constructive process" (p. 68).

Constructivist pedagogy, as Richardson (2003) envisages,

> is thought of as the creation of classroom environments, activities, and methods that are grounded in a constructivist theory of learning, with goals that focus on individual students developing deep understandings in the subject matter of interest and habits of mind that aid in future learning. (p. 1627)

The constructivist pedagogy's focus shifts as Richardson (2003) states, away "from considerations of how individual students learn to ways of facilitating that learning" (p. 1625). Richardson (2003) explicates five characteristics of constructivist pedagogy from research done into constructivist pedagogical practices. These five characteristics are as follows:

1. attention to the individual and respect for students' background and developing understandings of and beliefs about elements of the domain (this could also be described as student-centered);
2. facilitation of group dialogue that explores an element of the domain with the purpose of leading to the creation and shared understanding of a topic;
3. planned and often unplanned introduction of formal domain knowledge into the conversation through direct instruction, reference to text, exploration of a Web site, or some other means.
4. provision of opportunities for students to determine, challenge, change or add to existing beliefs and

understandings through engagement in tasks that are structured for this purpose; and
5. development of students' metawareness of their own understandings and learning processes. (p. 1626)

These characteristics are distinctively different from the behavioural notion of knowledge transfer through repeated reinforcement. The behaviourists expounded on a learning theory based on the 'law of effect' that expounds from experimentation with animals and applied to humans, that what needs to be repeated (i.e. assumed to have been learned) can be achieved through reinforcement (Glasersfeld, 1995a). Rote learning and memorisation are entrenched in the behavioural pedagogy.

As Glasersfeld (1995a) informs, constructivism does not rule out memorization and rote learning in constructivist pedagogy. The caveat is that, learners may use such methods in their learning once they have constructed their own understanding of the knowledge they seek. This leads the discussion to what is learning within a constructivist perspective.

Learning

The constructivist definition of learning differs from that of a traditional perspective. The traditional definition of learning, as expressed by Proulx (2006), is a "process of accumulating the knowledge … that grasp(s) and stores knowledge in the person's head" (Proulx, 2006, p. 6). This is similar to Kirschner's (2006) definition of learning "as a change in long-term memory" (p. 75). To a constructivist, learning as defined by Proulx (2006), is a dynamic process, "as the *in-action* capacity to continuously, recursively, and coherently maintain one's coherence" (p. 6). Scaife (2007) has a more elegant definition stating, "learning to be a process of change of knowledge" (p. 96). Knowledge and learning to constructivists are "inextricably intertwined" (Proulx, 2006, p. 6).

The focus of constructivist pedagogy, from Howe and Berv's (2000) perspective, would be nurturing these attributes (knowledge, attitude and interest) to enable learners to construe their own understanding as part of their learning (Howe & Berv, 2000). Scaife (2007) adds another attribute to the constructivist learning process i.e. learner's learning skill. A learner's learning skill acts as leverage in the construction of new knowledge from their current experiences and knowledge. Glasersfeld (1995a) ventures further in internalising the process of learning to the learner. He explains learning from a radical constructivist perspective as follows:

> (i)t requires self-regulation and the building of conceptual structures through reflection and abstraction. (Glasersfeld, 1995a, p. 14)

The focus in learning is not to look for the right answer but to learn how to solve problems that the learner will face in future. Learning, is hence, an internalised process of change upon one's existing knowledge, through the attributes of experience, new knowledge, attitude, interest and learner's learning skill.

Teacher's role and challenge

Glasersfeld (1995a) in discussing students' learning in the classroom draws a link to the teacher's role in the process. He states that teachers will have to first "elicit an explanation or generate a hypothesis as to how the student has arrived at the answer" (Glasersfeld, 1995a, p. 15). Only upon such a process can the teacher facilitate students' constructing their own conceptual structures. This discounts the purely didactic instructional techniques from the constructivist pedagogy. As discussed before, didactic techniques can be incorporated in a constructivist classroom where the situation is appropriate (for example, teaching about safety issues).

Dewey (1938) lays out the role of teachers and his thoughts clearly resonate with constructivist-oriented teaching. He states that:

> it is part of the educator's responsibility to see equally to two things: First, that the problem grows out of the conditions of the experience being had in the present, and that it is within the range of the capacity of students; and secondly, that it is such that it arouses in the learner an active quest for information and for production of new ideas. The new facts and new ideas thus obtained become the ground for further experiences in which new problems are presented. The process is a continuous spiral. (p. 79)

Educators in a constructivist learning environment, as Howe and Berv (2000) emphasise, should have the means "to effectively deal with uncertainty and … controversy" (p. 38) and judge how to appropriately use these situations as means of their teaching techniques.

Glasersfeld (1995b) is dismayed with teachers of the non-constructivist orientation, for creating a crisis in teaching by adopting a stance of claiming to provide value-free objective knowledge to learners. To justify this, they adopt what Freire (1970) describes as the 'banking method of teaching', i.e. didactic teaching techniques for their classes, in the belief of putting forth value-free objective knowledge to their learners. This perspective is congruent with the positivist epistemology.

Howe and Berv (2000) specify constructivist-oriented teaching through the attributes of knowledge, attitude and interest, which are embodied in the two components of learning:

> 1. instruction must take as its starting point the knowledge, attitudes, and interests students bring to the learning situation, and
>
> 2. instruction must be designed so as to provide experiences that effectively interact with these characteristics of students so that they may *construct* their own understanding. (Howe & Berv, 2000, p. 31)

On the other hand, Kirschner (2009) criticises the role of teachers in the constructivist-oriented environment, of adopting inauthentic practices in their pedagogy. According to Kirschner (2009) :

> (i)t is the teacher's job to teach science, teach about science, and teach how to do science. It is not the teacher's job to

> practice science as part of the teaching exercise; leave that to the scientists. (p. 152)

Using the case of a science subject, Kirschner (2009) accentuates the learners' lack of knowledge and experience as a major hindrance to the constructivist-oriented teaching. Kirschner (2009) highlights a fundamental difference between pedagogy and epistemology in stating that:

> the choice of a pedagogy can and possibly must be 'informed' by the epistemology that the learner should acquire, but is not the same as making use of that epistemology as a pedagogy. (p. 153)

Kirschner (2009) continues that such an assumption has caused much confusion across the spectrum of educators from curriculum developers to instructional designers and teachers. Kirschner (2009), I think, refuses to accept the fact that teachers can facilitate students to construct their own knowledge. It seems, in his argument, the role of teacher is to metaphorically 'pour' knowledge into the heads of the learner.

Kirschner (2009) highlights four main differences between experts and novices, from the six identified by Donovan, Bransford, and Pellegrino (1999), in support of his criticism, as:

1. experts attend to and notice more important features or meaningful patterns of information in a problem or a situation than novice
2. experts have a great deal of accessible content knowledge organized to reflect deep understanding of the subject matter.
3. expert knowledge is not simply reducible to sets of isolated facts or propositions, but reflects 'contexts of applicability' of that knowledge
4. experts retrieve important aspects of their knowledge with little effort, whereas novices spend a great deal of effort attempting to remember and process individual knowledge elements. (Kirschner, 2009, pp. 147-148)

Experts' skills mastery in spotting patterns, organising knowledge, contextualising the knowledge, and affordance of knowledge usage are attributes that differentiate them from novices. Kirschner (2009)

emphasises the need for experience to be gained before learners are placed into situations where experts practice. This viewpoint clearly shows the differing epistemological position on learning. Constructivists believe that learners use prior experiences to construct knowledge. Kirschner (2009) argues that the lack of knowledge and experience are reasons why learners cannot learn the constructivist way.

Interestingly, both the constructivist (i.e. Glasersfeld) and the critic (i.e. Kirschner) use Piaget's concept of assimilation and accommodation to support their arguments. Glasersfeld's ideas on Piaget's concept of equilibrium, assimilation and accommodation were discussed before. Kirschner (2009) picks Piaget's mention of children or adolescents as 'miniature adults' to support his argument. He iterates Piaget's concept that:

> development of intelligence, is based upon assimilation of newly experienced phenomena in already existing cognitive schemata and accommodation of those schemata in cases where the new information does not match the existing schemata. (Kirschner, 2009, pp. 145-146)

Kirschner (2009) elaborates, that according to Piaget, children's development goes through a series of 'cognitive stages' characterised by a cognitive structure that impacts thinking. Each stage showcases how children understand reality and Kirschner (2009) highlights that all of the stages except the final stage provide an inadequate approximation of reality. Learners, claims Kirschner (2009), see and interpret the world differently and are not "capable of carrying out the abstract cognitive transformation necessary for 'true' knowledge construction" (p. 146). Hence, Kirschner (2009) argues that learners will not be able to learn through authentic experiences.

However, I would state, experts were learners at some point of time as well. A balanced critique would investigate how experts gained the experience and whether that process is congruent to the constructivist notion of learning and teaching. Kirschner's (2009) criticism of learners' being unable to interpret 'reality' devalues the constructivist

epistemology of building on one's prior experience. Constructivist teachers are not expecting learners to behave as experts. Rather, learners are asked to conceptualise and work on issues from their own experiences and raise issues that would facilitate the construction of their own conceptualisation. The role of experience in learning is raised and discussed next.

Role of Experience in Learning

Billett (2015) emphasises the role of experience in education. In writing about practice-based learning, Billett (2015) states that the "project of education is essentially about provision of experiences from which students are intended to learn particular kinds of outcomes (i.e. knowledge)" (p. 1). This differs from Kirschner's view of experience in reference to learning science. Dewey (1938) clearly states that "experience and education cannot be directly equated to each other" (p. 25). The construction of knowledge through conceptualisation has to occur within the learner. This will require reflection. Boud, et al., (1985), in narrating the process of reflection in learning, highlights the role of experience to the process. The authors state that,

> (o)ne of the most useful activities that can initiate a period of reflection is recollecting what has taken place and replaying the experience on the mind's eye, to observe the event as it has happened and to notice exactly what occurred and one's reactions to it in all its elements. (Boud, et al., 1985, p. 27)

Glasersfeld (1995a) clearly answers Kirschner's (2009; 2006) criticism of the constructivist link between experience and learning, in stating that learning "requires self-regulation and the building of conceptual structures through reflection and abstraction" (Glasersfeld, 1995a, p. 14). The traditional transfer model, teaching through repeated reinforcement, cannot guarantee learning or understanding. In his interview with Poerksen (2004), Glasersfeld states that "language cannot be used to transfer conceptual content; all conceptual content must be constructed by the students themselves" (p. 41).

In discussing the concept of experience, Glasersfeld and Ackermann (2011) draw attention to two attributes of experience in their definition. Firstly, experience is what "was actually lived through, and left an impression" (p. 194). Experience also has a 'know-how' attribute that normally takes time to acquire, usually through a series of practices or doing the task. Experience hence, has components of lived and 'know-how' reflected in the task.

Glasersfeld (1995c), using the example of how an infant would not be able to grasp an object unless it is brought to touch the infant's finger, elaborates that some movements and skills are challenging to impart to learners without proper scaffolding and opportunities provided to the learner. Glasersfeld (1995c) explains this as:

> (t)he sequence of sensorimotor elements the infant must coordinate to form a more or less smooth, guided movement cannot be taught. Such coordination can only be facilitated by the guiding adult providing opportunities for the right elements to happen at the right moment. (p. 372)

The above discussion highlights Kirschner's shortcoming in stating that learners be only exposed to expert's domain upon gaining sufficient experience. However, constructivists believe in constructing knowledge via learners' prior experiences. The experience learners have is the start point for constructivist-oriented teaching. Kirschner doesn't accept this point.

In consolidating the discussions on learning, teachers' roles, challenges and experience, the next section will focus on how these will facilitate learning in a constructivist-oriented environment.

Facilitating Learning in a Constructivist Environment

Learning and teaching are distinctive processes. Glasersfeld (cited in Poerksen, 2004) also argues that facilitation of learning for teachers starts from deducing the learner's current understanding and then planning the learning process from there. Glasersfeld (cited in

Poerksen, 2004) continues that utterances from students, which may be incomprehensible to teachers, cannot be dismissed. Teachers will have to seek insights into why students are making such utterances and find means to facilitate students' construction of knowledge. Glasersfeld emphasises this in his interview with Poerksen (2004):

> Most children's utterances are not at all meaningless – they are only incomprehensible to us adults, at first. We must ask ourselves: Why is this or that utterance meaningful for the child? How is that possible? – The 'mistakes' of students are, therefore, of enormous importance: they provide insights into their thinking, and they offer decisive hints for the creation of new situations in which the faulty solutions and methods of the children will no longer work. (p. 42)

Glasersfeld (cited in Poerksen, 2004) links this process of teaching to Piaget's notion of accommodation. When learners are faced with a situation where "one's actions do not match one's expectations, then learning can begin" (cited in Poerksen, 2004, p. 42).

The resource required and involvement of teachers in this process is huge. Teachers will have to be patient and as Glasersfeld (cited in Poerksen, 2004) notes, "(n)aturally, adapting to constructivistically inspired teaching will cost time, but applying these considerations continually will often produce something astonishing" (p. 43).

Positive evidence is also now available on constructivist pedagogy success in mathematics education (Wood, et al., 1995). The study results show that over time, students acquire the skills of how to learn and can readily use these skills in learning across all other domains of their life. Poerksen (2004) notes that in these contexts (i.e. not in all contexts) the "whole attitude towards school and the taught subjects has changed" (p. 43) as a consequence.

The role of teachers has, hence, shifted from that of an omniscient presence in the classroom to facilitating learning. Teachers, states Poerksen (2004),

> no longer base their authority on the quantity of apparently objective knowledge but on their capability and experience in solving problems together with their students. (p. 44)

McCarty and Schwandt (2000) task a constructivist teacher with creating a learning environment that will provoke students' mental constructive processes, which will showcase to the teacher the student's viable solutions. Radical constructivist demands on the teacher are even higher, requiring teachers to create a picture of each student's mental constructions. To facilitate this process, a conducive and nurturing learning environment has to be created.

However, McCarty and Schwandt (2000) are sceptical of the constructivist ideal of teaching abstract concepts. They argue that learners would not be able to abstract a concept if they were not taught about it. Construing abstract concepts requires knowledge but to McCarty and Schwandt (2000), the process "remains wholly unclear how a teacher is to convey to students on the basis of their previous experiences" (p. 53).

This criticism overlooks the fact that constructivists do not rule out didactic teaching. A lecture or a knowledge discourse is always possible in a constructivist classroom. However, doing so within a framework of building on the prior knowledge of learners would be a prerequisite. A basic tenet of constructivism is that teachers plan their activities and teaching based on the learner's prior knowledge. This is the impetus of constructing all learning activities. The process of knowledge discourse can be done as long as it is congruent to the needs of the learner.

Proulx (2006) asserts that constructivism is "a theory of learning and not a theory of teaching or pedagogy" (p. 7). The association of teaching and pedagogy to constructivism, claims Proulx (2006), has created problematic terms like 'constructivist teaching.' Towers and Davis (2002) concur that constructivism does not prescribe specific teaching

approaches for education. The innovative nature of how an educator uses existing or invents new pedagogic approaches to facilitate the construction of knowledge in their learning space is left to their imagination and innovativeness. Hence, learning in a constructivist-oriented environment can be done with the assistance of a variety of teaching tools, techniques and methods. To Proulx (2006) constructivism is a “proscriptive discourse, and not a prescriptive one” (p. 8).

Proulx (2006) in discussing constructivist practices explains the role of mistakes made by learners in learning. Proulx (2006) claims that “(m)istakes inform the learning process enormously and enable a better understanding of the domain or concepts worked on” (p. 10). In the same way, learners’ mistakes are not failures but rather impetus on what to seek or the misalignment of conceptual knowledge in the learner. Mistakes will have to be part of the knowledge construction process in all learning.

Teachers’ focus on lesson preparation should be directed on “how can this be learned” (Proulx, 2006). This would shift teachers’ paradigm of thinking towards a learning orientation rather than a teaching orientation. This will require teachers to construe activities, problems, situations, cases, and questions in accordance with the experience of the learner.

Constructivist Educational Principles

In wrapping up the discussion on constructivist education, and to the complaint that constructivist perspectives lack sufficient guidelines for pedagogical instructions, techniques and strategies (McCarty & Schwandt, 2000; Phillips, 2000; Tobias & Duffy, 2009), this section will briefly review principles of constructivism in education. Over time, authors (Brooks, 1990; Cunningham, Duffy, & Knuth, 1993; Ernest, 1995; Fosnot, 1996; Glasersfeld, 2001; Hein, 1991; Honebein, 1996;

Olsen, 1999; Pelech & Pieper, 2010; Phye, 1997; Wilson & Cole, 1991) have been proposing principles of constructivism for learning.

A listing of these principles is found in Appendix 2. One particular list that encompasses the essence of constructivist epistemology and encapsulates the essence of most principles is by Glasersfeld (2001). Constructivism, according to Glasersfeld (1995a), has not produced a new innovative sphere for education. As he explains,

> (c)onstructivism does not claim to have made earth-shaking inventions in the area of education; it merely claims to provide a solid conceptual basis for some of the things that, until now, inspired teachers had to do without theoretical foundation. (Glasersfeld, 1995a, p. 15)

Glasersfeld (2001) emphasises five principles for teachers engaged in constructivist teaching and I think these principles apply to constructivist-learning environment as well. The principles are:

1. "Teaching does not begin with the presentation of sacred truths, but with creating opportunities to trigger the students' own thinking. One of the prerequisites… the teacher believes that students can think" (Glasersfeld, 2001, p. 10)

2. Teachers need to be familiar with subject matter as well as have a "repertoire of didactic situations" (Glasersfeld, 2001, p. 10)to facilitate learners to build concepts in class through spontaneous interest.

3. Teachers are misguided if they declare work done by students to be wrong. Students' effort must be acknowledged and effort must be made by the teacher to understand where in the thinking process the student been unable to comprehend the concept or solution effectively.

4. Teachers must have an "inkling of the students' present ideas and theories" (Glasersfeld, 2001, p. 11) to facilitate students' thinking and construction of knowledge or concept.

5. The "formation of concepts requires reflection, teachers must have available some means to provoke it" (Glasersfeld, 2001, p. 11). The easiest way is to get students to talk about what they are thinking.

Table 5.1 summarises various authors' principles of constructivism and their resemblances with Glasersfeld's (2001) listing. The process of applying notations in comparison is adapted from Olsen (1999). The notations D, I and N refers to:

D - direct indication in Glasersfeld's (2001) listing

I - inference in Glasersfeld's (2001) listing

N - not indicated in Glasersfeld's (2001) listing

Glasersfeld's (2001) list of constructivist principles has 40 direct indications and 15 inference (out of a possible 60) in comparison with the other listings of constructivist principles as reflected in Table 5.1.

Authors / Glasersfeld's (2001) five principles (p. 29-30).	Pelech & Pieper (2010, pp. 32-41)	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
"Teaching does not begin with the sacred truths," but creating opportunities for students' own thinking … "the teacher believes that students can think"	**I**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**I**	**I**	**D**	**I**
Facilitate learners to build concepts in class through spontaneous interest	**I**	**D**	**I**	**D**	**D**	**I**	**D**	**D**	**N**	**I**	**I**	**N**
Students' effort must be acknowledged and effort made to understand student's comprehension to guide them further	**I**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**I**	**N**	**D**	**D**
"Inkling of the students' present ideas and theories" to facilitate students' thinking and construction of knowledge	**D**	**D**	**I**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**I**
"Formation of concepts requires reflection," teachers must provoke students to talk about what they are thinking	**D**	**D**	**N**	**D**	**I**	**N**	**I**	**D**	**D**	**D**	**D**	**D**

Table 5.1 Comparison of Constructivist Principles

Legend
D - Directly indicated
I - Inferred
N - No indication

There are also misnomers about constructivist-oriented teaching. Proulx (2006) identifies five such 'taboos of teaching' i.e. actions perceived unsuitable for constructivist-oriented teaching from preconceived understanding. These five taboos provide a good contrast to the principles listed above. It also highlights the practical difficulties faced in implementing constructivist strategies at academic institutions like a polytechnic. The practical difficulties at the polytechnic are sometimes created by the over simplification of what constructivist classroom entails. Not understanding the constructivist epistemology and its application to the teaching process causes these challenges. These myths are:

1. **'Don't tell' practice**.' As Davis and Sumara (2002) explain, teachers should avoid telling students or giving direct instructions as it contravenes constructivist principles. Teachers see such direct instructions as violation of the constructivist process of construing knowledge and as an imposition of the teachers' views on learners. Proulx (2006) clarifies that "constructivism is not saying that teachers should not explain, it only renders problematic the assumption that by 'telling' or explaining the learners will automatically understand" (p. 9).

2. '**Learner cannot be wrong'** since knowledge is subjective. This stems from the relativist principle of constructivism. Proulx (2006) clarifies, "learners are not free to create anything, the assertiveness of any claim has to be shown compatible with the situation and 'experience lived' to be considered viable. Knowledge has to fit with/in the domain in which it was construed" (p. 9).

3. **Teaching is helpless**. This is an outcome of the first two taboos listed above, one that renders teaching helpless, as learners will develop their own knowledge. This links to the nativist principle of thinking - that each individual is born with an innate knowledge – and education is a process of drawing this out – and hence it is not constructivist in any regards. The constructivism position would be that individuals construe knowledge based on their existing experiences, "(l)earning is then not a process of drawing out, but of actively construing" (Proulx, 2006, p. 9).

4. **Exhaustion by repeated questioning**. This is highlighted by Bauersfeld (1994) on the assumption of not telling the learners what they can find on their own accord.

Constructivists do not argue against linear instructions, or telling learners what to do. Constructivists, however, do not assume that such instruction will be understood or learned.

5. The fifth taboo relates to interpretation of terms like ‘to construct’ and ‘active student’ – usually linked to the idea of physical activity with objects or artefacts. This is similar to linking the term ‘to construct’ with building something (architectural). In constructivist pedagogy, ‘to construct’ would refer to nurturing knowledge construing skills through reflection, analysis, questioning and working through problems.

These myths, give a clear demarcation of a framework for constructivist-oriented teaching. Constructivist perspectives cannot be reduced into more discrete parts and listed exhaustively for the purpose of teachers. The framework and a clear understanding of the constructivist epistemology will stand any teacher in good light for constructivist-oriented pedagogy.

Asian Values and Thoughts and Constructivism

As this research is situated in an Asian context, an analysis of Asian values, beliefs in education and their congruence to constructivist epistemology will be discussed next.

As stated in the Stanford Encyclopaedia of Philosophy (Riegel, Summer 2013 Edition), Confucius used a variety of pedagogical methods in his teaching. An illuminating quotation about his teaching is as follows:

> Only for one deeply frustrated over what he does not know will I provide a start; only for one struggling to form his thoughts into words will I provide a beginning. But if I hold up one corner and he cannot respond with the other three I will not repeat myself. (Lunyu 7.8 cited in Riegel, Summer 2013 Edition)

The constructivist teaching principles of facilitating a learner through the process of disequilibrium is evident in this quotation. It is also reported that Confucius does not discourse at length on a subject matter but would rather raise questions, quote passages from the classics and use

analogies as means of teaching his disciples. These techniques resonate with constructivist epistemology.

In addition, McEnroe (2014) cites a conversation between Confucius and his disciple that shows strong constructivist orientation:

> [Confucius] Do you think that my way of acquiring knowledge is simply to study many things and remember them?
>
> The student said; 'Yes, isn't that the case?'
>
> Confucius replied, 'No, I have one principle which I use like a thread, upon which to string them all. (McEnroe, 2014 para 3)

Archie (2013) cites the twin concepts of 'Jen' (wren) and 'Li' (lee) as the basis of Confucianism. Jen and Li as explained by Archie (2013) are:

> Jen - human heartedness; goodness; benevolence, man-to-man-ness; what makes man distinctively human (that which gives human beings their humanity)
> Li - principle of gain, benefit, order, propriety; concrete guide to human action. (Archie, 2013 para 3)

Of the two, Confucius declares Jen as the primary principle in governing a person. Hence, Confucius would be referring to this as the one principle that 'strings' his thoughts together. This would align with the constructivist orientation of individuals constructing their own knowledge from their experiences.

McEnroe (2014) emphasises that, Confucius' advice to teachers was to establish individual student's weakness and strength and educate them accordingly – "(took) the stock of each student, and then encouraged their strengths and improved their weaknesses" (McEnroe, 2014 para 9).

Moving on to the Indian sub-continent, the works of Vivekananda, (who lived between 1893-1902, and is highly reputed as a thinker and a Hindu reformer) is considered. Roy (2001) describes Vivekananda's ideas on the role of education as follows:

> Education is not the amount of information that is put into your brain and runs riot there undigested, all your life. Education for him means that process by which character in formed, strength of mind is increased, and intellect is sharpened, as a result of which one can stand on one's own feet. (2001 para 3)

Citing the Vedantic text, Vivekananda states that "knowledge is inherent in every man's soul" (Roy, 2001 para 6) and uses the word 'knows' to imply the process of 'discovering' what is within. Although the first reading of this idea sound innatist, this is not the intent. The call is for individuals to discover about themselves and this is through individual learning and reflection alone. It is this idea of individuals discovering about themselves that I feel relates to the constructivist epistemology.

Sharma (2013) concludes his discussion on an overview of learning, teaching, and student-teacher relation espoused on Hinduism as follows:

> (w)ithin the seemingly dominant practices of teacher-frontedness, learning by heart, transmission model of education in Hindu ethos of learning and teaching, there indeed were agendas and practices of more student-centered, practice-based, approaches and methods that fostered learning, teaching and autonomy. (pp. 87-88)

The use of teaching techniques such as debates, discussion, questioning discussed by various authors (Ghosh, 2007; Mishra, 1998) provides more support in aligning Hindu-teaching practices to have constructivist orientation.

The methods of learning, Confucius having disciples residing with him (the master), and the Indian gurus and their Gurukulam (living with the preceptor) are quite common in the Asian classics. The teacher in both these traditions showcases virtues and moral principles of life through their own deeds and the disciples see and learn as they reside with their masters. However, the process of learning, portrayed as disciple imitating, repeating and memorising what the masters tell them is not necessarily an appropriate reflection. Gurus and masters in both these traditions build on their learners' knowledge and provide opportunities

for their disciples to experience there learning in life situations. This provides learners with the space and time to self-construct their knowledge.

Principles and virtues of learning advocated by both Confucius and Vivekananda resonate with constructivist epistemology. The Confucian idea of allowing individuals to learn at their own pace and through their own conceptualisation of the learning shows alignment with the constructivist principles of knowledge. Similarly, Vivekananda's notion of individuals discovering their knowledge aligns with the constructivist ideal.

CHAPTER SIX
PEDAGOGY & TEACHING APPROACHES

Introduction

The Oxford English Dictionary (OED) defines pedagogy as the "art, occupation, or practice of teaching" and also as "the theory or principles of education; a method of teaching based on such a theory" (Pedagogy, 2005). Loughran (2013) refers to pedagogy as the art and science of educating learners. As Loughran (2013) and others (Alexander, 2004; Higgs, 2012; Kemmis, 2012; Loughran, 2013) point out, the literature has many varied definitions of pedagogy. For the purpose of this literature review and my research, I will confine the discussion on pedagogy to constructivism and the practice-based education perspectives. As the debate on pedagogy is wide-ranging, it is beyond this literature review chapter to capture the whole breadth discussion on the topic. Besides, my conceptual framework for the research adopts a constructivist perspective and polytechnic education in Singapore is taking on a more practice-based approach. Hence I will focus the discussion on pedagogy to these two areas.

I will discuss some views on the nature of pedagogy, what different definitions of the terms mean and its application for usage in an educational setting, like the Polytechnic. Then, I will review the relationship between pedagogy and teaching by discussing Shulman's (1986) concept of Pedagogical Content Knowledge (PCK), pedagogical characteristics of a constructivist learning environment and Practice-based education (PBE). Here, I provide a definition of pedagogy from the review done. A short exploration of pedagogy in Singapore and polytechnic education in Singapore follows that. I discuss a case example of an existing pedagogical model from within the research site in trying to map the understanding of pedagogy to the Polytechnic context. The literature review concludes with a discussion on how best to manage the term pedagogy and teaching practices for the purpose of understanding polytechnic education in Singapore.

Views on the nature of Pedagogy

Higgs (2012) refers to pedagogy as “a form of social practice that shapes the educational development of individuals, framed around a perspective, model or theory of education that encompasses complex interdependencies between philosophical, political, moral, technical, and practical dimensions” (p. 74). She lists critical, liberal and vocational pedagogical perspectives as examples. Higgs (2012), who has been researching and writing on practice-based education, maintains that the study of pedagogy integrates the domains of practice, curriculum and education. Daniels (2001) on the other hand, draws on cognitive, affective and moral dimensions to define pedagogy as “forms of social practice which shape and form the cognitive, affective and moral development of individuals” (p. 1). Both Daniels (2001) and Higgs (2012) discuss learners' development in their definitions of pedagogy, but the focus of development differs.

The relation between curriculum and pedagogy is another strand in the discussion on the topic. Alexander (2004) describes the European continental view of pedagogy, that excludes Britain, as bringing “together within the one concept [i.e. pedagogy] the act of teaching and the body of knowledge, argument and evidence in which it is embedded and by which particular classroom practices are justified” (p. 10). Alexander (2004) claims that continental debate on pedagogy and education lacks the "rich discourse surrounding the idea of curriculum" (pp. 10-11) found in similar discussions in Britain and United States (US). Alexander (2004) on the other hand, sees curriculum as a domain of pedagogy. He prefers to define pedagogy as "the act of teaching together with its attendant discourse. It is what one needs to know, and the skills one needs to command, in order to make and justify the many different kinds of decisions of which teaching is constituted. Curriculum is just one of its domains, albeit a central one" (p. 11).

Loughran (2013) attempts to summarise the discussion on pedagogy by stating “that pedagogy needs to be conceptualized as rich, complex and sophisticated” (p. 118) rather than merely a synonym for teaching. He continues that, a deeper understanding of pedagogy rests in recognising and appreciating the complexity and intricacies embedded in learning and teaching. Mason (2002, 2009) holds a similar viewpoint in discussing the complexities of teaching. The need for teachers to consider what to teach, how to teach and how learners understand teachers’ actions embodies the complexity involved in pedagogy. Mason (2002) proposes the idea of noticing, which provides teachers with a framework to work on their pedagogy. Noticing, to Mason (2009), entails three things, “being present and sensitive to the moment, having reason to act, and having a different act come to mind” (p. 1). Mason (2002, 2009) suggests that noticing provides teachers with ways of becoming conscious of the interactions between learning and teaching in the classroom and taking action in real time to ensure the intended learning is occurring. These complex activities encapsulate pedagogy. Mason (2009) argues that not only does it encompass the pre and post planning, preparation and processes of teaching but also how it is carried out and the changes that occur while the learning and teaching are on-going. Mason’s idea of noticing seems compatible with a constructivist perspective. His idea of noticing can be seen as a form of diagnostic assessment and the actions taken in response to noticing constitute diagnostic teaching.

Loughran (2013) concurs and argues that teachers and learners are embroiled in these complexities in the learning process. He declares that “(t)here is no one way to teach a subject and no one way that all students learn that subject” (p. 120). Loughran (2013) concludes that these complex processes make teaching problematic. To Loughran (2013), this creates uncertainty to the teaching process and for teachers. These complexities involved in pedagogies are also picked up by Scaife (2007) in his discussion on the radical constructivist perspective of teaching. He states that “at a deep level the learner is

unknowable" (p. 98). As Scaife (2007) elaborates, no one can ascertain another person's knowledge, and this complicates the teaching process. To Scaife (2007), "(t)he task of pedagogy is to help each learner to make the journey from where they start to the intended destination" (pp. 97-98). Although the curriculum determines the destination, the journey of progressing learners from their prior knowledge is complex and entails uncertainties. And, since individual learners' needs are 'unknowable at a deep level', teachers will have to design their pedagogic approaches with uncertainties. Scaife (2007) claims that teaching can continue with such uncertainties just as "physics continues to operate with uncertainty" (p. 98).

Pedagogy, hence, is an integral process of understanding the complexities and uncertainties of learning and teaching and how these processes coexist together. Loughran (2013) mentions that there are other influences on pedagogy. The interaction between teacher and students, student and student, learner and subject matter, and the context of the lesson are some factors that influence the complexity and uncertainty of pedagogy.

Dewey (1929) more specifically draws on the relationship between knowledge and practice in discussing pedagogy development. Dewey (1929) discusses the need for teachers to continually re-examine their practices to bolster a deeper understanding of their pedagogy. As Dewey (1929) states "(e)ach day of teaching ought to enable a teacher to revise and better in some respect the objectives aimed at in previous work" (p. 75). The continuous improvement of teaching practice is part and parcel of pedagogy. Developing such rich understanding of pedagogy has an impact on how teachers synergise content knowledge with pedagogy.

Pedagogical Content Knowledge (PCK)

Pedagogy goes beyond teaching, and as Shulman (1999) emphasises, pedagogy is not content-free. The concept of pedagogical content

knowledge (PCK), introduced by Shulman (1986) argues the case for a close integration between pedagogy and content knowledge. As Shulman (1999) states:

> (t)he concept of pedagogical content knowledge … implied that teaching as 'the transformation of understanding' rested on depth, quality and flexibility of content knowledge and on the capacity to generate powerful representations and reflections on that knowledge. (p. xi)

Content knowledge is the expertise teachers have on a subject matter. Such expertise alone is not sufficient for teaching. In my view, designing the teaching of content knowledge with appropriate teaching approaches that will facilitate learning is PCK. Such teaching approaches should be designed with the learners' needs, learning context and learning environment in mind. The development of PCK is a continuous process. As Loughran (2010) argues, staff will have to work continuously on their PCK for specific areas and keep adding on to their repertoire of teaching approaches. PCK development is hence an on-going task for teachers to add on to their repertoire of teaching techniques on a subject matter.

The integration of subject knowledge and pedagogy is further refined by Gess-Newsome (1999) as various points on a continuum stretching over two end points. At one end of the continuum is an integrated model and at the other end, a transformative model.

Guess-Newsome (1999) explains the integrated model as,

> (w)hen two materials are mixed together, they can form a mixture or a compound. In a mixture, the original elements remain chemically distinct, . . . In contrast . . . (a) compound is a new substance, distinct from its original ingredients, with chemical and physical properties that distinguish it from all other materials. (p. 11)

In the integrated model, the different entities retain their unique characteristics. In a teaching situation, the teacher can draw on various methods of teaching and integrate them into a process that enables learning. The different methods fit together for the intended purpose but

retain their uniqueness.

In the transformative model, as Gess-Newsome (1999) explains, a synergy occurs, and the entities are merged, resulting in a new method. Each entity's characteristics are no longer distinct. The characteristics of the different pedagogies transform to a new entity. Such transformative new pedagogy is meant to enhance students' understanding.

Before moving on to the discussion of constructivist-based pedagogy, it would be pertinent to draw a conclusion on the nature of pedagogy. A focal point in the discussion on nature of pedagogy is the importance given to the process of thinking about teaching. The complexities of teaching and how teachers manage it is reflected in the discussion. In my view, answering the 'how, what and why' questions of teaching would encompass pedagogy.

Constructivist-based Pedagogy

There are major differences between pedagogical practices that are grounded in a transmission approach and those that nurture students' learning through their experiences. Many authors including Loughran (2010, 2013) and Scaife (2012; 2007), argue for teaching to be anchored based on student's prior knowledge and experiences. Learning environments that anchor on learner's experience recognise pedagogy attributes of "intellectual challenge, support for learning, linking and relevance, and sensitivity to diversity" (Loughran, 2010, p. 37). As Loughran (2010) states:

> the way we teach should be a consequence of reflection on the learning possibilities and/or limitations of a particular episode. If that is the case, then the teaching approach we develop is a result of our pedagogical reasoning; that is, a teaching procedure used for a particular reason to achieve a particular purpose in response to the nature of the teaching and learning environment. Approaching teaching in that way is dramatically different from simply trying to implement a fun activity in the classroom in order to ameliorate students' lack of interest in the content of the subject. (p. 37)

Richardson (2003) rationalises the constructivist struggle of creating a pedagogy, as constructivism is a theory of learning and it is difficult to construct a specific theory of practice or pedagogy. Richardson (2003) goes on to define constructivist-based pedagogy as “the creation of classroom environments, activities, and methods that are grounded in a constructivist theory of learning, with goals that focus on individual students developing deep understandings in the subject matter of interest and habits of mind that aid in future learning” (p. 1627). She lists five characteristics of constructivist pedagogy (Table 6.1).

Scaife (2012) also puts forward a convincing argument for a constructivist-based pedagogical approach to teaching at Higher Education. He emphasises the need to cultivate the ‘epistemic hunger’ that is embodied in learners to unearth their intrinsic motivation to learn. Scaife (2012) goes on to list various principles and strategies that the constructivist approach offers in this regard. In an earlier work, Scaife (2007) in discussing initial science teacher education, lists six general pedagogic approaches from a radical constructivist’s perspective. Table 6.1 places both Richardson’s (2003) and Scaife’s (2007) constructivist pedagogical characteristics side by side for the purpose of comparison. There are some common themes in both the lists such as drawing on students’ prior experience, engaging students’ interest in the subject matter and the use of activities to facilitate learners constructing their knowledge. However, each of the lists needs to be understood and applied in its entirety. Hence, deriving standardised pedagogic practices or characteristics of constructivism is difficult. In designing a characteristic listing of constructivist pedagogical approaches for the Polytechnic, consideration is given to the needs of polytechnic education, its mission and its pedagogical approaches and intended outcomes.

Scaife (2007)	Richardson (2003)
• Pairs and small group discussion	• Student-centered lessons
• Predictions – draw on the inborn 'epistemic hunger' to engage and predict	• Learning through group dialogue and shared understanding
• Application of ideas through activity	• Planned and unplanned introduction of knowledge into the discourse through direct instruction, reference to text, website and more
• 'Knowledge from' rather than 'knowledge of' – Exploration rather than reception	• Learner to be challenged on existing knowledge through planned intervention
• Socratic questioning	• Developing learners' metawareness of their own understanding and learning process
• Diagnostic assessment transforms formative assessment	

Table 6.1: Constructivist pedagogic characteristics

It would be significant here to note Richardson's (2003) criticism of constructivist pedagogy, namely,

> that psychological constructivism's roots are western, liberal, and individualistic (Eurocentric), and much of the current approach to constructivist pedagogy, at least in the United States, was developed within privileged classes. It is not clear to me that the less privileged and minority cultures are interested in the strong individualistic approach suggested in current constructivist pedagogical approaches to teaching given the perceived importance of community maintenance and development. (p. 1633)

Singapore's polytechnic education, situated in an Asian cultural setting, may raise some concerns as well. Teachers and students at the Polytechnic may not readily embrace the values and principles underpinning constructivist pedagogy. However, there are other techniques that teachers can embrace to incorporate a constructivist approach in the design of teaching. One such technique is the use of diagnostic assessment and teaching.

Diagnostic Assessment and Teaching

Scaife (2012) integrates diagnostic teaching and assessment to the constructivist approach to teaching. To Scaife (2012) (t)eaching that

acknowledges and responds to ‘where learners are coming from’, namely their current knowledge, understanding and feelings of confidence and motivation, is sometimes called diagnostic teaching (DT)” (p. 97). DT requires diagnostic assessment (DA) to be done before adopting and innovating teaching strategies and practices that the tutor would deem appropriate for a class. Once DA of learners’ needs is done, teachers would be in a better position to design teaching approaches appropriate for the learners. In this regard, teachers need to be clear on the underpinning principles of pedagogy that they are deploying in their lesson. A case in point is the understanding of constructivist principles that underpin the PBL and PBE approaches discussed in the previous chapter (Chapter Four). Teachers’ clarity on the underlying pedagogic principles will bring out the dual constructivist principles (Glasersfeld, 1995b) discussed in the earlier chapters (Chapters Two and Five). The explication of the dual radical constructivist principles, i.e.:

- knowledge is not passively received but built up by the cognizing subject, and (Glasersfeld, 1989b, p. 162)
- the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality. (Glasersfeld, 1995b, p. 18)

will create the ‘first stage’ of clarity required for staff. Teachers will then have to diagnose students’ learning needs (DA discussed above) and think about the design and adoption of teaching approaches accordingly. This will allow for staff to adapt, innovate and make changes to their teaching process. In my experience as a staff developer, such clarity of pedagogy and teaching approaches is lacking at Poly T.

Pedagogies of Practice-based Education (PBE)

Kemmis (2012) enlightens the discussion on pedagogy and practice-based education (PBE) by drawing on the historical role of pedagogy. He relates to historical data (before the medieval era) and states “education was always regarded as a preparation for life, not as a preparation for assessments, examinations and qualifications”

(Kemmis, 2012, p. 81). Hence, to Kemmis (2012), education was always practice-based. Kemmis (2012) maintains that Pedagogy (capital P) is concerned with the 'why' and 'how' of educating children. It is not confined to what happens in the classroom alone. In fact, Kemmis (2012) draws attention to how the teaching process has become the main expression of pedagogy. He argues that "(i)n Anglo-American-Australian usage over the last 50 years or so, curriculum has come to be the field that concerns what should be taught, and pedagogy (with a small p) concerns how things are taught" (p. 83). According to Kemmis (2012), the Europeans' understanding of Pedagogy had always been in encompassing all aspects of education that are in sync with the community and society. He narrates:

> Pedagogy, properly speaking, aims to embrace both normative and technical aspects of education and upbringing, to provide an understanding of the whole enterprise, in all its technical, practical, moral and political complexity. A Pedagogical theory, therefore, is a theory of all that. (Kemmis, 2012, p. 83)

In discussing the topic of pedagogy, Kemmis (2012) also introduces the term praxis, which denotes undertaking action for its inherent goodness. It relates to deliberating on acting rightly with moral, social and political consideration when facing uncertainty. To Kemmis (2012) praxis:

> is part of the self-formation of the one who acts: the person who is doing praxis is doing it because it is good in itself to do it, and because by acting this way the person will be in accordance with the good of the human community – creating the good society by acting for the good of society. (Kemmis, 2012, p. 87)

Within an educational and practice-based setting, the attribute of praxis instils the continuous development of knowledge. Pedagogy of practice-based education, hence, is not confined only to the art and activity of teaching. Kemmis (2012), concludes that Pedagogy of practice-based education has 'ancient roots' and that:

> (i)t is an apt Pedagogy for preparing students for the professions because it prepares them for the exercise of the intellectual virtues required for professional practice under the uncertain practical conditions that life throws at us. (Kemmis, 2012, p. 99)

There are new demands on pedagogy for the PBE model. The need to nurture learners for a PBE environment and the nuances of practice within and between professions are just two demands for consideration. The next section will discuss the pedagogy of deliberateness and signature pedagogy before looking at pedagogy in the context of Singapore and polytechnic education.

Pedagogy of Deliberateness

In the context of PBE, Trede and McEwen (2015) discuss the 'pedagogy of deliberateness,' which focuses on preparing professionals with a continuous quest for skills mastery with the aptitude and attitude for it. Trede and McEwen (2015) elaborate on the pedagogy of deliberateness as preparing:

> students before placements for uncertainty and rapid change as well as for diversity of cultural, economic, political and material workplace environments; it would encourage students during placements to develop strategic questioning skills and deliberately position themselves appropriately in the workplace; and after placements it would create communicative spaces to critically reflect on WPL [workplace professional learning] experiences and identify strategies to improve their next placement experiences and emergent professional practices. (p. 29)

Pedagogy of deliberateness focuses on preparing learners for the various workplace and work-based experiences. The intent is to nurture a professional ethos of deliberateness in the continuous quest for skills mastery in the profession. People with this attribute are called Deliberate Professionals (DPs), a term popularised by Trede and McEwen (2013) from Australia.

Educating a DP draws, as Trede and McEwen (2013) state, on "three pedagogical concepts: 1) critical consciousness raising; 2) autonomy and self-directed learning; and 3) critical thinking" (p. 4). Here critical consciousness raising adopts the notion of change where learners have control over their lives. Autonomy and self-directed learning refer to learners' control of their learning. Critical thinking refers to a learner,

“thinking for self and with others, and not allowing others to think for us (i.e. the learners)” (Trede & McEwen, 2013, p. 4). The pedagogy of deliberateness calls for learners to question traditional practices and their intentions, with a view of creating new practices for the future. The pedagogy of deliberateness aims to equip learners with skills for lifelong learning and attributes for continued improvement in their professional development and practice.

Signature Pedagogies

Shulman (2005b) introduces the idea of ‘signature pedagogies’ that “prefigure the cultures of professional work and provide the early socialization into the practices and values of a field” (p. 59). To Shulman (2005b), the way teaching is done will shape the professional behaviour of the learners. Hence, identifying signature pedagogies for the different practices and professions becomes crucial in a PBE context. Shulman (2005a) details distinctive features of signature pedagogies as follows:

- pervasive, routine and habitual
- make students feel deeply engaged
- breed accountability of performance and interaction
- must adapt to changes in the conditions of work and in society and to evolving norms of practice. (pp. 22-23)

Signature pedagogies correlate with the practice-based models, as there are distinctive practices for each profession. It would also be appropriate to learn such practices through signature pedagogies that embody the values and ethos of the practice.

Working Definition of Pedagogy

In the light of the above review I will define pedagogy as a process whereby teachers design their teaching approaches, taking into consideration ‘how, what and why’ questions of education. It should diagnose learner needs to facilitate the learning process to attain the intended learning outcomes. And all of these are done for the inherent goodness of the learners’ future i.e. the praxis principle of pedagogy.

Pedagogy in Singapore

Singapore's educational success, with good TIMSS (Trends in International Mathematics and Science Study) and PISA (Programme for International Student Assessment) rankings, as observed by Dimmock and Goh (2011b) has been primarily achieved through didactic teaching with memorisation, drill and practice and smartness in taking high stake examinations. Dimmock and Goh (2011a) also argue that the educational framework in Singapore is still based on "traditional post-industrial pedagogy, a curriculum that emphasises, traditionally regarded high stake subjects, such as maths, science and English, and high stakes summative testing" (p. 216).

The TSLN (Thinking School Learning Nation) initiative introduced in 1997, as Luke (2005) remarks, was the first concerted move in directing pedagogy within schools to be student-centered encompassing active learning strategies in cultivating autonomous and independent learners. Gopinathan (2015) draws on research done by the researchers at the National Institute of Education, Singapore (NIE), where he believes most serious work on pedagogies relating to Singapore is carried out. He highlights that Singapore adopts a distinctive 'hybridic pedagogy' that refers to a weak use of constructivist-based learning principles and the extensive use of strategies in learning factual and procedural knowledge (Gopinathan, 2015). The focus is on curriculum 'coverage' and transmission of factual and procedural knowledge in preparing learners for high stake examinations. Constructivist-oriented initiatives such as TSLN and TLLM are misaligned to the curriculum and pedagogical needs in schools. As Kapur and Huey (2013) elaborate, teachers are at odds in introducing constructivist-oriented teaching when they are tasked to develop students achieving good grades at high stake examination for entry to next level of education. Gopinathan (2015) concludes that the "'hybridic pedagogy' would be unable to produce students with the sort of competencies required by the knowledge economy" (p. 81).

The ‘hybridic pedagogy’ situation discussed by Gopinathan (2015) can be found at the Polytechnic. The next section will discuss a particular pedagogic model used by Poly T as a case example. Following this is a review of pedagogical practice across the polytechnics in Singapore.

Pedagogy at Polytechnics in Singapore

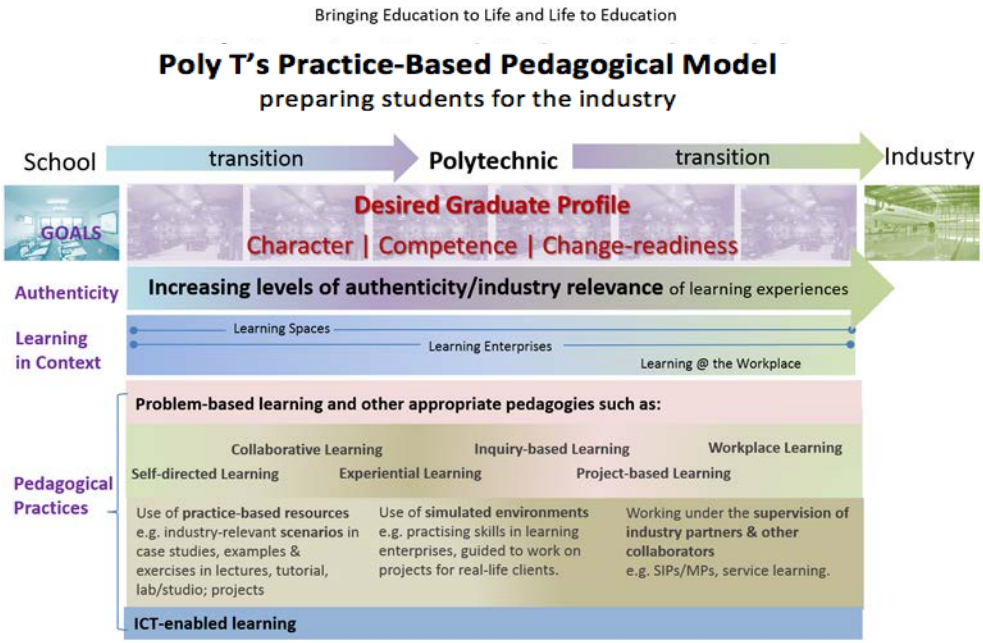

Figure 6.1 Practice-based Pedagogical Model of Poly T

Figure 6.1 showcases the pedagogical model adopted by Poly T since 2015. The framework is anchored on a practice-based model and incorporates a variety of pedagogical practices such as PBL, self-directed learning, experiential learning, inquiry-based learning, project-based learning and workplace learning. These, better referred to as teaching practices, are spread along the increasing level of authenticity and industry relevance of learning experience in the model. Self-directed learning, practice-based resources falls at one end of a continuum i.e. authenticity, while workplace learning under the supervision of industry partners falls at the other end of the continuum i.e. industry relevance. However, the model stops short of providing its epistemological roots. An articulation of the underlying principles linking

these pedagogical approaches would provide much clarity to the pedagogic model and its epistemological roots.

Firstly, I feel that the ‘pedagogical practices’ listed in the model above (Figure 6.1) clearly reflect a constructivist perspective. However, there is no mention of constructivist principles underpinning the pedagogical model. This restricts possible depth of discussions and research in the area. It also provides staff with limited clarity on pedagogy matters and the epistemological basis of such a model.

Secondly, the non-committal nature of provisioning pedagogical and teaching practices at the Polytechnic is an area of concern. An example would be the case of deploying PBL at Poly T. Poly T declares PBL as a core teaching practice to its curriculum and encourages its adoption. There is also clear documentation on the stages, the process of PBL implementation and publications available on the subject matter. Professional development sessions are also made available to staff implementing PBL. However, this resolve falls short in administrative details, where PBL is only required as a teaching practice in at least one instance in each diploma's three-year curriculum (Tan, 2005; Tan, Little, Hee, & Conway, 2000). Hence, students completing their diploma, with some 20 to 25-core modules over a three-year duration, may have only one exposure to PBL. Such non-committal stance sends a wrong message to staff. The tendency, hence, is to stick with the traditional means of teaching, only doing ‘lip-service’ to such core initiative adopted by the Polytechnic.

My experience of searching for literature specifically on Polytechnic pedagogy in Singapore provided little returns. This inhibits a thorough literature review on the subject matter. The dearth of literature other than on PBL can be due to little systematic research and its subsequent publication on Polytechnic pedagogy at these institutions. I therefore, resorted to the official websites of the polytechnics to review their pedagogy.

The discussion on pedagogy found in the various polytechnic websites reveals to me a clear misalignment with my working definition of pedagogy. For example, one polytechnic declares PBL as its 'sole pedagogy.' PBL is a framework or a protocol rather than pedagogy. Moreover, Polytechnics declare CDIO (Conceiving – Designing - Implementing – Operating), value-based learning, teaching-factory concept and service learning as means of teaching their students. These are at most teaching practices, not pedagogy.

Clarifying the notion of Pedagogical Approach and Teaching Practice

The pedagogical model of Poly T discussed above, and the brief review of Polytechnic pedagogy make it clear that the use of the term pedagogy is not congruent with my working definitions of pedagogy discussed in this chapter.

It is beyond the scope of this study to discuss the issues of how pedagogy is being defined and interpreted within the polytechnic educational setting in Singapore. For the purpose of this study, discussion on pedagogy will be confined to the nature of the pedagogical approaches or teaching practices undertaken at the polytechnics.

The discussion on pedagogy at the Polytechnics in Singapore is shrouded by a preference to narrate pedagogical approach and teaching practices rather than pedagogy. The usage of pedagogy as a noun is not common at the Polytechnic in Singapore. The preference is to use the adjective i.e. pedagogic or pedagogical approach taken in terms of educating students. I define pedagogical approach, as a means of setting rules and principles based upon which lessons are designed and taught. An approach guides the teacher on the design, the use of suitable instructional methods and procedures that would be appropriate for teaching the subject. It guides teachers in their thinking

and action. Teaching practices entail the instructional aspects of what teachers do in class for learning to take place. The pedagogical approach entails the thinking and reasoning underpinning the design of teaching. Hence, pedagogical approach encapsulates teaching practices.

The emphasis within the polytechnics seems to focus on the pedagogical approaches. Since pedagogical approaches and teaching practices are subsets of pedagogy, it would be more appropriate for the research discussion to focus on pedagogical approaches and teaching practices undertaken at the Polytechnic, than on pedagogy.

CHAPTER SEVEN
METHODOLOGY

Introduction

A chapter on methodology outlines the "path to inquiry" (Schwandt, 1990, p. 258) and responds to the question which Guba (1990) poses, "(h)ow should the inquirer go about finding out knowledge?" (p. 18) Lincoln and Guba (1985) mention that the means of rationalising knowledge could be generated through an understanding of the ontology, epistemology, methodology and methods of research. These constituent parts pull together a holistic view of the research process. In this chapter, I will elaborate on the research design and process that I have undertaken for this research.

Worldview or Paradigm

The conceptual framework in Chapter Two provides a discussion on worldviews and also states that my research will adopt a constructivist worldview. This position is further supported by my positionality in Chapter Three.

The emphasis is on beginning with the researcher's worldview for the benefit of the reader. McMillan (2015) emphasises that the worldview is the lens through which the researcher researches. As McMillan (2015) states:

> (d)ifferences in these assumptions shape not only study design, but also what emerges as data, how this data can be analysed and even the conclusions that can be drawn and recommendations that can be made from the study. (p. 20)

Table 7.1 provides a comparison of constructivist and positivist worldview on research issues pertaining to ontology, epistemology, methodology and methods.

Element	Constructivism	Positivism
Ontology	• There are multiple realities. • Individuals construct different understandings based on their past experiences and knowledge. • Facts and values are inextricably linked.	• There is a single reality. • The nature of reality can be understood through careful measurement and testing. • Facts and values are independent.
Epistemology	• The researcher and the researched are inseparable. • Complex sound phenomenon are perceived as irreducible • The researcher's belief and experiences influence the questions asked and how the findings are understood.	• The researcher is separate from the phenomenon, event or process under study. • Individual variables are defined and relationships between them studied. • Measures can be taken to eliminate biasness and minimise subjectivity.
Methodology	• Approaches are mainly qualitative. • Ideographic – focus on describing individual cases. • The goal is to understand how and why events occur and how individuals make meaning of them.	• Approaches are mainly quantitative. • Nomothetic – focus on formulating general principles/rules. • The goal is to uncover the nature of the real world, in order to explain and predict causal connections and associations.
Methods*	• 1st person perspective.	• 3rd person perspective.
		❖ Survey ⟷
	❖ Interview ⟷	
	❖ Observation ⟷	
	❖ Ethnography ⟷	

(Adapted from Mann & MacLeod, 2015; Wellington, 1996, 2000; Wellington & Szczerbinski, 2007)

** Methods can be used within any worldviews. These rows showcase some methods that are commonly used by the positivists and constructivists. Taking positivist and constructivist as two ends of a continuum, the relative position of the various methods illustrated in the table shows the likely usage of the methods by the worldviews. For example, survey is predominantly positivist-oriented research method as compared to observation, which is predominantly constructivist-oriented research method.*

Table 7.1. A comparison of constructivist and positivist worldviews: ontology, epistemology, methodology and methods

As discussed in the conceptual framework chapter (Chapter Two) and reiterated by Guba and Lincoln (1994), either worldview can make use of use any of the methods (Guba & Lincoln, 1994). It is the assumptions, interpretations and means of using the methods that will differ (Lincoln, 2010). For example, researchers from both the constructivist and positivist worldviews can use survey method. The positivist would define the causal relationship between variables, establish hypothesis based on the variables' causal connection and use

the data collected via survey to test the hypothesis. In the case of the constructivist, the survey indication is only one interpretation of a case, which will have many other aspects to be fully understood. Hence, to the constructivist, the survey results provide only one strand of the researcher's story.

For my research, I have used the interview method. The next section will discuss the methods of my research.

Methodology

Wellington (1996) describes methodology as "the activity or business of choosing, reflecting upon, evaluating and justifying the methods you use" (p. 16). Methodology, according to Skies (2004), is not concerned with the actual, practical use of methods but rather with the description and analysis of research methods used for the study. As Wellington (2000) succinctly states, "(n)o one can assess or judge the value of a piece of research without knowing its methodology" (p. 22). The research methodology rationalises the whole research design's congruence to the worldview adopted.

Constructivist Research

Constructivists predominantly adopt an interpretive or qualitative approach for their research. Denzin and Lincoln (2013) state that qualitative research is difficult to define as it does not have any theory or paradigm that is distinctively its own. It situates its researchers in the context of the research and views the world from that context. As the authors state "(q)ualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry" (Denzin & Lincoln, 2013, p. 17). According to Denzin and Lincoln (2013) qualitative research involves generating information through case study, personal experience, introspection, life story, interview, artefacts, and cultural text that describe meanings. Therefore, qualitative research deploys a wide-range of interpretive practices, searching always to get

a deeper understanding of the participants in the process. The emphasis of qualitative researchers is the value-laden nature of inquiry. They seek answers to questions that stress how social experiences are construed and given meaning.

Qualitative research is endlessly creative and interpretive. The researcher does not just generate huge amount of information and write-up her or his findings. As Denzin and Lincoln (2013) state, there are no objective observations. Hence, from a constructivist perspective all observations are situated in the world of the observer. In this sense, the researcher construes qualitative interpretations.

Research Design

Research design as described by Denzin and Lincoln (2013) can be a "flexible set of guidelines that connect theoretical paradigms" (p. 29) to strategize the inquiry and the methods of evidence generation. This way, a research design situates the research and the researcher's worldview clearly and connects these ideas, "to specific sites, people, groups, institutions, and bodies of relevant interpretive material, including documents and archives" (Denzin & Lincoln, 2013, p. 29). The research design also draws attention to challenges in producing all the necessary information for the purpose of analysis of the research questions. A research design also showcases how the researcher will address the twin issue of representation and legitimacy in the study (Denzin & Lincoln, 2013).

Research Methods

Research methods are selected based on what I will need to know to fulfil my inquiry on the research questions. As Bell (2005) states, this will ascertain the best methods that can be used in soliciting the information available for my research. In this section, I will briefly describe the need for information, in relation to the research questions for my research, and rationalise the methods that will best furnish the information in line with my worldview and positionality.

Pedagogic approaches and the changes envisioned within polytechnic education in Singapore are the main focuses of the research. Polytechnic stakeholders involved in pedagogic matters form the primary source of participants for the research. To gain an in-depth view of their opinion on pedagogic matters, one-on-one interview was done with various stakeholders. In addition, the study also draws on literature and artefacts e.g. Guidelines on Course Document, Pedagogical Model, ASPIRE report, Committee on Future Economy report and other documents available and accessible to me. Table 7.2 gives an overview of the sources used to address each of the research questions.

RQs	Sources		
	Literature	Artefacts	Interview
RQ1. What pedagogical approaches are commonly practised in the polytechnic?	✓	✓	✓
RQ2. Who are the key stakeholders and what is their influence on the pedagogies practised in the polytechnic?	✓	✓	✓
RQ3. What are the pedagogies that the key stakeholders wish to see practised in the polytechnic?			✓
RQ4. How can the polytechnic accommodate the key stakeholders' expectations on pedagogies?	✓		✓

Table 7.2. Research Questions and Sources of Evidence

Literature

Literature pertinent to the research topic provides a foundational layer of information. From the experience of my searches, literature on pedagogical approaches in polytechnic education in Singapore is scarce. However, the recent interest and government direction for changes to polytechnic pedagogies have generated some pertinent reports and speeches that are used in this field. In addition, literature

from other countries, particularly work-based learning and practice-based education from Australia, are also considered as part of the information generated for the research.

Artefacts

Singapore is recognised for its systemic process of planning and implementing changes desired for the country. Committee reports, white paper and other records are means of putting on record desired changes in the Singapore system. This is also true to the education sector, as explained by Varaprasad (2016), the founding Principal of Poly T, in his recent publication. The first polytechnic established in Singapore was the outcome of the 1953 Dobby report (Varaprasad, 2016). Varaprasad (2016) also listed other reports that established the other four polytechnics. This clearly showcases the prominence of reports as essential artefacts on Singapore's planning of polytechnics since its independence in 1965. The utilisation of artefacts, such as ASPIRE Report, CFE Report and SkillsFuture details, form another source of information gathered for the research.

Lincoln and Guba (1985) differentiated records from documents on the basis of whether the text was prepared to show proof of some formal transaction. Records provide formal and official detail on transactions while documents contain more non-formal and unofficial details. Examples of records are marriage certificates; building contracts and minutes, while memos, letters and reports are classified as documents by the authors (Lincoln & Guba, 1985). As Hodder (2003) states, such "distinction is also relevant for qualitative research, in that researchers may often be able to get access to documents, whereas access to records may be restricted by laws regarding privacy, confidentiality, and anonymity"(p. 156). Hodder (2003) refers to records as "mute evidence…(s)uch evidence, unlike the spoken word, endures physically and thus can be separated across space and time from its author, producer, or user" (p. 155). The establishment of polytechnics, its rationale and objectives are usually the result of committee reports and

recommendations made to the government. Hence, analysing such reports and records provide information on the research topic. Such artefacts would be a useful means of establishing evidence for the various RQs.

Interviews

Bernstein (1991) and Kvale (1996) view interview as a conversation with a purpose between the participant and the researcher. Bernstein (1991) narrates that the conversation:

> begins with the assumption that the other has something to say to us and to contribute to our understanding. The initial task is to grasp the other's position in the strongest possible light. One must always attempt to be responsive to what the other is saying.... The other is not an adversary or an opponent, but a conversational partner. (p. 337)

The purpose of the interview, stated by Lincoln and Guba (1985), is for the construction, reconstruction and projection of the research focus from selected participants. Compared to other methods of research, e.g. survey, observation, ethnography etc., interview provides the best resource to generate information pertaining to polytechnic pedagogies, from the stakeholders. The face-to-face interviews allows for conversation style of discussion that allows me to understand participants' take on pedagogy and how this is deployed in the teaching process. The purposeful conversation furnishes rich information that can be compared with artefacts and literature on the topic of research.

Kvale (1996) introduces interview process and intent through two metaphors, namely the miner and the traveller. The metaphorical miner attempts to unearth valuable metal or nuggets buried within the interviewee. In the process of unearthing these 'nuggets', the researcher makes sure there is no contamination to the 'nuggets'. The objective of the researcher is hence to put forth the 'truth' unearthed from the interview process. Such an orientation to the interview process adopts a positivist epistemology.

The metaphorical traveller, on the other hand, uses the interview process as a journey through a landscape and in the process indulges in conversation with people. The traveller chooses the route for the travel and the people to be engaged throughout the journey. The objective is to delve deeper into the issues and understand them well. Thereafter, the metaphorical traveller narrates the tale of the journey from her or his experience. There is much reflection that goes on during the journey and it has an impact on the researcher. The metaphorical traveller's interview process adopts a constructivist epistemology.

I have carried out the interviews for my research following closely the stages listed by Wellington (1996), which are: Interview Schedule, Piloting, Selection and the Interview itself. I will use these sub categories to elaborate the interview method for my research.

Preparing the Interview Schedule

In preparing the interview schedule, the first task was to draw-up a series of questions (Appendix 3). These are translations of the research questions into practical interview questions. The questions were crafted to be precise and concise as the interviewee had to understand the essence of the question and provide their views on them. A long elaborate question has the potential of losing its essence when asked (verbally) at the interview. These questions have to be retained in the interviewee's memory for a short while for them to analyse and answer them accordingly. Hence, precise and concise criteria dominated the interview question structure. In addition, questions raised during the interview were structured to obtain participants' personal perspectives and practices on pedagogies (such as 'in your opinion;' 'in your view' etc.). In personalising the wording, I hope to encourage participants to express their viewpoints on subject matter and not the institutional rhetoric. This technique of eliciting responses from a personal perspective, made the participants feel at ease in discussing the subject matter. Most participants shared freely on their experiences. Such personalised formatting of questions is termed a diagnostic technique,

by Jon A. Scaife (personal communication, 9 Nov 2016), which aims to portray that the researcher values the participant's position on the subject matter. This technique aligns with the constructivist epistemology.

The duration for each question was also estimated through the pilot interview process. This was done to ensure the interview did not stretch beyond the duration stated i.e. 45 minutes.

Interviews can be done in different formats. As Guba and Lincoln (1981) state, in a structured interview, the researcher defines the problem and the interviewee has to answer these established questions. The same questions are asked of all participants, in an attempt to obtain consistent information. On the other hand, in an unstructured interview, there is flexibility with very little control in the hands of the interviewer. Lincoln and Guba (1985) elaborate that in an unstructured interview the interviewee provides both the questions and the answers. As the authors quip, "(t)ell me the questions I ought to be asking and then answer them for me" (Lincoln & Guba, 1985, p. 269). Wellington (1996) further added that the direction of such an interview is unpredictable and each interview may be focused on different things. Wellington (1996) continues that the analysis of such interviews collectively will also raise difficulties. However, an unstructured interview provides uniquely individualised viewpoints as expressed by Guba and Lincoln (1981). Both these methods of interview provide some useful means of generating information. As such, I have taken a middle ground and used a semi-structured approach, which is an amalgamation of both approaches, for my research. A fixed number of questions were asked of all interviewees, which provide the consistency across the various interviews done. Additional questions or probes were also prepared for each question so as to seek elaboration, clarification or examples as to what was being shared by the interviewee. This provides some flexibility in exploring issues deeper, especially when the interviewee did not provide such depth in their initial replies. There was also

opportunity for interviewees to suggest areas of focus that I could explore.

The characterisation of relationship between the interviewer and interviewee is another factor that affects the interview setting. Massarik (1981 cited in Lincoln & Guba, 1985), elaborates on a variety of interview characterisation. These are: the hostile interview - where the relationship is that of enemies; survey interview – where there is an automated processing of asking and seeking answers to a set of questions; rapport interview – described as a 'human-being-in-a-role' process; asymmetrical-trust interview – where the interviewer is seen as the sage and the interviewee the pupil; depth interview - where both parties are deemed as peers; and phenomenal interview - where both parties are deemed as caring companions, committed to empathic search for information. Of these characterisations, the depth interview captures the essence of my interviews, as both the interviewee and I see each other as peers in the field of polytechnic education.

As it was a semi-structured interview, I was mindful of probing rather than prompting during the interview. As Wellington (1996) highlights, prompting indirectly leads the interviewee and can cause bias in the response elicited. Probing, on the other hand, seeks clarification to responses and does not guide the interviewee. Wellington (1996) argues that the lack of probing in an interview has the danger of recording ambiguous responses that will cause difficulty in analysis.

The interviews were audio recorded and participants' consent was obtained at the beginning of the interview process. Two audio recorders were used for each interview. One was placed on the left and the other on the right of the interviewee. Both audio recorders had batteries fully charged prior to the interview although each had a battery life of two hours. As there were no notes taken during the interview, two audio recorders provided a safe guard on capturing full audio information at

the interview. The interviews were then transcribed verbatim and shown to the respective interviewee.

Piloting

The interview questions (Appendix 3) were piloted with two polytechnic lecturers separately. This was done for the following purposes:

- To check clarity of questions
- To gauge time required for the interview process
- To evaluate the kind of responses that can be anticipated and possible probes (questions) that would be required
- To ascertain question and content flow
- To audio record the interview and to transcribe the text. Establish audio clarity of the two devices to be used and the issues related to transcribing the audio files
- Establish possible length of transcript of interview
- Testing the ambiance of the interview location and its appropriateness for interview.

Lecturers participating in the pilot were informed of the demographic details of potential interviewees and their feedback sought on the sampling as well. This feedback was incorporated into the interview process.

The questions were also sequenced in a logical manner of working through the research topic from a wide focus to specific instances and examples. This was done to prompt the macro perspective (bigger picture) from the interviewees and gradually move deeper into the subject matter with specific instances and examples.

Prior to Interview

Upon obtaining the informed consent on participation, an attached note (Appendix 4) was sent to inform the interviewee of the research focus, why he or she was invited to participate in the study, the duration of the interview, location for the interview, the procedure of the interview, the

anonymity rule and data confidentiality of all information generated at the session. As Bell (2005) states, although these are repeated before the start of the interview, prior reading of this information prepares the interviewee for the process and allows for clarifications. The presence of two audio recording devices, with files, charts and forms created a very serious ambience at the start of the interview. Participants were re-assured on the anonymity of information reporting and on the confidentiality of all information shared at the interview. This assured participants and made them more relaxed at the start of the interview.

Selection & Participants' Consent

In addressing the focus of the research, various stakeholders from the polytechnic were invited to participate in the study. Stakeholders invited to participate were informed of the consent received from the Principal and Chief Executive Officer (PCEO) for the conduct of the study. Such approval clears the way for participation and is an operational process within the organisation. Participants were invited through personal contact and email. In the invitation document it is explicitly stated that participation is voluntary and participants are free to withdraw from the process any time, without there being any disadvantage to them whatsoever. Details that were furnished to participants include the following:

- The aims and objectives of the research
- The research questions
- The information generating process

Informed consent was obtained through a form designed for the purpose (Appendix 5).

Participants signed to confirm their consent to participate in the research at the start of the interview. Purposive and snowballing techniques were used in inviting participants for my research. Purposive sampling, as its name implies, involves selecting participants with a specific purpose in mind. Snowball sampling in a sense follows from

this although it may not always be purposive. Snowball sampling seeks recommendation from interviewees on possible additional participants for the research. The researcher then approaches the recommended participants. As this process was undertaken, I also kept an account of the diversity of participants involved in the research. The accounting of diversity reduces the risk that the research process is skewed towards a particular group of stakeholders. Some consideration in selecting participants included years of service, experience in polytechnic education, roles and responsibilities held within the polytechnic and different specialisation areas. The spread of interviewees also supports the credibility criterion in the evaluation criteria established for the research (Chapter Two).

The Interview

Audio recordings of the interview were done. These audio recordings are kept in my computer and backup hard disk. Both these devices are safe kept by me. To maximise participants' time, all interviews were conducted at the convenience of the participants, in a conducive environment. The rooms used for the interviews were well lit, air-conditioned and had minimal noise from the exterior. The position of the room and seating arrangement also provided little opportunity for the interviewees to be distracted from other occurrences (such as students or staff walking pass) outside the room. Interviews ranged from 38 to 59 minutes in duration. Interview data were verbatim transcribed and participants were provided the opportunity to correct and make additions to the transcript. The corrected transcripts were used for data analysis. All transcript data were managed anonymously.

The interviews adopted a semi-structured interview protocol and participants had the liberty of skipping questions that they deemed inappropriate or were uncomfortable answering.

Information Confidentiality

All personal data pertaining to individuals involved in the research are

kept securely by me. These details are not placed within the transcript. Access to the data is restricted to my supervisor, the university examiners and me. All correspondences with the participants are done on a one-to-one basis mostly through email. Such correspondences are kept as confidential records. Only I have custody and control over all information generated for this study. I used my personal computer to work on all the analysis for the research. For the purpose of analysis, each participant was assigned two letters i.e. RG, KL and so forth. This is for the purpose of tracing details for analysis and in co-relating details from transcript for research discussions only.

Participants were informed of the possibility of the data being used for future research projects and publications. No personal details will be revealed and only I have access to the original information generated. All information generated will be destroyed 6 months after my graduation from the EdD programme.

Analysis of Information Generated

Interview transcripts will form the bulk of information generated in the research process. The eight interviews with stakeholders have generated 92 pages of textual data.

Kvale (1996) lists 5 ways of analysing interview transcripts. These are:

- meaning condensation – “reduction of large interview texts into briefer, more succinct formulations” (Kvale, 1996, p. 192)
- meaning categorisation – to code interview text into categories. These categories can be pre-defined or generated while coding is done.
- narrative structuring – to bring out the meaning from the interview text in the form of stories or narratives. There is a chance that the narratives are longer than the interview transcript.
- meaning interpretation – “recontextualizes the statements within broader frames of reference” (Kvale, 1996, p. 193). This is done to provide context for the entire interview or link to a theory. In this coding process, text expansion always occurs.

- generating meaning through ad hoc methods – to apply a variety of approaches to the transcript coding process, in order to bring out meaning from different parts of the text. The outcome of this coding process can be in the form of numbers, figures, charts and words.

The process of making sense of interview transcripts can be done through meaning categorisation, which is what I have used to analyse all the interview transcripts for my research. Meaning categorisation is also referred to as thematic analysis (TA). Braun and Clarke (2013) describe TA as "providing a systematic approach for identifying, analysing and reporting patterns – themes – across a dataset" (p. 178). TA, as Braun and Clarke (2013) continue:

> is relatively unique among qualitative analytic methods in that it only provides a method of data analysis; it does not prescribe methods of data collection, theoretical positions, epistemological or ontological frameworks. (p. 178)

It is just a method of analysis and can be used to address any type of research questions. Such a thematic coding process will provide a deep understanding of information shared by interviewees. Specific details on how the analysis was done and the identification of themes for analysis is discussed in the analysis chapter (Chapter Nine).

Conclusion

This chapter summarises the research design adopted for the research. It details the methods, sampling and procedures undertaken in gathering the necessary information on the research questions. The rationales of adopting these methods were also discussed.

CHAPTER EIGHT
INTERVIEW TRANSCRIPTION & CODING

Introduction

This chapter provides the transcription and coding process involved in the study. It starts with details on how I did the transcription of the interviews and the protocol established for the purpose of establishing credibility and consistency. Next, I discuss the coding process adopted i.e. thematic analysis (TA). These details are discussed to give readers a good grasp of the evidence-generating process before I venture into the analysis in the next chapter.

Transcription

As Kvale (2007) states, "(t)o transcribe means to transform" (p. 93) the information from one form to another. In my case, I am transforming an interview conversation into a written form. At this first stage of the transcription, I also determine my strategy in analysing the interview data for my research. I selected the thematic approach as it allows me to explore the evidence more in-depth and to bring together viewpoints from different stakeholders on the research focus. I adopted Braun and Clarke's (2013) seven stages of the thematic analysis (TA) for my study. The seven stages are as follows:

1. Transcription
2. Reading and familiarisation; taking note of items of potential interest.
3. Coding – complete, across entire dataset
4. Searching for themes
5. Reviewing themes (producing a map of the provisional themes and subthemes, and relationships between them – aka the 'thematic map')
6. Defining and naming themes
7. Writing – finalising analysis. (pp. 202-203)

Orthographic or Verbatim Transcription

The primary source of information for my research is the interviews done with Polytechnic stakeholders. The process of systematically

generating evidence from the interview is done through transcribing the interviews verbatim and analysing them. Sandelowski (1994) refers to transcript data from interviews as ‘partially cooked’ rather than as raw data. She argues that this is due to the ‘selective arrangements’ done by the researcher in preparing their data for analysis. Braun and Clarke (2013) had similar viewpoints in stating that a transcript is “two-steps removed from the actual interview experience” (p. 162) and that there will be a loss of information. The two-steps removed from the actual interview refer to the audio recording being one step and the transcription of the audio recording being a second step away from the actual interview. Braun and Clarke (2013) view the transcription process, as “an interaction between the recording and the transcriber, who listens to the recording and makes choices about what to preserve, and how to represent what they hear" (p. 162).

In due regards, I have adhered to the advice from Braun and Clarke (2013) to avoid listening to the meaning of words for the purpose of verbatim transcription. This helps capture the essence of the interviewees' ideas rather than venturing into my interpretation of what is said. I found this process very meaningful as I had different opinions on some of the matters discussed. It also helped me record what was spoken rather than my interpretation of the conversation.

There is also need to maintain consistency and be meticulous in the transcription of different interviews. To better manage the task, I adapted a notation guide. These notations are also useful in maintaining anonymity in the transcript. I also captured some nuances in interviewees’ conversation such as laughter, emphasis, repeating phrases like ‘you know', ‘right', ‘ah' and ‘lah', with the notation guide in the transcript. However, face-to-face interviews that are audio recorded could not capture some of the non-verbal expressions such as the ‘rolling of the eyes’, gesturing with hands, nodding of the head, that was visible to me during the interview. Some of these non-verbal expressions have meaning to the messages that the interviewees were

sharing but were sadly not recorded. On reflection, for the later interviews, I tried to incorporate some of the non-verbal gestures by articulating some of these expressions into my questions and in getting a verbal recording of it. Examples would be, ‘you nodded to the issue and hence confirm it – right?' or ‘your smile states you are in agreement with that view?' I have listed the notations that I have adopted in transcribing the interviews in Table 8.1 below.

Features	Notation	Explanation of Use
Identity of speaker	Two-letters (e.g.,. PJ, TN, RG) VJ	A randomly selected pair of letters for each participant. This made the participants more personable in the analysis process than in assigning a numeric running number for each interview. Assigned to me
Non-verbal utterances	(xxxx)	Use of brackets to state or explain non-verbal utterances. Example, for laughing (laughter); coughing (cough).
Pausing	(.); (..) & (…)	(.) represent a short pause; (..) a slightly longer pause; (…) a long pause. Only three levels of a pause will be reflected in the transcript
Abbreviations	As spoken	Will transcribe as spoken. Example, – the term problem-based learning was transcribed as either PBL or problem-based learning as the interviewee mentions it.
Punctuation	‘.’; ‘?’; ‘!’ ‘-‘	A full stop is added when the speech indicates a sentence completion. If ideas and thought process are flowing in speech, a ‘–‘ will be used to separate such ideas or thought processes. The question mark and exclamation marks will be indicated according to tone and pitch detected in the recording.
Word Emphasis	<u>Underlined</u>	Words that are emphasised in the interview will be underlined. E.g. (<u>Values</u>).
Confidentiality and Anonymity	[ ]	Where the interviewee reveals details that can be used to trace back their identity, such details will

		be omitted from the transcript and a more generic term used to showcase the idea in square brackets. E.g. [course]; [colleagues name]; [subject title]; [appointment] etc.
Post transcript inclusions	<*xxxx*>	All post transcript inclusions that are not in the audio recording will be captured with the 'less than or more than' symbols, and the text would be in italic.

Table 8.1 Notations designed for the purpose of transcription. Adapted from Braun and Clarke (2013, pp. 165-166)

In each case the verbatim transcript was completed within three days of the interview and emailed to the interviewee for their reading. This is to provide interviewees with an opportunity to read what they had mentioned in the interview. This is in line with the credibility criterion – member check attribute, which I have used for the evaluation of my research (discussed in Chapter Two). Changes suggested to the transcript by participants were verified with the audio recording first. If the verifications were accurate, changes were made to the transcript. If the suggested changes consisted of new information that the participant wished to add on that were not in the audio recording, I tagged them as post-interview information in the transcript with the symbols '< >' and the text within this in italic font, to differentiate the details. I considered these as post transcript details for the purpose of analysis. Two of the interviewees replied with slight changes to the transcript, to make their messages clearer. I have tagged these as post transcript details (Appendix 6).

All transcript documents were password protected and stored on my computer. Although the transcripts are anonymous, password protecting the document is another added security on data confidentiality.

Coding and Thematic Analysis

All the transcripts were coded and analysed as detailed in Braun and Clarke's (2013) TA stages, 2 to 6. In the coding process, I have adhered to the principles of being systematic and thorough. As a start to the TA process, I read all transcripts first to gain an understanding and familiarity with the content. This was useful for the coding segment of the task. Besides, having transcribed the interviews on my own, I was getting more acquainted with the text.

I adopted complete coding rather than selective coding for the study. The difference between these two process is that in complete coding the aim is to identify 'anything and everything' for coding. In keeping with the protocol of TA, the selection of themes for analysis was done later. In selective coding, the process of identifying themes about the research question is done first, and only relevant information from the dataset is coded. I started with complete coding, systematically going through all lines of transcript, interview-by-interview and extracting key ideas, terms, and phrases from each transcript. All the extracted phrases contained citation details for purpose of tracking back to the original transcript. The extracted terms were collated together. Thereafter, I read through the details, demarcating each to a broad subject area. As I was doing this, themes started emerging and this was noted. Once this was completed, I read through details in the demarcated subject areas and started generating themes that best encapsulate the ideas shared by participants to the respective RQs. With the first cut of themes generated, I returned to the transcript to re-read, adopting the selective coding process of establishing relevant details for the themes. In the end, the process of coding incorporated both elements and this according to Braun and Clarke (2013) is the norm. This also makes the coding process inclusive. Another key point from Braun and Clarke (2013) was for codes generated to be meaningful for analysis without reference to the transcripts. I adhered to these principles and found it useful in generating themes for the

purpose of analysis. I did the coding process once the participants returned the transcripts via email. The coding process and the construction of themes were slowly showcasing a saturation point at the sixth interview transcript. I did two further interviews and felt sure that the information was saturating. Hence I concluded the process of my interviews for the research.

This chapter has described how I used the transcription of the interviews and notations in the process. I have also discussed the details of how I incorporated additional information in the transcript. The coding process was then detailed. I will move on to the analysis of the transcript in the next chapter.

CHAPTER NINE
ANALYSIS AND FINDINGS

Introduction

Knowledge generated from the interview transcript through coding process and themes will form the basis of the analysis in this chapter. As Braun and Clarke (2013) state,

> (t)here are two main ways data extracts can be treated in qualitative analysis (of all types). One is to treat the extracts as illustrative examples; the other is to actually provide an analysis of the content of the extract itself. (p. 252)

The illustrative process implies using the extracts from the interview descriptively. In the illustrative approach, the ‘story' is understood even if the extracts are removed. This is not the case in the analytical approach. Braun and Clarke (2013) describe the process as follows:

> In the illustrative approach, your analytical narrative provides a rich and detailed description and interpretation of the theme, and data quotations inserted throughout are used as examples of the analytic points you are claiming. If you were to remove your extracts of data from the narrative, it would still make sense to a reader. … In the treating extracts analytically approach [sic], your analysis would not make sense if the extracts were removed, as your analytic narrative is closely tied to the content of the extracts presented. (p. 252)

Braun and Clarke (2013) mention that combining both approaches to suit the research purpose is also a method commonly undertaken by researchers. For the purpose of my research analysis, I will be combining both methods in crafting the ‘story’ that I have generated from my interviews.

I will address my RQs through the themes generated from the interviews. Braun & Clarke (2006) describe that a theme "captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set" (p. 82). Themes hence form the basic narrative storyline that I generate from the interview transcripts. I generate themes by looking at the link between codes derived from the interview transcripts. A good

theme is one that helps to organise the content generated from the interviews about the research focus. Features make up the sub-component of a theme. I have generated ten themes from the interview transcripts for the study.

Braun and Clarke (2013) link the process of theme generation to that of a sculptor creating a figure. The theme is what the sculptor creates, and the features form the detail that makes the figure. This means that the same data would be 'sculptured' differently by different sculptors.

The use of pseudonyms to identify interview participants provides a personal perspective. On reflection, I found the initial intention of using an alphanumeric code (reflected in the Ethics application) to represent participants, very impersonal. Hence, I decided to use a two- letter pseudonym for each of the interview participants, and this allows me to visualise the participants as I describe my generation of their viewpoints in the research. The pseudonym also disguises the gender of the participants that has no relation to the research. The pseudonyms used have no reference to participant's name and hence maintain the anonymity assured in the interview process.

I organised this chapter on analysis of the interview data along the four research questions that I have crafted for the study. I started with the profile of participants and their awareness of ASPIRE and SkillsFuture initiatives in Singapore. This sets the preamble to the analysis of the RQs. Next, I analysed the RQs in the following order as it links the analysis well. First I analysed RQ2, which identified stakeholders and their influence on Polytechnic pedagogy. This is followed by RQ4, which focuses on accommodating stakeholders' expectations. Finally, I combined the analysis of RQ1, which investigates pedagogical approaches currently practised within Poly T and RQ3, which explores stakeholders' expectations of pedagogical approaches for polytechnics. I find it useful to discuss both RQ1 and RQ3 together as they are interlinked.

I will be quoting my participants' ideas shared at the interviews as part of the analysis. In accordance with the APA citation manual (*Publication Manual of the American Psychological Association*, 2010), I will be treating all of these extracts as personal communications, and hence there will only be in-text citation provided. The in-text citations will provide the pseudonym with the year, timestamp of interview and page number of the transcript. The format will be as follows: (Pseudonym, Year, Timestamp, Transcript page number). There will be no references, as the transcripts are not publicly retrievable. This process also conforms to my pledge for anonymity of interviewees in my research process.

As the interviews are a conversation between the participant and me, the verbatim transcripts lack sentence structure. There are also filler words (arh, hmm, you know, lah – a popular slang word used by Singaporeans) in the transcript. Kvale (2007) provides three guidelines on managing verbatim interview transcripts for presentation. The first is to contextualise the quote in the presentation through rendering the interview context and question that elicited the response. The second is to render quotation in a readable style. Kvale (2007) suggest dropping the filler words in quotations. The third guideline is to be "loyal to the habitual language of an interviewee" (p. 132) in reporting their ideas. Kvale (2007) suggests that the researcher could "translate their (interviewee's) oral style into a written form in harmony with their habitual modes of expression" (p. 133). I have adopted Kvale's (2007) last two guidelines on citing the transcripts. I have dropped filler words to render the quotations from participants readable. I have also retained the interviewee's style and essence of conversation for the quotations by retaining the words and phrases that the interviewee has used to showcase the 'habitual' language in the quotations. I have not incorporated Kvale's (2007) first guideline as my analysis is organised by my RQs and the themes are generated from the coding. Repeating the questions and interview context, as suggested in the guideline, would not be necessary.

Pseudonym	Discipline	Teaching Experience in Polytechnic (Years)	Subject Leader or Tutor	Experience in Curriculum Development	Pedagogy Leader or Staff Developer	Academic Unit Section Head	Course Management	Teaching Award Recipient	Involved in ASPIRE or SkillsFuture committees
PJ	IT	11	*	*	*	*	*		
TN	Business	9	*	*		*			
RG	Applied Science	5	*	*					
TM	Business	22	*	*	*	*		*	*
JR	Design	20	*	*	*		*		
TK	Engineering	4	*	*					
HK	IT	18	*	*		*	*		*
KL	Applied Science	10	*	*	*		*	*	

Table 9.1 Profiles of Participants

Profile of participants

Table 9.1 provides a summary of the profile of participants in my research. The columns of the table provide the roles, responsibilities and experience the participants have over the years of involvement in the polytechnic. The first column states the pseudonyms of the participants. The next column on discipline provides each participant's domain of expertise. The participants' years of experience in the polytechnic varied from some joining the institution as recently as four years ago to those who have been with the Polytechnic for 22 years. Collectively, all participants have a combined total of 99 years of experience at the Polytechnic. The columns of Subject Leader or Tutor and Curriculum development imply participants' roles in teaching and designing curriculum at the polytechnic. All participants have such experience. Pedagogy leader or Staff Developer imply they have leadership roles within their School or Polytechnic in mentoring and leading pedagogy-related matters with colleagues. Four participants have this experience. Academic Unit Section Head (SH) deals specifically with academic matters relating to a discipline of study while Course Management entails both academic and administrative roles. Four participants have these experience out of which two of them have both SH and Course Management experience. Two participants have also received teaching awards for their teaching and student engagement roles. Two participants have been committee members of either ASPIRE or SkillsFuture committees at the polytechnic and at national level. The various columns showcase diverse roles and experience participants have in relation to academic matters at the polytechnic. I believe the rich diversity of the participants allows for a good depth of evidence on polytechnic education and pedagogical approaches adopted. Participants bring these experiences to the study. There are at least two participants for each category in my sample group for the research.

Before analysing the RQs, I will discuss the opening questions I posed to the participants at the interview on their awareness of ASPIRE and SkillsFuture initiatives in Singapore.

Awareness of SkillsFuture and ASPIRE initiatives

All interviewees were familiar with both ASPIRE and SkillsFuture initiatives and their directions for polytechnic education. However, one of the participants was not able to relate ASPIRE initiatives to polytechnic education. But this was not the case for the four strategic thrusts of the SkillsFuture initiative and its relation to polytechnic education. There was general support for the SkillsFuture initiative, as it was deemed to be the required move for the future growth of the country. Only one participant (TM) differed in voicing concern that the SkillsFuture's focused approach may pigeon-hole graduates to a specific skill set and not allow for their career expansion later in life. TM, narrates it as follows:

> the child may want to explore and go into a new industry and he cannot because he just doesn't know how to operate in some other industry because you have messed him into a cell from which he cannot break out. And that is not education. That is not education for liberation that's education for domination. (TM, 2016, 24:32, p.8)

The head of Education Directorate of the OECD voiced the same sentiment in a recent Economist survey on Lifelong learning. Schleicher (cited in Economist, 2017, January) states:

> (v)ocational training has a role, but training someone early to do only one thing all their lives is not the answer to lifelong learning. (Economist, 2017, January)

Some interviewees (HK, KL, RG) felt that SkillsFuture initiatives were actually "new names for old practice" (HK, 2017, 03:06, p.1). They felt that the task of polytechnic education was in nurturing para-professionals, ready for the world of work from day one and that was the focus of SkillsFuture as well. So there is nothing extraordinarily different from SkillsFuture to polytechnic education. However, all

interviewees agreed that a new drive and a re-focus on polytechnic education by SkillsFuture is a useful boost to polytechnic education. The SkillsFuture initiative gives polytechnic education space in the national agenda and has generated much discussion by all within the country. This is new for the polytechnic education community in Singapore.

RQ2. Who are the key stakeholders and what is their influence on the pedagogical approaches in the polytechnic?

The second RQ establishes from participants the key stakeholders of polytechnic education. Participants' view on the influence these stakeholders have on pedagogical matters was also produced. Table 9.2 lists the primary and secondary stakeholders as identified by participants.

Primary Stakeholders	Secondary Stakeholder
• Students • Industry • Staff	• SkillsFuture • Parents • Management • Ministry of Education

Table 9.2. Primary and Secondary Stakeholders

Figure 9.1 presents the data set. The first row of bars shows the tally of participants' choice of key stakeholders of polytechnic education in Singapore. The second row of bars shows the participants' ranking of the degree of influence the stakeholders have on pedagogic matters relating to polytechnic education. As reflected in the Fig 9.1, students, industry and staff are seen as the key stakeholders with the most influence on pedagogic matters at the Polytechnic. The others i.e. SkillsFuture Council, Parents, Polytechnic Management and MOE are ranked as secondary stakeholders and have varying degrees of influence on pedagogic matters.

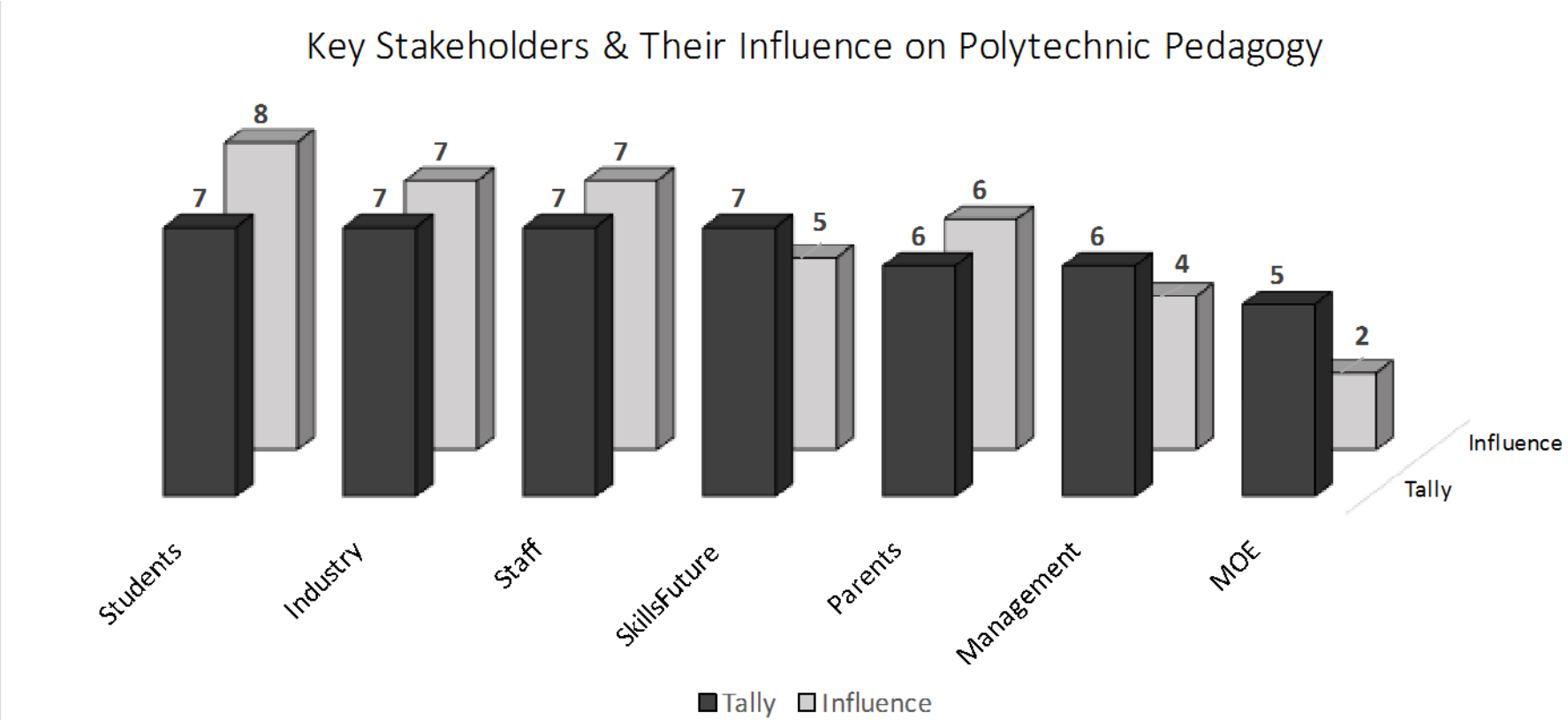

Figure 9.1 Key Stakeholders and their influence on Polytechnic Pedagogy

The next section will analyse responses to RQ2 in detail.

Students

Seven of the eight participants mentioned students as key stakeholders of polytechnic education. TN puts it this way: “students first - they are our clients, and so they are the base of everything" (TN, 2016, 09:47, p.4). Invariably, participants feel that students, as pseudo ‘clients,’ have the greatest influence on pedagogical practices at the Polytechnic. This is of interest to me, as I did not view students as such. Many of the participants, PJ, TN, HK, JR, TM and KL, rationalised that students are the reason we are in the ‘business’ and that we should cater to their needs. They feel that pedagogical approaches and teaching practices adopted must align to students’ learning needs; hence students play a key role in the process. PJ expresses this as follows:

> one stage we said all students are digital natives … the impetus was not to change because of technology but because … of students. … we have always had technology but … we tried to use technology that was more relevant to the students. (PJ, 2016, 13:01, p.4)

Students’ influence on pedagogy has mixed reactions. Some participants, KL, PJ and HK, feel that students are not aware of what pedagogy means nor of its value to the learning process. Some participants, KL, TM and JR, presume that being ‘student-centred’ would imply teachers align pedagogical approaches to students’ needs. Hence, the pedagogical approaches used have to be what the students assume as essential means of being trained as para-professionals. The use of PBL, projects, simulation, work-based practices and involvement in learning enterprises are some examples of pedagogical approaches used at Poly T. KL express how some of these pedagogical approaches require more effort from students. Hence, rationalising the use of the pedagogy and its value in nurturing their skills to be para-professionals garners students’ support. For example, role-playing as a pharmacist gives authentic experiences to students as to what they will have to do upon graduation. Students value the role-play teaching technique as a

means of acquiring the skills and competency required for the profession. KL expresses this as follows:

> the role play … I give them a very short time frame – so what I am telling them is that, yes – while you have all the resources you want – your patients are not there to wait for an hour [for you] to find the information … they [students] appreciate it. (KL, 2017, 20:32, p.5)

However, HK qualifies that staff should take what students demand selectively and not accept everything. KL concurs and states that students do not necessarily want to undertake tasks that demand much of their effort in the learning process. For example, students do not necessarily accept the 'bitter pill' teaching practice of problem-solving or confronting an ill-structured problem. KL suggests, that if all things fail in convincing students to partake in such practice, it be made mandatory -- "try to manage it first – if all things [fails] – push it down their throat" (KL, 2017, 41:37, p.9).

On a personal reflective note, this idea may not align with the constructivist orientation on learning. Forcing learners to adopt practices may only get them to accomplish the task with 'surface' learning. Learners need to subscribe to the rationale of the pedagogy.

Industry

Industry is generally reviewed as a critical stakeholder as far as determining the profile and skills requirements of graduates. The consensus among several interviewees (RG, PJ, TM, JR, HK and KL) is that industry has no knowledge about pedagogy and hence would not be able to influence it. This is shared by both RG and KL as follows:

> I think they are concerned about the results [but] not so concerned about the pedagogy. They don't even understand certain pedagogy. But they do look at the so-called output, which is the students' performance. (RG, 2016, 14:04, p.4)

> typically we get feedback from industry … how come your students have got this learning gap – they don't know why or what can be done about this … therefore we will try and reflect and … better design curriculum to meet what they require. (KL, 2017, 12:20, p.3)

Also, since industry encompasses a wide spectrum of organisations, associations and chambers, the profile of industry partners matters. As highlighted by HK, who is a management staff member with wide academic experience, speaking with senior management in industry will invariably provide macro perspectives on what profile graduates should possess. While speaking with line supervisors, they would provide the micro details on what is lacking in terms of technology and skills. Hence, inputs from industry need to be managed at various levels.

> it can be quite challenging … how to pitch it … if you ask … the immediate supervisor who is quite low … in the company's hierarchy, they will tell you the technical stuff … this guy is not good – technically this and that and that. So then if we listen to them – we will teach a lot of the latest stuff – you keep changing … On the other hand, if you ask people higher up … the top management – they will say soft skill is lacking – problem-solving skill is lacking. (HK, 2017, 14:20, p.4)

Participants concur that since industry partners employ the graduates, they can put forth their view on what is lacking with our graduates. RG states that industry representatives can clearly state what is lacking in terms of skill sets and it is left to the polytechnic staff to determine the appropriate pedagogy that can be deployed to address the concern.

> we get from the industry … your student's hands-on skill is not as good, technical understanding is not sound, or they lack problem solving skills … (these) are very general although very good comments but they don't necessarily tell you … to adopt a certain approach to solve the issue. Because they don't have the knowledge. (RG, 2016, 14:10, p.4)

A case in point is problem-solving skills in our graduates. Industry representatives do occasionally state that students on an internship or fresh graduates lack problem-solving skills. The decision to use PBL, project-based learning or other pedagogical approaches in nurturing students to be competent in problem-solving methods rests with the staff. Industry hence is seen by the respondents as a key stakeholder of polytechnic education but lacks the know-how directly to influence the pedagogy.

Staff

The ranking of staff as stakeholders is on par with students. As PJ states, “I think definitely the first two will be students and people who are teaching” (PJ, 2016, 12:46, p.3). Staff are involved in the implementation of pedagogy and play a critical role in the process. RG reflects on this as follows:

> I would tend to think that student and staff have the most influence as it is staff who get in contact with the students most of the time. (RG, 2016, 13:42, p.4)

Some participants (PJ, RG, & HK) view staff as the bridging factor between other stakeholders' demands and the pedagogical approaches within classrooms. Some other participants (KL, TN) deem staff are the governing pillars of pedagogy, “we ourselves know the pedagogy we want” (KL, 2017, 13:20, p.2) and they ultimately decide on the pedagogy adoption for the subjects. HK and RG also shares that staff at the Polytechnic have great freedom in the selection and deployment of pedagogy for their subject.

> We do have some freedom … to choose what we do… freedom [for] individual lecturers to teach. (RG, 2016, 13:45, p.4)

SkillsFuture Council

SkillsFuture Council is a new entity in the Singapore educational landscape. Its exact position vis-a-vis MOE or other ministries is not very clear to some participants currently. Others see it as an entity of its own, providing directions to various ministries and coordinating the national effort in nurturing a skills mastery mindset among Singaporeans. But most participants agree that polytechnic needs to heed the direction of SkillsFuture Council, and it may also be a ‘top-down’ directive. Six out of eight participants support the rationale provided for the direction of SkillsFuture Council. Many also highlighted that the initiative of the Council was already in practice within the polytechnic. HK expresses this as follows:

> in fact, some of which may sound like a lot of new things but actually [polytechnic name] has already been doing many of them, so it is more like some of them were given a new name for old practices. (HK, 2017, 03:06, p.1)

Parents

Some participants, TK, HK and TN, deem parents as important stakeholders but also agreed that parents have little knowledge of pedagogy at the polytechnics. Parents are keen to understand their child's developments within the Polytechnic and in some instances are also ready to assist in any way possible. However, since these are curricula for higher education, participants felt that there is not much scope for parents' involvement.

> parents .. they must support us – but sometimes I feel they may not know …Least influence ... I think parents. (TK, 2017, 12:30, p.4)

Some participants (HK, TN) also share that parents do voice some concerns with regards to teaching practices and in a few instances these are raised to the higher authorities within the Polytechnic, ministry or government. In such cases, the staff involved would invariably be at the receiving end of such feedback and will have to address these issues. Most of the time, as shared by HK this relates to project-based work where students spend an inordinate time especially in the wee hours of the night over several days to get their task done. Another example shared was the case of the internship where the distance between home and workplace, the type of work and working hours are the usual complaints received. Other than these odd cases of complaints, participants deem parents' influence on pedagogical matters very low. This has been my experience as a course manager as well.

Management

Management here refers to section heads, course managers, directors and other key appointment holders in the polytechnic. These stakeholders are responsible for the administration and management of diploma programmes and polytechnic academic operations. They decide on polytechnic-wide pedagogical implementation such as PBL, e-learning, and practice-based education. Management also plays the role of designing and monitoring the required core pedagogical

approaches for the polytechnic. Many participants, TN, TM, HK, GR and KL, feel that pedagogical approaches were generally 'top-down' and there were little consultations from the ground i.e. staff.

> they set the general and big direction for us to follow … I have to say so far everything has been very top-down. … I am thinking that in future we should develop more bottom-ups kind of approach. (TN, 2016, 8:46, p.4)

Some participants feel that management is distancing itself away from the ground and hence, losing touch with what is the real situation. There is a call by participants, one in particular for management to walk-the-talk. As TM, a member of staff with the longest service in Poly T amongst my participants, states:

> (m)anagement should walk into the classroom. They should by rule teach at least one class … an actual diploma programme. (TM, 2016, 10:32 p.4)

Management influence on pedagogy is hence largely seen as directives given to staff. Such influence is not to the liking of participants who wish to be engaged in the process. HK feels that such lack of engagement is not assisting staff in deploying pedagogical approaches that are appropriate and meaningful for student learning. HK feels that merely monitoring pedagogical implementation serves no purpose. HK reflects that:

> if we are driven by KPI (Key Performance Indicator) – and we are impatient – sometimes we end up doing ourselves a disfavour. (HK, 2017, 57:51, p.14)

Generally, there is mixed feeling on the role of management as stakeholders in polytechnic education.

Ministry of Education (MOE)

Some interviewees, TM, KL and TN, do not see MOE as a stakeholder. MOE's role is confined to giving directions for polytechnic education and in providing the funding. They deem MOE's role as guardian of the polytechnic education. Some interviewees share that since there is no choice but to 'toe-the-line' drawn out by MOE, they are not stakeholders but the 'owners' of the polytechnic education process. As TM states

"MOE I see as just [an] endorsing body …MOE slaps it down" (TM, 2016, 10:30, p.4). MOE, as part of the government, is seen as having the role of charting the future path of polytechnic education and envisioning what would be the needs of such an institution to Singapore's economic dynamism. Participants also feel that MOE has only been setting the framework for polytechnic education and has left it to the Polytechnic management to determine its curriculum and pedagogy. MOE is also deemed to be adopting a top-down approach as far as guidelines and directions promulgated for polytechnic education are concerned. KL shares this sentiment as follows:

> MOE says, this is the direction … therefore … every poly cramp it into class and we all have to figure out what exactly needs to be done … and the key word is – <u>what needs to be done.</u> (KL, 2017, 8:35, p.3)

Participants identified seven groups of stakeholders as having a role in polytechnic education. Amongst these, students, industry and staff were seen as having the greatest influence on pedagogy matters. The nature of pedagogical influence differs and has been discussed in this section. The other group of stakeholders i.e. SkillsFuture Council, parents, management and MOE is seen as having a lesser degree of influence on pedagogy matters as seen by participants. SkillsFuture Council and MOE play a role in setting the direction, while parents are concerned with their children's education. Participants largely see management as the administrator of polytechnic education and its related pedagogical approaches.

RQ1. What pedagogical approaches are commonly practised in the polytechnic?

RQ3. What are the pedagogies that the key stakeholders wish to see practised in the polytechnic?

This section will analyse participants' views on pedagogical approaches and teaching practices commonly practised within the polytechnic and what the key stakeholders would wish to see practised. These are the

focus of RQ1 and RQ3 (restated above). Since these RQs are related to one another, I will be combining the analysis of these RQs. I will initially state the common pedagogical approaches and teaching practices identified by participants as deployed within the polytechnic. Next, the discussion moves to the various themes that I have generated from the interviews on the subject matter. I will also link the elaboration of each theme to the literature review discussion in chapters four to six, where appropriate.

Pedagogical Approaches and Teaching Practices

Table 9.3 list the commonly deployed pedagogical approaches and teaching practices identified by participants during the interview. The following analysis will discuss participants' view on the implementation of these pedagogical approaches and teaching practices within Poly T.

* Problem-based Learning * Project-based Learning * Client-based Learning
* 'Active Learning' * Experiential Learning * Work-based Learning
* Workplace Learning * Practice-based Learning * Gamification * E-learning
* Game-based Learning * Student-centred Approach * Blended Learning
* Self-directed Learning * Didactic Teaching * Design Learning
* Case-based Learning * Studio-based Learning * Work-related Learning
* Simulation * Learning Enterprise

Table 9.3 Pedagogical approaches and Teaching practices deployed in Poly T

It is interesting to note that lecturing is not listed even though it is still a predominant means of teaching at the polytechnic. In addition, most of the pedagogical approaches and teaching practices listed by participants capture the term learning, more widely than teaching.

All the interviewees were familiar with Problem-based Learning (PBL) and project-based learning approaches in particular. PBL is acknowledged as a prescribed core pedagogical approach for Poly T and has to be deployed in at least one subject in the three-year diploma curriculum.

Project-based learning is deployed by all interviewees and stood out as a widely used pedagogical approach in polytechnic education. The following section will analyse participants' viewpoints on these pedagogical approaches and teaching practices and their impact on polytechnic education at Poly T. The analysis is grouped according to themes that I have abbreviated as TE.

TE1 - Learning through Projects

Project-based Learning

The essential nature of project-based learning approach to polytechnic education is exemplified by KL as follows: "I cannot imagine polytechnic education whereby students do not work on projects" (KL, 2017, 06:13, p.2). All participants deem learning through projects as a crucial process in the polytechnic curriculum. HK explains the importance of projects this way:

> (p)rojects in the sense … that's when the rubber hits the road – it really go[es] down to do something … [getting] hands dirty and then from there they [students] realise what the lecturer has been talking about during lecture … they realise what the tutorial is. (HK, 2017, 09:21, p.2)

Projects are deemed as an integral means of connecting the various concepts and theoretical knowledge to students' understanding through application. This pedagogical approach also encapsulates the applied study framework inscribed in the polytechnic curriculum since its inception.

Projects also link subjects taught in silos within the diploma. PJ, JR, TM and HK felt that students sometimes don't see the link between subjects taught. JR expresses the need for project work as an appropriate pedagogical approach to link this gap as follows:

> So the project in a way is fine … you can call it the backbone … move from one year to the other where there is always a connection – whether it is a horizontal connection or whether it is vertical in-depth. So the new curriculum that we have for

> [Diploma] very much focuses on this integrative nature. (JR; 2016, 04:44, p.2)

Projects also have the flexibility of being used at various stages of learning e.g. the initial semester of student's life at the Polytechnic right up to the end when students undertake their final year project. Tutors' control in scoping the project to align with curriculum and learners' skills, is another advantage cited by HK, JR, TK and KL. Project-based learning approach also avails the possibility of infusing self-directed learning, industry ethos and ethical considerations that students will have to construct. HK, GR, KL, JR and TN mention that projects also provide excellent means of cultivating skills such as collaboration, peer teaching, project management, problem solving and many other 21st-century skill priorities.

> It is the nature of our project, when we look at the key component … whether it is collaboration or to do with process, skills, critical thinking, it is all interweaved in the projects that the students do. (JR, 2017, 32:10, p.9)

HK also feels that projects provide a useful means for students to learn conceptualisation process and skill. HK argues that students were not trained to conceptualise their thinking as they enter the Polytechnic. HK views the process of conceptualisation as requiring the understanding of theoretical knowledge of a concept, applying the knowledge to a real life context and through that process conceptualising their understanding of the concept. HK acknowledges that this process is new to many polytechnic freshmen. HK and JR feel that this process has to be nurtured and hence, the need for project-based learning approach. Both of them also feel that projects allow students to gain the experience through first doing things before creating a conceptualisation of the knowledge required for the profession. HK expresses it as:

> we don't have many students who are so conceptual – who can understand theory very well and enjoy reading – I think project generally [does this] –very good. (HK, 2017, 09:22, p.2)

HK's viewpoint is compatible to Piaget's (Piaget, Gruber, & Vonèche, 1977) fourth stage of cognitive development where abstract conceptualisation occurs. Students gain a deeper understanding of subject matter, through the stages of assimilation, accommodation and equilibrium discussed in the literature review (Chapter Five) and conceptualising their ideas at the abstract level.

Authentic Task in Learning

Interviewees also highlight how authentic projects from industry would be beneficial to students learning industry requirements. All interviewees share the idea of embedding authentic practices into classrooms. However, some participants, HK, TM and TK, had a reservation about the degree of authenticity that is possible with polytechnic education, especially in the initial year of study and within the Polytechnic setting. HK explains that:

> if you are teaching at certain more elementary level, you can't expect the real world – very complicated problem to be presented, and you still have to adjust [to] the complexity of the project. (HK, 2017, 09:46, p.3)

Participants share numerous ways of bringing authentic learning into classroom practice. Examples given include small-scale industry projects, real-life case scenarios or undertaking specific activities as practised in the industry. Authentic projects, practices or activities are normally ill-structured or entail 'wicked problems' (mentioned by JR as a term used in their field), and this may not necessarily align with the intended learning outcomes of the diploma curriculum. This is deemed as a hurdle to infuse authentic practices in the pedagogical approach at Poly T. TK shares that "contextualising the syllabus to a real problem is the tough part" (TK, 2017, 20:34, p.6).

The recent introduction of embracing the ideas of sustainability in subjects is another means of inculcating authenticity in polytechnic education. JR foresees the increasing role of sustainability studies and its prevalence in all subject areas across Poly T. JR continues that

discussing sustainability issues within projects drives students to look at authentic issues and it links studies to real world practices. The following extracts from JR illustrate how the concept of sustainability allows for the integration of authentic practices into the curriculum both at a subject level and vertically across the curriculum (different years):

> you know they talk about sustainable development and all Schools and institution to have some – so-called component in the curriculum, we have integrated – we need to look at what will happen to the world in the future, and we are already seeing the trend. So that even becomes more important for students to make their own decision and look for alternative and to have good decision-making skills. (JR, 2017, 23:51, p.7)

and

> we have this subject called sustainable design, and it runs from year 1 to year 2 to year 3. So it is offered at different levels, and it dovetails with the project. So the big aim of this subject is to really … design with respect to …being sensitive to the context, sensitive to the climate sensitive to the user, so that becomes a new start with empathy first and then you move on. (JR, 2017, 23:55, p.7)

Another viewpoint is that authentic learning cannot be pitched in a realistic way as it may be beyond the grasp of students. TM shares that most polytechnic students do not have the prior working experience to indulge in authentic practices. TM narrates an example:

> The other issue I have with authentic learning – at least the idea that many people have is – we must make it as close as possible to industry … therefore the problems or the situation that we present them … you are working in this company as the supervisor handling 20 others, – this is beyond them. They have no idea what the industry is, they have not handled 20 people – so it is no longer authentic to them. (TM, 2016, 09:02, p.3)

In summarising the theme on learning through projects, it is noteworthy that there are some shortcomings in these approaches. However, both project-based learning and the use of authentic practices align to the applied study focus of polytechnic education in Singapore. All participants are convinced that project-based learning plays a significant role in polytechnic education.

TE2 - Inculcating Lifelong Learning Attributes in Students

The next theme examines ways of inculcating lifelong learning attributes in students. HK describes lifelong learning as a mindset where individuals are constantly pushing themselves to learn. This is how HK describes lifelong learning:

> I guess it is just their attitude – that is I will never arrive, and I will keep learning I will keep improving – that kind of mindset – that people will be open to change – people will be willing to learn. (HK, 2017, 30:31, p.12)

Participants generally agree on the need to nurture lifelong learning attributes in students. All participants support this explicit focus that is a strategic thrust of the SkillsFuture Council. However, nurturing lifelong learning attributes is viewed as a process that cuts across curriculum over the duration of students' study at the Polytechnic. Inculcating lifelong learning attributes requires individual student's involvement and acceptance. It is also deemed essential for the future of Singapore's economy where the emphasis is on upgrading and skills mastery. RG feels that students need to be motivated to cultivate self-regulation practices to be lifelong learners. In the post-transcript comment, RG notes (denoted within '< >') that it is not easy to follow through in cultivating lifelong skills in students. RG voices this as:

> (t)o me it is a very much stand-alone important stuff. I think it is definitely important and it is vital for personal growth, vital for the national economy and everything. It is just fine, it is not so easy *<I mean it is not so easy to follow through>* because it depends on your motivation, depends on your own capacity and your self-regulation. A lot of things involved. (RG, 2016, 20:46, p.6)

TK argues that passion for the profession is another key factor. TK expresses it as "I think the passion for learning we will have to develop first" (TK, 2017, 27:14, p.8). However, some participants, RG, TK and HK, believe that cultivating passion in the subjects is a tall order. This is because many students are not enrolled in diplomas of their choice.

> our students, a lot of them do not come into the course of their first choice. It could be [their] 5th or 10th choice. (RG, 2016, 28:20, p.8)

Besides, as PJ states, many students do not have a good idea of what the profession is all about and what sort of practices and work requirements it entails. Hence, cultivating the passion in students regarding the area of work has to be embedded in the pedagogical approaches and teaching practices.

> I think coming into the poly … they actually hear that they have to be passionate about skill … actually a re-adjustment I think at the later years … Year 2 and end of Year 2; Year 3 you will start to see that in majority of students … they will start to transform … say I am learning this because I really want to pick up the skills … and this is what I want to be in the future, and then … the passion I think comes in. Initially no. So I think the passion comes in a bit later … through exposure and teaching. (PJ, 2016, 38:20, p.9)

From my teaching experience, sharing personal work anecdotes and how I mastered my skills through a series of subjects, projects and practices attract students' attention and interest. Students seem keen on understanding about the profession through anecdotal experiences, and this has to be infused in the pedagogical approaches. A good example of doing this would be through PBL, which requires students to collaboratively explore solutions to an authentic problem with the guidance of a tutor. Such situation provides opportunities for tutors to share their industry experiences in solving similar problems with students.

Another factor highlighted by participants is necessity. An impending necessity would be a good rationale for learners to cultivate lifelong learning attributes. A good rationale, as expressed by TK, is that the need for individuals to upgrade or be left behind necessitates upgrading. TN, TK and HK also share this sentiment. TK expresses such a necessity as follows:

> because I find that we are stuck in the workplace, and we feel that our expertise is enough … we won't want to learn any more. Unless we know that the things are changing so fast ... we can't stop then the motivation to keep on learning will be there. (TK, 2017, 26:05, p.8)

Some participants feel that without motivation, passion and self-regulation, it would be difficult to nurture lifelong learning attributes in polytechnic students. Participants also share that extrinsic incentives do not have a lasting impact in cultivating lifelong learning attributes. As TK laments,

> No passion for learning – even though we keep on saying that – lifelong learning is very difficult. All the incentives will not work. It won't work. (TK, 2017, 27:15, p.8)

The literature review discussion (Chapter Four) on nurturing agentic learners and deliberated professional attributes in graduates studying within a Practice-based Education (PBE) environment dovetails with this lifelong learning perspective from participants. The current lifelong learning attributes, in the graduate profile found at Poly T, are wide-ranging and generic. The graduate profile at Poly T has to encompass Agentic Learner, Deliberate Professionals (DPs) and lifelong learner attributes. Such a profile should also be aligned to the professional needs of the industry. This idea will be made as a recommendation in the next chapter.

TE3 – Pedagogical Clarity

TM is upset with the way students are confused about what PBL entails as pedagogy and states, "you go around claiming you are doing PBL, I don't mind whatever you claim anything you want, but don't confuse the child" (TM, 2016, 05:42, p.2). The expression highlights the lack of clarity of pedagogy among staff at the Polytechnic.

Clarity on Pedagogical Approaches and Flexibility of Use

Many participants, TM, JR, TK, HK and KL, call for clarity of pedagogy and flexibility of its usage. Clarity in defining various pedagogical approaches promoted at Poly T, such as PBL, elearning, self-directed learning and PBE are necessary for the purpose of teaching. TK acknowledges this in answering a question on the clarity of pedagogy as follows: "(c)larity … honestly speaking sometime we are not very

clear also" (TK, 2017, 33:59, p.9). And during the interview, TK differentiated active learning and experiential learning as follows:

> active learning there is still some facilitation going on – Yes – not totally on their own. Experiential learning … I believe is more on their own. (TK, 2017, 10:20, p.4)

From the citation above, it is clear that some staff do deploy pedagogical approaches based on their limited understanding of the process. HK shared that the lack of clarity generates inconsistent practices among staff. To some degree, it also fails to convince staff on the pedagogical approaches to be undertaken in their teaching. This leads to staff undertaking some practices haphazardly. HK conveys this as:

> when certain pedagogical practice has been made compulsory – even that – I think the implementation wasn't that beautiful – some people do it because they have to do it – some people drag their feet – some people in the end don't do a proper job – I feel there is still quite a way to go. (HK, 2017, 42:48, p.10)

Some participants, KL, JR and TN, also feel the need for flexibility in adopting pedagogical approaches within the diploma. The common concern is that the nature of some subjects is so different that some requirements prescribed for certain pedagogical approaches by the institution do not fit. In such instances, there is a tendency for staff to adapt or 'play down' aspects of the prescribed requirement in their implementation. KL recounts it as:

> what I observe is that … possible because of our nation – we really follow the protocol – although – when there are certain steps that they may not … totally agree … they will play down, less of omitting. (KL, 2017, 38:28, p.8)

JR spoke about the lack of clarity on the pedagogical issue and the flexibility to adapt in recounting the case of PBL implementation. JR states:

> if you ask me, for the longest time, you know, we talk about problem-based learning and [School] always had some reservation about this and simply because you know we think we are doing it already. (JR, 2017, 30:50, p.9)

The lack of understanding what PBL entails, with prescribed details furnished by the institution, is still an area of contention among staff. Some staff feel that they are practising PBL but are not adhering to the prescribed details from Poly T. I feel that establishing guidelines on pedagogical approaches do not necessarily provide clarity. In my opinion, a deeper understanding of the principles underpinning the pedagogical approaches will provide clarity. Such clarity will provide staff with the flexibility required in designing the teaching practices and pedagogical approaches that suit the learners' needs and subject requirements.

Pedagogical guidelines

PJ and HK are apprehensive of the reasons pedagogy guidelines are formulated at Poly T. PJ argues that pedagogical guidelines are established for the purpose of accountability and not for clarity. The guidelines are used to govern the ISO (International Standards Organization) processes and its adherence to classroom practices. PJ feels that pedagogical rationale or reasoning may not be the key purpose of developing such guidelines.

PJ further elaborates that pedagogical guidelines should provide basic details to assist staff in deploying the pedagogy. And that there could be other mechanisms to support staff facing challenges in implementing the pedagogy. PJ considers guidelines as insignificant means of managing both the direction and challenges faced with pedagogical implementation. PJ voices this as:

> Guidelines are there to definitely guide to help someone see that this is it - an area that you should be looking at, should be aiming towards. I think there should be other mechanism[s] to address this kind of issues. I meant in terms of the challenges that lecturers are going to face. There should be other mechanism[s] to address that. There should be other instruments to look at the area. Because setting up the guideline and maybe enforcing even more guidelines does not … directly address this. (PJ, 2016, 40:01, p.9)

This argument extends to pedagogical terminologies used by staff without a clear understanding of them. TM cautions that such action becomes ‘dangerous' (underline in transcript denotes emphasis made by the interviewee) in stating:

> (p)eople use lots of terms without understanding the premises and concepts behind the pedagogy – using pedagogy without understanding the premises <u>becomes very dangerous at the end of the day.</u> (TM, 2016, 03:55, p.1)

TK shares how some staff have trivialised the use of some teaching practices. An example TK gives on how some staff interpret ‘active learning’ as a process of not teaching in class; “from chatting with my colleagues – they treat active learning like this – don’t teach [laughter]” (TK, 2017, 42:43, p.11). This is another instance of lacking clarity in teaching practice.

TM and JR suggest having a resource person, with good grounding on pedagogical matters to assist staff within their respective Schools and at the polytechnic level. The reason being that this individual will be able to facilitate and mentor staff in pedagogical endeavours and provide guidance very much required on the ground.

> I would hope that the school would identify individuals that would be important. … So it will be to the advantage of the school to set up a resource base. This is your academic resource base. You know this people here you can approach. (TM, 2016, 38:10, p.11)

TM believes the suggestion will also allow staff to immerse in the pedagogy and review the processes accordingly. TK concurs and adds that there seems to be a rush in getting pedagogy introduced in the polytechnic. Staff are given tight timelines on new pedagogy implementation and hence, lack the time and space to reflect and review the implementation adequately. As TK exclaims:

> things are running too fast for them to really sit down to think through – gives me the impression that – because the direction is there – everyone is gearing towards that. (TK, 2017, 03:42, p.2)

HK cites the lack of ‘honest’ feedback on teaching practice as another reason for the lack of clarity in pedagogical approaches. There is a tendency of providing ‘politically correct' feedback, and this is a disservice to the staff, and the teaching practised. The concern raised by HK is that giving honest feedback on teaching practice (such as misalignment of teaching practices to pedagogical principles) may be reflected in the staff’s appraisal and hence, such feedback is not given. HK believes that staff must be told in honest terms when there are non-alignment of pedagogical approaches with the theory and principles and the remedies that could be done about it. There needs to be a developmental mindset in this regard as HK states:

> even though it may be politically difficult – there need to [be] some yardstick - there need to be some ways to tell people – they are not doing the right thing – so that they will up [the] level – because there is a concern. (HK, 2017, 54:49, p.13)

eLearning

Similar concerns are raised with elearning practices at the Polytechnic. Although all participants generally accept the rationale of elearning approach, its implementation has been questionable. Participants feel that the practice is a ‘top-down’ directive on elearning implementation and the KPI (Key Performance Indicator) targets set for all diplomas. The quantitative targets drive the need to incorporate elearning into the curriculum. However, PJ, TN, JR and HK commented on the superficial practices done in meeting the KPI targets only. HK reflects on this as follows:

> your elearning, you do it to the extreme, than you can do it … like MOOC way which almost you can roll it out to many students with very few staff involved – but currently, we don’t practice that. It is still at very infancy stage for [Polytechnic name]. (HK, 2017, 05:51, p.2)

JR shares that some elearning subjects are better done as face-to-face modules. There is a forced fitting of practices just to meet some KPI and such process does not allow for flexibility at all. This

inconveniences staff and more time is devoted to adapting to elearning requirements. JR elaborates:

> again there are lots of reservation … we always prefer face-to-face delivery. Many of our elearning subjects are - you know the students come to us and tell us that we will be better off in a face-to-face scenario – so we go back to the classroom and meet them at different timeslots. (JR, 2017, 38:40, p.10)

The discussion within this theme of pedagogical clarity raises some pertinent concerns among participants. The desires for pedagogical clarity, guidelines and time to reflect on tasks are major concerns raised by participants. I think this may be a symptom of a lack of understanding of the basic principles underpinning pedagogy at the Polytechnic. I will discuss this concern as a recommendation in the next chapter.

TE4 - Structured Learning Approach

The next theme that I have generated from the interviews is the participants' desire for a structured learning approach to polytechnic education. The suggestion is to focus the first-year curriculum on nurturing foundational knowledge by scaffolding activities and instructions in the classroom for the adopted pedagogy. Participants feel that this allows for the transition of students from a teacher-centred secondary school learning environment. Then, second-year curriculum takes on industry practices through work-based learning, practice-based tasks and short industry visitations that expose students to the real world-of-work environment. This is followed by a third-year curriculum of practicum, internship and experience of the industry through workplace learning via attachment to learning enterprise and industry. Ideally, this structured approach would culminate with a capstone project i.e. major project, which is a polytechnic wide curriculum requirement. Students, hence, will have the opportunity to reflect on their preparedness for the industry. Participants feel that such a structured curriculum helps build confidence in students and graduate

them to be work ready. TN, RG and JR share this idea as reflected in the extracts from the interview transcripts below:

> my ideal situation will be a classroom learning followed by work-based learning followed by work-place learning… ideally, it should be year 1, year 2, year 3. (TN, 2016, 19:47 p.7)

> the year 1 should be like building the fundamentals, I don't believe in year 1 throw[ing] students into the industry … year 2 I guess it could have a so-called blended model with some industry experience. Maybe just by taking students to the factory visit, industry visit and more of that and if possible … a short internship or mini-internship - short apprenticeship… Year 3 needs to have more internship and major project needs to be applied. So more like a gradual thing that increases the percentage of exposure to the industry. (RG, 2016, 18:43, p.5)

> first year becomes foundation, second year we go further deeper into the discipline and third year become industry base. (JR, 2017, 28:05, p.8)

Hence, a structured curriculum approach of building foundational knowledge through scaffolding of instruction and practice-based and work-based learning followed by internship is the preferred structure for organising learning in the polytechnic.

No Didactic teaching for Polytechnic

Although there is a call for the first-year first-semester curriculum to be teacher facilitated, some participants, TM, TK and KL, are not supportive of didactic teaching practices for polytechnics. These participants feel that didactic i.e. 'teachers tell and students absorb' is not for polytechnic education. TK expresses this as, "definitely what I feel is not just tell them, and then they absorb" (TK, 2017, 10:08, p.3). Many do not accept the notion of 'spoon feeding' students with knowledge. KL goes on to state that:

> (d)idactic learning is definitely efficient [laughter] but is it effective or not – that is [a] question mark… I think <u>effectiveness</u> is more important. (KL, 2017, 42:20, p.9)

KL was referring to didactic teaching (mistakenly stated as 'learning' in conversation) assumed as an efficient method by many. Hence, a behavioural orientation of learning is ruled out for polytechnic education

generally although behavioural strategies can be useful and effective for some skills training e.g. teaching safety issues in workshop or hygiene in food science.

TE5 – Constructivist Approach to Teaching

The next theme, adopting a constructivist approach to teaching, contrasts interviewees' desire for a more engaging pedagogy as compared to a didactic-oriented pedagogy. The constructivist-oriented theme is also in line with my experience and desire for polytechnic education. A constructivist orientation to teaching requires a shift in the mindset of staff and how they view students' learning in particular. Many participants, PJ, TN, TM, KL, JR and RG, believe that students can be guided to learn from their experience of doing various activities. The use of experiential learning, collaboration, peer teaching, PBL, projects, work-based learning and PBE are means of adopting a constructivist orientation to teaching. Constructivist orientation also supports teaching at the workplace. This is iterated by PJ as follows:

> the important point about that is teacher-centred versus student-centred because teacher-centredness will mean that I just tell you and you just learn. And I think that is not how the industry works. Industry doesn't just say I tell, you do. Industry will actually say I show you and you learn. Overtime and I scaffold enough for you to follow along. So that is why I say a more constructivist approach is something that we should have here. (PJ, 2016, 09:13, p.3)

TN shares that students learning from their experience of doing projects with authentic tasks, visiting industry sites, attachments to learning enterprise and other experiential learning activities, need much scaffolding from their tutors. Students value such experiences, as it gives them a firm hold on the skills and practices that will be useful for them on graduation. TN elaborates as follows:

> to enhance student learning and mould them into a most ready candidate for the industry, I think experiential learning will allow them to experience the real environment very quickly. (TN, 2016, 18:25 p.6)

It is noteworthy that experience alone would be insufficient for learning. For experience to be effective in the learning process, there is a need to reflect on the experience. This reflective exercise would require tutors' scaffolding the process for learners, initially.

There are further evidences gained from the interviews that align to a constructivist approach to learning at Poly T. The following discussion on scaffolding, gamification, Predict-Observe-Explain, 'active learning' or engaging students and PBL reveals the strong alignment participants have with constructivist approach to learning at Poly T.

Scaffolding

Some participants also share that the art of scaffolding students' learning is aligned to the applied study orientation of learning at the Polytechnics. PJ emphasised the importance of scaffolding as critical to any pedagogy used within the polytechnic. Scaffolding, in line with Vygotsky's ZPD principle, is deemed as useful for Polytechnic applied educational context. This is how PJ explains it:

> pushing you … almost like a Vygotsky kind of model… ZPD … so I have learned up to this point, now I might push you [to] pass a certain boundary. I will always try and measure where you are at, and I always scaffold enough for you to move on and if there is too much I will lower down. (PJ, 2016, 10:26, p.3)

Gamification

Gamification is another key element of pedagogical approach highlighted for polytechnic education. Gamification, as PJ explains, allows for varying degrees of engagement of learners using strategies and techniques that game design avails to tutors. Gamification is differentiated from game-based learning where the latter relates to using games to stimulate learning. As PJ states, in gamification, the strategies and processes of engaging the learner or player (in the instance of games) are used to design lessons or modules. As such, lessons or modules are designed with the aim of challenging learners to acquire a specific skill at the quickest time possible to accomplish a

specific task. Such a motive designed into lessons or modules draws on gamification strategy in its learning design. PJ explains gamification as:

> the interesting thing about gamification is that the experience is equally important as the outcomes. Whether I got it right or wrong. Experience of actually enjoying the process, the experience of saying that I want to go further and I want to explore. These things are important in gamification. (PJ, 2016, 12:15, p.3)

Gamification is hence a means of nurturing learners to progress in their learning at their pace and enjoy the experience. I believe the triggering of prior knowledge and building from experience is hinted in this viewpoint.

PJ also views gamification as the overarching framework within which various pedagogical approaches are practised. Gamification, hence, forms the backdrop upon which staff can integrate different pedagogical approaches. PJ views gamification as:

> not a pure stand-alone pedagogy. So you can gamify PBL, you can gamify elearning, you can gamify project-based approach. (PJ, 2016, 06:55, p. 2)

In the same sense, PJ also underscores that a poor version of gamification is adopting a behavioural orientation to learning, where gamification is used to condition the ‘learning' process in students.

Predict-Observe-Explain

The strategy of predict-observe-explain that TK uses to teach Physics could be applicable for some disciplines within the polytechnic.

> I will take some Physic toy models … ask students to predict certain phenomena before I really do the experiments … then I will show them what’s going on … they will be amazed … I invite some students to give possible explanation of why this is happening. (TK, 2017, 6:30, p.2)

There is literature on predict-observe-explain (Liew & Treagust, 1995) and a refinement of that protocol to PEOR (Predict, Explain, Observe, Reflect) by Bonello & Scaife (2009) that TK is unaware. This teaching practice draws on a constructivist orientation of learning. The teaching

practice is adopted to move students away from being dependent on textbooks for all of their learning and make lessons more active and engaging. TK explains that when students predict and observe any phenomena, they are engaged and are eager to see if their prediction aligns with the understanding of the phenomena. If the prediction is not aligned, students' inquisitiveness is sparked, and they are engaged in finding out more. I believe and concur with the authors (Bonello & Scaife, 2009; Liew & Treagust, 1995) that such engagement with the activity draws students closer to the subject matter and cultivate passion.

'Active Learning' and Engaging Students

Some participants are sceptical of 'active learning' as a teaching practice. TK, HK, KL and PJ deem that all learning has to be active; hence 'active learning', as a terminology, may not imply anything in particular to teaching practices. Some participants reflect on 'active learning' as:

> honestly I cannot tell what (is) so special about active learning that isn't practised previously. (HK, 2017, 6:50, p.2)

> Active learning … I am not too sure if active learning is pedagogy or just something that people …try. (KL, 2017, 4:10, p.1)

> active learning … I see it more as outcome of constructivist pedagogy. I don't see it as pedagogy. (PJ, 2016, 3:15, p.1)

HK and TK feel the term is all encompassing and too wide to be classified as a teaching practice. HK shared that 'active learning' was occurring within PBL, projects and other teaching practices and that it translates as not pouring knowledge into the learner's head. HK feels that there is a strong contention to engage the learner in the 'active learning' rhetoric and this is encouraging. HK and TK also feel that engaging students and keeping them active in class does not necessarily translate to learning. TK conveys it this way:

> I will not say engagement makes them learn 100% but at least we keep them on task. (TK, 2017, 11:38, p.4).

‘Active learning' may keep students on task but I think the consolidation of that task into a reflective process that aids learning has to be designed by the tutor. This can be in the form of reflection, debrief or discussion on learning from the activity.

Problem-based Learning

All interviewees practised PBL, a core pedagogical approach at Poly T. There are, however, mixed feelings about a prescribed structure of the PBL approach implemented at Poly T. Some, RG, TM and JR, feel that such prescriptive means of implementation provide very little flexibility to staff. These participants feel that the prescribed stages in the PBL structure are not conducive for some subjects. Hence, some staff ended up force fitting the pedagogical approach to the subject. This is not favourable as the staff are just doing it to fulfil an administrative or audit requirement. RG and TM share some concerns with regards to PBL implementation as follows:

> PBL just do it … student headache we headache, no choice. (RG, 2016, 31:10, p.9)

Also, there are varying interpretations of what PBL entails and some participants shared that many staff are implementing different variations of PBL in their subjects.

> we do PBL and I go into the class and I say … have you done PBL before, and some of them say yes … let me explain this to you and I get students sitting there saying … you are very different. … because that is not the way the other (PBL lesson) is done … it can be quite frightening. (TM, 2016, 4:15,p.2)

TM shares that this is due to the lack of process put in place to consolidate and guide the implementation of PBL at Poly T. TM express this as follows:

> I think it is because we go through a training session and we say this are the 7 steps [of PBL] and first step is this and this and let’s do it. … there is no body there to guide them [staff] to tell or no review … say we have done PBL for one semester and what are the plus and minuses … [this] has to be done. You know – there isn’t an immersion and then I understand that clearly how it should be done. (TM, 2016, 39:05, p.11)

In addition, only half of the participants involved in this study could align the underlying principles of PBL to the constructivist orientation of learning at the interview. Others could not relate PBL approach to any principles of learning. This point reinforces my believe on the need for clarity of principles underpinning pedagogy.

TE6 – Mimic industry work – Learning through Industry Practices

Participants report pedagogical approaches that mimic industry work practices as useful for polytechnic education. Pedagogical approaches that involve learning enterprise, simulation, work-based and workplace learning are some examples mentioned at the interview. The next section will discuss some suggestions made by participants on pedagogical approaches for polytechnics.

Learning Enterprise (LE)

LE is very familiar to all interviewees, and they can relate to the different roles of LEs within their Schools.

> the learning should be … centered around certain practices. Industry practice, authentic practice so they could … work at the learning enterprise to drive the learning. (RG, 2016, 25:55, p.7)

> within our School there is the Learning Enterprise – so basically to immerse the students in a more authentic environment – so they will know what is the real world situation within campus setting. (KL, 2017, 4:20, p.2)

LE provides an experiential learning approach that orientates students to real life tasks but done within the protective borders of the educational institute. As TN explains:

> (i)f you are doing the real one then certain level of danger is there but however that is where the lecturers and tutors and the syllabus will all come in. Our job is to ensure that the students learn in a realistic yet safe … environment. (TN, 2016, 18:10, p.6)

LE is assumed as an appropriate training ground for students, before internship. Participants (KL, RG, HK & TN) are of the opinion that LEs provide a safe environment for students to hone their skills and be

supervised closely by staff. TN claims that stakeholders, especially students, parents and industry readily attest to the usefulness of LE in nurturing students for professional practice and internship.

> industry, parents and people generally know that our students come with experience gained from the exposure of work(ing) … café, kiosk, internship and projects. (TN, 2016, 37:40, p.12)

Simulation

All participants acknowledge the usefulness of pedagogical approaches that adopt simulation of real world environment for the purpose of teaching at the Polytechnic. Many of the centres of excellences at Poly T are in fact simulation centres for learning. However, only one participant (TN) has used such a centre for teaching. TN states that it allows for practice in a near real environment – "it is simpler … simulation …. not real … but is something that can be practised" (TN, 2016, 7:35, p.3). Most participants associate simulation with either LE or work-based practices. There seems to be an overlap in understanding between simulation and LE among participants. The divide between simulation, LE and other forms of teaching is unclear to some. This is how PJ express the doubt:

> like here in the studio, we are simulating the industry … but … they are literally working on real world projects, you could still say it is simulating, or emulating the industry … I don't know … bit of a grey area for me. (PJ, 2016, 3:45, p.1)

Learn through experience

JR feels that the experiences students get from being attached to LEs, engaging in real life projects and incorporating sustainability requirements in their task provides authentic learning experiences for students. Such learning experiences are critical to the polytechnic education setting.

> We alone as educators … we can't … the onus is also on the industry partners … when they go there, they practice and work on projects and that is where they start to hone their skills (during) SIP and more industry engagement … we need to co-partner with our industry … move with us hand-in-hand and help us make our students even better in the areas of skills development. (JR, 2017, 28:10, p.8)

Adopting pedagogical approaches that provides experience of work in industry is deemed as a key factor in the selection of pedagogy for some participants (JR, TN, PJ and TM). JR relates how teaching is very much aligned to industry practices as follows:

> it is not something that is new but that is how the industry also work and we need to mirror that in the studio. (JR, 2017, 33:25, p.9)

TM feels that it would be useful to involve industry partners in the evaluation of projects done by students. Bringing industry partners to the evaluation process gives real life exposure to students in relating with industry members. From my experience, students value feedback given by industry partners more than feedback by tutors.

> we are looking at industry-based project … because industry comes in for evaluation. We have done that also and we still do it. … we find that there is value in that because there is pressure now – external party is sitting in. (TM, 2016, 29:40, p.9)

This view is shared by JR who prefers to invite industry partners to the critique sessions they have for their subjects. Students get first-hand exposure of how industry partners critique works and the different perspectives they bring to the task. Such exposure provides students with the rich learning experience of the industry.

> we do have this partnership with [industry name] where we co-create the design brief … they come here twice. They sit in the critique sessions … give comments to students. (JR, 2017, 10:25, p.3)

Another advantage of learning through experience is for students to inculcate certain practices that are the norms of the profession. An example shared by one participant (TN) was the frequent and repeated changes made by the client to their projects even as the project was nearing the deadline. Such an occurrence in projects assigned by teachers on campus would generate students complaining about the tutor for changing the project specification so frequently. Although students initially complained about the frequent changes made by

industry partners, they learned to adapt to it and to manage the situation. TN explain this as:

> (h)owever, in week 10 or 11 you will start to see the difference. You will start to see these students trying to improvise and do things and then when we tell them the information is not here yet – they will know what to do … So they have written such reflection. We think it is a very good learning because you will never learn this kind of [things]. … you can teach them this kind of thing in class, but they will never be able to experience it themselves. (TN, 2016, 23:41, p.8)

I am convinced that the applied study nature of polytechnic education and the mission to graduate students who are work-ready dictates pedagogical approaches that mimic industry practices.

TE7 - Capstone Pedagogy – Workplace Learning

Workplace learning is a capstone pedagogical approach of polytechnic education since its inception. This is further boosted by the recent strong emphasis by SkillsFuture Council initiatives and drive. Workplace learning or internship, as it is referred to within Poly T, is the litmus test that ascertains students' preparedness for the industry. Workplace learning is done in the final year of studies and students are motivated in being attached to find out their readiness for the industry. The recent effort to extend the duration of internship from 12-16 weeks to 24-30 weeks is welcome by most participants at the interview. This change, resulting predominantly from the SkillsFuture Council's initiative, provides polytechnic students with more exposure to the industry in an effort of retaining more graduates within the profession. HK and KL share their views on internship as follows:

> internship is really important – really really important because without that they don't know how the real world is like – they may still be living in the ivory tower and think that everything is so theoretical. But the real world is not like that – real world is a lot messier. (HK, 2017, 24:30, p.6)

> I think having a long duration is better – because we have always heard of cases where by the industry … [is] very enthusiastic to train our students. They give them opportunity to have rotation. (KL, 2017, 25:07, p.6)

Preparing learners for learning at workplace

TK highlights the need to prepare students for workplace learning during the interview. TK states that a mindset change from learning within a classroom setting to workplace learning is required. As TK explains:

> because workplace is not you alone … [while] studying you are responsible for an answer … they [students] bring that mindset to work. … you are not learning for yourself… it is a response to peers … a lot of group work. (TK, 2017, 37:37, p.10)

The dynamics of learning at work is very different from that of learning in a classroom. Workplace learning also provides a means of measuring student's acceptance to remain within the profession. HK believes:

> internship expose them to the industry – sometimes – it is for the good – sometimes they learn better – that is nice – they realise that it is not for them – and then they change line. … So that is why, the government is always saying about the career guidance – if you have to guide them earlier than you have to know the real thing – than they work towards it –hopefully they won't get delusion along the way and suddenly change and then all the investment in them is wasted. (HK, 2017, 25:14, p.7)

Learning at the workplace requires different skill sets. KL concurs with this viewpoint, and the need for students to be prepared for workplace learning is discussed in the literature review (Boud & Solomon, 2003; Tennant, 2000). The need to weave these attributes into the curriculum and teaching practices is made more prominent now in polytechnic education in light of SkillsFuture initiatives. Furthermore, the discussion in the literature review on ways of nurturing students for workplace learning and the needs of PBE for polytechnic are relevant here.

KL recounts how such a gap in preparing students for workplace learning is currently managed:

> I have to be so explicit to tell them when you go out there … the learning is not restricted to your supervisor standing next to you and say come sit down – let me teach you what you need. They may not be teaching you at all. They ask you to do price tagging the whole day – but you can learn because when you do price tagging, you are also observing what is going on. (KL, 2017, 26:47, p.7)

The need to prepare students for learning in the workplace is hence clear. The eight themes and sub-themes discussed in this section analyses pedagogical approaches and teaching practices and what stakeholders wish to see practised in the polytechnic. I will consolidate these themes into recommendations in the next chapter. The next section will discuss how polytechnics can accommodate stakeholders' expectations on pedagogy.

RQ4. How can the Polytechnic accommodate the key stakeholders' expectations on pedagogies?

PJ makes an observation that there are different stakeholders at the forefront of polytechnic education over the past few decades. At one point of time, staff played a dominant role in determining the direction and pedagogical initiatives at the Polytechnic. Staff's experience and industry expertise that they brought to the polytechnic are seen as key pillars in determining the direction of polytechnic education. This trend has shifted towards students, as 'consumers' of the educational process and their preferences dominated the influence of pedagogy. Recently, industry has come to the fore especially with the SkillsFuture initiative that is sweeping through the Polytechnic landscape in Singapore. PJ recalls this as:

> (I) remember at one stage teachers were the biggest markers. Their voice determines… then students became a big marker and were called consumer – the whole consumer came into education. And that's now seem to be a norm … So from that sense, I think we will shift. (PJ, 2016, 31:01, p.7)

The expectations of the predominant stakeholders at a particular period seem to have a bigger than impact in shaping polytechnic pedagogy. There are a few themes emerging from the interviews for this RQ. Balancing the demands of stakeholders, provisioning a support base for pedagogical development, and engaging staff are the three themes I have generated for this section.

TE8 - Balancing the demands of stakeholders

The expectation of pedagogical changes is made by all stakeholders i.e. students, industry, parents, MOE, SkillsFuture, management and staff. The common feeling among participants is to balance such pedagogical demands by the stakeholders. Some participants, RG, TM, and HK, feel that the balancing process has to take into consideration the long-term needs of polytechnic graduates' employability and the needs of the country. In this regard, RG feels that staff and polytechnic management play a crucial role in balancing the demands of industry, students, MOE and parents. Staff and polytechnic management also have their own expectations. All of these have to be balanced in charting the direction of polytechnic education. RG summarises this as:

> … it is conflicting. What students want may be very different from what the industry wants. So I guess our role is probably mediator – someone [who] can see the picture clearly, explain to every party why we do what we do. (RG, 2016, 33:36, p.9)

As the Polytechnic balances the expectations of different stakeholders, TM feels that the wider educational needs of the students should not be ignored. TM argues that education should adapt a holistic approach and meet the needs of preparing learners for the future. An example given by TM is that the polytechnic is neglecting the role of nurturing critical thinking and relevance of current affairs in learners now. TM iterated this as:

> I really feel that critical thinking and awareness of global affairs is pittance here. It is terribly sad. (TM, 2016, 49:55, p.13)

In a similar way, RG calls for the focus of polytechnic education to be on nurturing students' cognitive, thinking and PBL processes skills. These skills are deemed as pre-requisites for any pedagogical approach, as expressed by RG:

> (w)e shouldn't neglect other development areas such as cognitive skills or thinking skills, PBL skills, which are equally important. I think it is the pre-requisite for any pedagogical development. (RG, 2016, 10:18, p.3)

The need to balance the demands of different stakeholders, I think, brings the discussion to the mission of polytechnic education. The

applied study nature of polytechnic education in preparing graduates for the industry remains the core focus. I think this focus provides the necessary basis for balancing all stakeholders' expectation on pedagogy for polytechnic education.

TE9 – Provisioning a Support Base for Pedagogy Development

In meeting the expectations of stakeholders' demands and desires for polytechnic education, many challenges and ideas are put forth by participants. I have grouped these ideas within the theme of provisioning a support base for pedagogy development. The next section will discuss features of this theme.

Lack of literature on polytechnic education

RG identifies the lack of literature on polytechnic education in Singapore as a key challenge. RG feels that staff who are keen on improving their pedagogical approaches have difficulty finding relevant literature, particularly with a focus on polytechnic education in Singapore. This hampers the staff's pursuit of finding out more about their practices. JR also notes the lack of resources in facilitating staff's investment into pedagogical processes deployed at the Polytechnic. JR also cites this as a reason for the lack of interest among staff in pedagogy matters. JR argues that staff should be doing research on their pedagogical approaches and be innovative in aligning their teaching to the needs of the learners and industry. JR states that:

> we need to bring more lecturers to go into … research … experiment and look for new pedagogy and go back and implement. (JR, 2017, 38:42, p.10)

RG concurs and argues that systematic research, done through action research or other means, provides for reflection on pedagogical approaches adopted in the classroom. RG elaborates this as follows:

> I think that is the difference between just being an innovative practitioner and being an active researcher. … Do action research … collect data and analyse the results … at least you define some ways to evaluate that. Only based on that then you can have a more thorough and systematic understanding

> [whether] your approach works or not and how to improve. (RG, 2016, 10:25, p.3)

Some participants (RG, TM and JR) feel, and I concur, that research provides depth of analysis for staff in how pedagogical approaches adopted relate to their intended learning outcomes. The sharing of such research allows more colleagues to understand issues and would draw more discussion, interest and further research. All these augur-well for pedagogy development at polytechnics.

Shared community space for pedagogic practices

Another limitation discussed by RG and TM is the lack of shared community 'space' for staff at the Polytechnic. Staff practising new pedagogical initiatives lack 'space' or means of sharing and discussing their initiatives with colleagues. Both RG and TM specifically spoke of the need to cultivate sharing in enhancing pedagogical implementation at Poly T. In fact, RG feels that the need for such sharing and collaboration should be extended to all the polytechnics in Singapore as they may face similar challenges and can learn best practices from each other.

> we could create more platforms to share … best practices or the … research we have done both within poly and across poly even in some formal sessions or conferences. As polytechnic is very unique sector in the world stage not many other countries have them. Maybe we can do more local sharing … informal sharing session, get to know what other polys are doing. (RG, 2016, 39:02, p.10)

TM adds that staff "are not reading enough" (TM, 2016, 11:12, p.4) on pedagogy and hence do not share about academic matters widely. TM also feels that more time needs to be allocated for staff to share on academic matters, similar to time allocated for physical fitness at Poly T.

> I think we need to have a time freed up … just like for fitness (FIT) … We need a FIT for the mind. (TM, 2016, 11:15, p.4)

In addition, TM feels, staff should be encouraged to write papers and make presentations at conferences. Such initiatives, TM argues, should

not be seen as ‘time wasting’ tactics by staff, from their teaching roles. TM stressed that the current messaging from some management staff was that writing paper for journals and presenting at conferences are ‘burdensome' activities not aligned with the primary objectives of the Polytechnic. This misconception has to be corrected.

Profile of learner

As pedagogical approaches are aligned to learners’ needs, staff need to have a good understanding of their learners. RG ask for better profiling of learners. As a wide spectrum of students comes into the Polytechnic, profiling their learning needs and other related areas to learning is deemed necessary. The lack of a good profiling process of students enrolling into Poly T is another concern raised by RG. A detailed profile of learners will provide staff with useful information about their learners. This could also influence staff’s design of pedagogical approach adopted for their modules. RG articulates this as follows:

> I think … we need to understand the students profile … not just in terms of their GPA (Grade Point Average) but more things in terms of personality, interest level, motivation, what’s their aspiration, we need to understand where they come from for their study. (RG, 2016, 10:16, p.3)

The provisioning of various mechanisms for staff to better engage in pedagogical matters is emphasised in this theme. Staff as the key stakeholders of pedagogy at the Polytechnic have some specific challenges that need to be addressed. These are discussed in detail in the next theme on ‘engaging the staff’.

TE10 – Engaging the Staff

Staff Orientation to Learning

PJ raises concern on staff's orientation on how students learn and the design of their teaching. PJ feels that staff has to move away from a teacher-centred approach towards a student-centred approach to teaching. This shift has to be managed as most staff, PJ believes, came

from a teacher-centred educational environment and may have the 'sage on the stage' mindset.

> other challenge is the mindset … Because the way we have experienced education is different. … you tend to teach the way you have learnt. … I think there is a transition when you come in from industry because you may not understand the nature of the students. That's where good pedagogical information is important. Because you must know where to give and when to take and when to draw a line and when to say no and how much [to] scaffold ... (PJ, 2016, 39:08, p.7)

TN echoes this concern and states that the prevalence of 'disruptive technology' and 'disruptive economy" is another factor that will force staff to accommodate to rapid changes. TN argues that staff have to be prepared for wave-like changes, not ripples, that globalisation and disruptive technology and economy will bring to polytechnic education. TN argues that staff will have to be ready to adapt and that the 'sage on stage' mentality does not augur well for the future.

> The disruptive economy … will cause a lot of waves not ripples … to the planning … of the curriculum in the polytechnic … the challenge for us is to get all the staff to get the mindset to catch up with times and be prepared for this and for me I have personally experienced colleagues who [are] … rather not so receptive to changes. (TN, 2016, 28:13, p.9)

Top-down directives do not persuade

A few participants (PJ, RG, HK) shared that top-down directives on polytechnic education, especially on pedagogical matters do have a negative impact on staff. These top-down directions made in view of 'higher demands' from MOE are just being endorsed and 'pushed' through by polytechnic management. As PJ laments, "we move to and from pedagogy too fast without understanding them" (PJ, 2016, 40:15, p.9). Such 'top-down' directives do not have staff's engagement.

The consensus among many participants, PJ, RG. TM, HK and KL, is for polytechnic management to persuade and rationalise new pedagogic initiatives with staff. In addition, participants feel that the need to rush through initiatives to meet specified targets has no value.

HK shares that polytechnic staff as ‘knowledge workers’ need to be engaged in the new pedagogical initiatives. HK rationalises it as:

> the problem is that we are dealing with knowledge worker – they don't like to be forced to do certain things – how can we inspire them to want to – to introduce more innovation into the pedagogy aspect. (HK, 2017, 43:09, p.10)

Shadow or Group Teaching

RG and TM suggest promoting shadow teaching and group teaching to inculcate pedagogical understanding among staff. Shadow teaching, RG explains, allows new staff to learn from more experienced staff. And for other staff, group teaching provides an opportunity to share and exchange ideas on pedagogy. The grouping may consist of staff with varied years of experience or expertise. Such group teaching process can act as a catalyst for new and innovative pedagogy for the polytechnic. RG shares the best practice as follows:

> a good practice our diploma do… is shadow teaching … Basically we are assigned a mentor and we are assigned a few classes to sit in … (these are) classes we will be teaching in the future. (RG, 2016, 34:08, p.9)

The themes of balancing the demands of stakeholders, provisioning a support base for staff and engaging staff, encapsulates the ideas shared by participants on accommodating stakeholders’ expectation of polytechnic education and pedagogy.

Conclusion

The chapter started with the profile of participants and a description of key stakeholders of polytechnic education and their influence on pedagogic matters. This is followed by an analysis of the ten themes discussed with the voices of the participants and my thoughts as well. In the next chapter, I will be putting forth my recommendations on the basis of what I have learned from the study.

CHAPTER TEN
RECOMMENDATIONS

Introduction

This chapter discusses the recommendations I am putting forward based on the research done on polytechnic education in Singapore. These recommendations embrace all the themes discussed in the previous chapter. The theme numbers (TE1, TE2…) indicated in parenthesis, links the themes to the proposed recommendation. The recommendations are not specific to each RQ but made collectively.

My recommendations, on reflection, have a constructivist orientation, as it reflects my positionality and outlook as an educator. The recommendations are intended to address issues raised by participants on pedagogical approaches for polytechnic education in Singapore. I have used my experience as a polytechnic lecturer and staff developer, and the knowledge construed through discussion with learned colleagues, academics and from literature to put forth the recommendations. I am also conscious of the desirability of practicality of the recommendations for possible implementation at the Polytechnic in Singapore. As an EdD thesis, bridging theory to practice is an important consideration in the recommendations proposed.

Recommendation – One (TE3, TE5 & TE7)

Clarity on Pedagogy

The discussion about clarity of usage on pedagogy, pedagogical approaches and teaching practices within a polytechnic setting highlights the need for a coherent approach on the matter. The first recommendation I propose is for the polytechnic to focus on the area of pedagogy in the polytechnic. This recommendation should have three sub-sections, namely Clarity of principles underpinning pedagogy, Definition of pedagogy and a Focused approach to pedagogy.

Clarity of principles underpinning pedagogy

The analysis on the theme of 'pedagogical clarity' (TE3 in Chapter Nine) highlights the need for clarity on the epistemological underpinning of pedagogy introduced at the Polytechnic. Only four of the participants were able to align principles of PBL to constructivism. This highlights a possibility that staff are reluctant to admit that they have uncertainty about aspects of pedagogy, for fear of embarrassment. In addition, staff adopting pedagogical initiatives have the responsibility of aligning the pedagogy to the subject's intended learning outcomes. This may necessitate innovative design of pedagogical approaches to fit the intended learning outcomes of the subject. Various other factors like meeting graduate profile requirements; students' learning needs; the environment and social issues also have to be taken into consideration. To make adjustments confidently, staff need to have clarity on the principles and pedagogical underpinnings. For a start, I think, it would be worthwhile to persuade staff on the value of understanding the underpinning principles of pedagogy. Such a process, I believe, will provide staff with clarity of purpose on pedagogy usage. This will also give confidence and guidance for innovative changes.

An example would be the need to state the epistemological basis of PBL, a core pedagogical approach at Poly T. PBL is premised on constructivist principles of engaging learners in the pursuit of knowledge through resolving ill-structured problems. Staff's understanding of the constructivist principles underpinning the pedagogical approach of PBL would better guide them in the design of their teaching practice. Adherence to the underpinning principles also provides coherence in the PBL practices done across the Polytechnic. Such clarity of purpose builds confidence in staff to share and discuss the challenges faced in implementing the practice as well.

Definition of Pedagogy

The lack of a common or defined understanding of pedagogy at Poly T is a concern for pedagogical development. Defining pedagogy for the Polytechnic gives staff and other stakeholders engaged in the learning process clarity. The Polytechnic deploys various pedagogical approaches such as PBE, PBL, LE, Project-based learning, elearning and so forth. There is a need to contextualise the various pedagogical approaches to the needs of the Polytechnic. As the Polytechnic matures as an institution, articulating its definition of pedagogy would be a good start in engaging staff on the pedagogic discussion. A definition of pedagogy is not cast in stone but acts as a premise for common understanding and usage. Definitions can change over time, based on usage and feedback from practitioners. The challenges and difficulties faced by staff will also create an opportunity for more discussion on pedagogy within the Polytechnic and for a possible generation of unique pedagogical approaches at Poly T. Such engagement augurs well for the learning culture in the Polytechnic. This could also be the premise of establishing professional learning communities within the Polytechnic.

I remember struggling to understand what pedagogy entailed in my initial years of teaching at the Polytechnic. There are no internal guidelines, other than commonly held practices, that staff duly follow. This should not be the situation for newer colleagues joining the Polytechnic fraternity and for those aspiring to be knowledgeable about their teaching practices.

A focused approach to pedagogy

There are various pedagogical approaches and teaching practices deployed at Poly T. Such varied usage does not provide the focus nor the energy required for the long-term development of teaching at the Polytechnic. Currently, there are excellent provisions for discussion on teaching approaches through the invitation of experts from overseas to come and be engaged with staff at the Polytechnic. Such sessions are

useful and generate much enthusiasm that only fades away over time to be resurrected by another new initiative. This has resulted in polytechnics adopting varied teaching initiatives at various periods. A case example with an exception to such practice is the polytechnic that has declared PBL as its core teaching approach in Singapore. At that polytechnic, there is a consistent effort in investigating and reviewing its PBL approach over the past two decades. This has resulted in an impressive list of research findings and published literature (Republic Polytechnic, n.d.). This proves the case for a prolonged and focused engagement on pedagogy at the Polytechnic. Staff engaged in the process will gain confidence with their practice, and this will invariably spur innovative ideas and productive approaches that will benefit the students over time. Hence, the recommendation is to have a focused approach to pedagogy at Poly T.

The three sub-recommendations point towards the need for clarity on pedagogy matters at the Polytechnic. The three ideas will enhance the way staff engage in adopting pedagogical approaches at the Polytechnic.

Recommendation – Two (TE5 and TE6)

Constructivist principles of learning to underpin Polytechnic Pedagogy

The pedagogical approaches and teaching practices identified by stakeholders as being deployed at the Polytechnic (Table 9.3) and the applied study orientation of polytechnic education aligns with the constructivist theory of learning. The applied study focus of polytechnic education in balancing theoretical knowledge with practical experience aligns with the constructivist orientation of teaching and the view on learning as constructing knowledge through experience. The strong emphasis on engaging learners in the practice of their profession, the SkillsFuture Council's increased importance placed on work-based and

workplace learning for polytechnic education are in tandem with the constructivist principles of teaching.

The PBE pedagogical model (Figure 6.1) promulgated in Poly T can easily include constructivist principles as the spine linking the various pedagogical approaches deployed over the three-year curricula. Explicit identification of constructivist orientation of teaching provides clarity and focus to the polytechnic's direction on pedagogy. The move by the MOE in Singapore in declaring Teach Less Learn More (TLLM) and Thinking Schools Learning Nation (TSLN) initiatives, both constructivist-oriented, are cases in point. The underlying premise of primary to junior college education in Singapore are clearly articulating a constructivist orientation of teaching and governs the direction for teaching. The polytechnic would benefit in declaring a constructivist orientation of teaching as its underlying premise, as it would provide clarity to both staff and students.

In the same token, the polytechnic could also articulate a set of constructivist guidelines for its use. There are many sets of principles in the literature on the constructivist approach to learning (Appendix 2). Adapting one of these sets of guidelines to the needs of Polytechnic would be useful in the dissemination of constructivist-oriented teaching within the polytechnic. My suggestion would be to adapt Glasersfeld's (2001) list to the needs of polytechnic education and adapting the terms to suit the local context.

Recommendation – Three (TE1, TE2, TE4 and TE7)

Preparing students for Workplace Learning

The third recommendation is to prepare students for learning in the workplace. Workplace learning is identified as the aim of the capstone pedagogy for the polytechnic. This is also the message from SkillsFuture Council's initiative and has been the directive for polytechnic education in Singapore since its inception. I have

discussed the necessity of preparing learners for workplace learning in the literature review chapter (Chapter Four). Table 4.1 from the literature provides a guideline on the learning attributes that students need to possess (before, during and after) for learning at a workplace and also to gain from a workplace learning experience. These learning attributes need to be nurtured and require the combined effort of all staff involved in facilitating students' learning over the three years of study within a diploma. Such learning attributes will become lifelong skills as learning at the workplace becomes pivotal in the future world of work. Hence, the recommendation is for a clear articulation of the attributes desired for students to be agile learners at the workplace. Similar to the current attributes that articulate the desired graduates profile, a similar listing of attributes for learning at the workplace is required. These attributes should influence the re-design of the curriculum where required and it should also determine the pedagogical approaches required for the modules. The design of pedagogy has to take into consideration the workplace learning attributes. A listing of workplace learning attributes for the specific professional area (unique to each diploma) would provide clarity of purpose and invoke the combined effort of all staff involved in nurturing students for learning at the workplace. These attributes also go in line with cultivating lifelong learner attributes in graduates. Continuously learning at the workplace and upgrading one's skills set is fast becoming a necessity for the future.

Recommendation – Four (TE5)

Profiling Polytechnic Students

Creating a profile for each student enrolled at the polytechnic, with information on her or his learning needs and academic interest would be valuable information to teachers. This is especially the case for a polytechnic that attracts students from a varied backdrop. Currently, the Polytechnic captures only the demographic data, past academic records and socio-economic data of students for mostly administrative

purposes. Tutors have very little information available on the learning needs and acumen of students taking their modules. It would be useful for the Polytechnic to establish a means of profiling students from a learning perspective. There should be a continuous process of generating information about the students throughout their polytechnic life. Students could also contribute to their profile, stating their academic inclination and learning desires. Such a profile made available to teachers provides valuable information that they can use in designing teaching activities that suit the needs of the learner. Learning analytics development in the field of education should be used for student profiling. This will provide rich diagnostic information to staff.

Recommendation – Five (TE2 and TE8)

Renew the Graduate Profile for Poly T

It is clear from the research that nurturing learners for the world of work in the future is crucial. Attributes of lifelong learning, agentic learner, deliberate professional, and other 21st century skills are requirements for all graduates. The current Desired Graduate Profile (DGP) of Poly T provides a generic set of attributes that lacks in areas of practice-based education and workplace learning attributes. As the future of work is changing drastically, there is a need to relook at the current DGP attributes to accommodate the needs of agentic learners, deliberated professionals and lifelong learners. The agentic attributes as listed by Billett (2015) and deliberate professional attributes by Trede and McEwen (2013) and the requirements of workplace learning attributes discussed in Recommendation 3 above could be adapted in line with local industry norms and the polytechnic educational environment. A renewed graduate profile should cater to the needs of the specific professional practice and not attempt to be generic to all. There could be generic skills that make the graduate profile, but the profile should reflect the nuances of functioning, learning and adapting to each professional area. For example, the graduate profile of a Cyber Security graduate should differ from that of a Visual Design graduate. A renewed

graduate profile unique to each diploma would provide focus and direction to all stakeholders.

Recommendation – Six (TE9 and TE10)

Encourage Educational Research & Build Professional Learning Communities

The need for staff to be engaged in systematic educational research especially in pedagogical approaches and teaching practices deployed at Polytechnic is the next recommendation. Systematic educational research is a useful means for staff to understand pedagogy thoroughly. The process of educational research, I believe, drives researchers deeper into understanding and exploring specific areas of teaching. This enlightens the researcher on the subject matter. Such research contextualised to polytechnic education in Singapore is another useful factor. The sharing of such research through publication and presentation engages others involved in similar practices. These activities build confidence and create a useful reservoir of resources for all stakeholders. Sharing of such research is also a means of nurturing professional learning communities. Such communities could provide practitioners with a platform to raise their doubts on pedagogical matters, especially with the uniqueness of polytechnic education in Singapore.

A ‘shared space' for staff engaged in pedagogy can also foster other suggestions made by interview participants in this study. Shadow teaching, team teaching, mentoring new staff, expert resource person within School and Polytechnic, could materialise through such initiative. This will provide for staff to engage and be engaged in polytechnic education.

Conclusion

The six recommendations made in this chapter, I believe, are practical to the current polytechnic educational landscape in Singapore. It is evident from the research that the Polytechnic needs to do more on

pedagogy. This is especially so with the SkillsFuture Council initiatives, that is drastically reshaping the polytechnic education in Singapore. The staff as key stakeholders in the design and implementation of pedagogy at the Polytechnic need to gain depth of understanding of the various approaches they bring into their classroom. The confidence gained in the subject matter i.e. pedagogy will empower staff.

CHAPTER ELEVEN
CONCLUSION

Introduction

The study on polytechnic education in Singapore: An exploration of pedagogies for a polytechnic, concludes with a set of recommendations that I think offers practical means of continuing the good work polytechnics have been doing in the Singapore higher educational setting. The study adds to the limited literature on pedagogy in polytechnic education in Singapore. The recommendations made would clarify the purpose of pedagogy and enhance the pedagogical approaches within the polytechnic. The study also addresses some of my predicaments faced as a teacher in the polytechnic. Hence, I believe, the research has achieved its intended objectives.

This chapter will reiterate the main findings from the research through the recommendations proposed. This is followed by a discussion on the criteria of evaluation established for the research as part of the conceptual framework for the research. The chapter concludes with identifying areas of future research and the limitations of this study.

Findings & Recommendations

The steadfast focus of polytechnic education in Singapore, on nurturing graduates ready with knowledge, skills and know-how to be work-ready immediately upon graduation is commendable. Secondly, the prolonged use of applied study methods for polytechnic education and their alignment to the newer initiatives of practice-based education and SkillsFuture Council's focus on skills mastery is another impressive feature of polytechnic education in Singapore. However, the lack of clarity on pedagogy, the appropriateness of pedagogical approaches to meet the changing needs of polytechnic education and the preparedness of staff for these purpose are some areas identified for change. It is in this context that the following six recommendations are

made for polytechnic education relating to pedagogy. The recommendations are:

1. Clarity on pedagogy
2. Constructivist principles of learning underpin Polytechnic pedagogy
3. Preparing students for workplace learning
4. Profiling Polytechnic students
5. Renew the graduate profile for Poly T
6. Encourage educational research & build Professional Learning Communities

The recommendations are derived from the review of literature, artefacts and the analysis of the interview with stakeholders. I'm confident that these suggestions are practical and will allow for greater engagement of staff in the pedagogy of polytechnic education if implemented.

Constructivist Conceptual Framework

The constructivist conceptual framework allows for the generation of ideas about the research focus. Using this framework, I was able to construct the pedagogy usage and its appropriateness for polytechnic education in Singapore. The viewpoints of staff, literature review, artefacts analysis and my inputs from teaching at the Polytechnic provided the evidence for the construction of themes and recommendations for the study. In this sense, the constructivist conceptual framework was educative in understanding the needs and perspectives of polytechnic education. The framework facilitates the research process of generating evidence from various sources in creating the narrative. It also allowed for my reflection on teaching and integrates my experiences with participants' perspective on the research focus. The conceptual framework naturally moved the research towards an interpretive method of evidence construction that aligned to the framework. The use of thematic analysis (TA) in understanding the evidence generated was also a natural alignment to the constructivist conceptual framework.

Evaluation of Research

I have been conscious in adhering to the evaluative criteria that I had set out in Chapter Two (i.e. Credibility, Confirmability and Fairness) for the research. The next section will briefly discuss each of the three evaluation criteria set out for the research.

First amongst this is the credibility criterion for the research. This requires establishing trustworthy and dependable findings and interpretation of the research. I have, at all stages, referred to the sources of evidence in the construction of ideas for the research. All ideas are cited to the literature, artefacts, interview transcripts or my reflection and experiences. I have been conscious in not influencing or putting forth my ideas above those of my participants. This was maintained especially during the interview process and the analysis phase. All the recommendations proposed were primarily constructed from ideas shared by participants. The credibility criterion is further strengthened through the profile of the participants. All participants are stakeholders in the polytechnic education process with varying degree of experience and roles in polytechnic education. The multiple perspectives they brought to the research are enlightening and provided for the credibility of the research process.

Confirmability, the second criterion, of research is ascertained through documentation of all evidence generated for the research. The full transcription of all interview data and the confirmation of the verbatim transcript received from participants adhere to the confirmability criterion of evidence generated. I also have at all possible stages quoted participants viewpoints on the subject matter in generating themes for the research findings. This enhances the confirmability criteria via showcasing the source of evidence for the analysis done. Although the process may not be as thorough as a financial documentation trail, I have been rigorous in mapping all the details

discussed in the respective sources and clearly stated when the viewpoints are mine.

I have also adhered to fulfil the third criterion of fairness, through complete coding of all interview transcripts and taking into account all the ideas that participants put forth on the topic of research. The process of aligning all recommendations to the various themes generated from complete coding of interview transcripts is another case in point in adhering to the fairness principle. By doing so, I am pleased to have honoured "the extent to which different constructions and the underlying value structures are solicited … within the evaluation process" (Guba & Lincoln, 1989, pp. 245-246). The fairness criterion was also enhanced with the diversity of participants interviewed for the research.

Notwithstanding my desire to adhere to the rigour of the research process, I may have inadvertently been blinded in my pursuit of evidence for the research. I have been reflexive with my processes and have made all attempts to close the gap in research methodology to my best knowledge. I remain vigilant to constructive feedback that may be given to me on my research as I continue my career as an educational staff developer at the Polytechnic.

Limitation of the Research

There are limitations to all areas of research. One limitation is the scope of my research. Polytechnic education is a broad area of study, and the exploration of pedagogy is limited to what I can research as a sole researcher. I am sure the same topic researched by a group of researchers would be able to generate much more ideas and inputs. This is attributed to a limitation of resources (primarily I as the only researcher) that I had at my disposal for the study.

The second area of limitation is to confine the research inputs from only staff from the institution. This provides one perspective on the issues

being researched. The research can be expanded to bring in the voice of students and other stakeholders like industry and government agencies involved in polytechnic education. Multiple perspectives from various stakeholders would have given much more breadth to the research.

Thirdly, the study is confined to only one polytechnic in Singapore. A comparative study of pedagogy at other polytechnics would have drawn more ideas on pedagogy and polytechnic education in Singapore. Such a comparative research may illuminate the difference in practice within the polytechnics in Singapore as well.

Areas of Future Research

One potential area of future research is to design ways of profiling students coming into the polytechnic. Development in the area of learning analytics and its related techniques offers much scope in profiling students' learning at the Polytechnic. The means of profiling students beyond the basic demographics into specific areas of learning, prior knowledge, confidence on subject matter, preferred means of engaging content and personal attributes in the area of study would provide useful information to tutors in designing lessons appropriately. Learning analytics is a subset of diagnostic assessment and this area can be researched further. The diverse group of students coming into polytechnics necessitates understanding them better. Such an exploration would generate useful information for the different stakeholders in polytechnic education.

Another possible research focus could be the discussion on Asian cultural factors and practices in adopting constructivist orientation to teaching. I have only touched the surface on the discussion in alluding to the Indian and Confucian thinking in relating to the constructivist ideas in the literature review chapter. The dual principles of radical

constructivism and its convergence with Asian cultural practice as in the case of Singapore offers a rich research focus.

Conclusion

A recent issue of the Economist (2017, January) reported that “(i)t is easier to learn later in life if you enjoyed the classroom first time around” (p. 9) The pedagogic experience students face in their three years at the Polytechnic could have an enormous impact on their professional growth and future learning needs. Getting a good understanding of the pedagogy of polytechnic education is hence a crucial area of investigation. The experiences we gain from our daily endeavours build our future. In all earnestness, I hope my humble exploration and sharing of polytechnic education and its pedagogy will continue the quest for research in this area.

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APPENDICES

Appendix 1 ASPIRE – Executive Summary and Recommendations

Annex A

Executive Summary of ASPIRE Committee's Recommendations Report

Our polytechnic and ITE system has been successful in enabling students to develop themselves and fulfil their potential. Its main strength is the emphasis on applied learning and its relevance to work and the careers pursued by its students. However, to meet the demands of the future and the aspirations of our students, the system must continue to evolve in an innovative and dynamic fashion.

All Singaporeans should have opportunities to realise their potential and progress in life, no matter what their starting point. Such opportunities can only come about with a strong economy. The recommendations focus on equipping our polytechnic and ITE graduates for the future so that they can seize opportunities and realise their aspirations.

We must support young Singaporeans to acquire the skills that they need to do well in their careers. In order to do so, we must create a strong skills system and industry linkages that support the alignment of the skills individuals have with what the job market needs. The education system must also evolve to keep pace with global developments.

We must create good skills-based progression pathways, help students and working adults make well-informed education and career choices, support learning on the job, and promote Continuing Education and Training (CET). We should build on our strong polytechnic and ITE system and our unique tripartite system to achieve these outcomes.

We need the right mind-sets so that everyone and every job is valued, employers take ownership of skills development, and lifelong learning is embraced.

These changes will require time and a concerted national effort, with many stakeholders involved.

Recommendations

Helping students make well-informed education and career choices

We must empower our youths to make well-informed decisions for their future. Our students should have accurate and up-to-date information to enable them to make good choices about their education and careers. Working adults should be similarly

empowered and equipped. Thus, we recommend the following:

- Recommendation 1: Strengthen education and career guidance (ECG) efforts in schools, polytechnics and ITE

Strengthening education and training in polytechnics and ITE

Our polytechnics and ITE must continue to provide a strong applied education, and equip their graduates with a strong skills foundation to join the workforce. We must also provide adequate support to help every student succeed in their studies. We therefore recommend the following:

- Recommendation 2: Enhance internships at the polytechnics and ITE.

- Recommendation 3: Increase *Nitec* to *Higher Nitec* progression opportunities so ITE students can deepen their skills.

- Recommendation 4: Establish polytechnic and ITE leads for each key industry sector to strengthen linkages with industry and help enhance programme offerings.

- Recommendation 5: Expand online learning opportunities to make it easier for individuals to learn anywhere and anytime.

- Recommendation 6: Provide more development and support programmes for polytechnic and ITE students to help every enrolled student succeed.

Helping polytechnic and ITE students deepen skills post-graduation

We need to provide more avenues for our polytechnic and ITE graduates to deepen existing skills or acquire new skills. We also need to better bridge the transition from school to work and enable our youths to apply the skills they have acquired, and build upon them further in their jobs. Hence, we recommend the following:

- Recommendation 7: Launch new programmes that integrate work and study, such as place-and-train programmes, to provide an additional skills- upgrading option for polytechnic and ITE graduates.

- Recommendation 8: Increase post-diploma Continuing Education and Training (CET) opportunities at our polytechnics to refresh and deepen the skills of polytechnic graduates.

- Recommendation 9: Support vocation-based deployments during National Service (NS) to help polytechnic and ITE graduates maintain their skills.

Helping polytechnic and ITE graduates progress in their careers

The changes to our applied education system will need to be well- supported by clearly articulated pathways of progression. These progression pathways and skills frameworks can also serve as benchmarks for hiring and progression practices within the industry. Thus, we recommend the following

Recommendation 10: Develop sector-specific skills frameworks and career progression pathways in collaboration with industry to support progression based on industry-relevant skills.

Conclusion

The ASPIRE Committee believes that these recommendations will help create more opportunities for our polytechnic and ITE students to progress and to achieve their aspirations. At the same time, they will help businesses with their manpower needs, and grow and develop talent pipelines. In so doing, we hope to secure a brighter future for each individual, and for our nation

Appendix 2 Principles of Constructivism

Author	**Pelech & Pieper (2010, pp. 32-41)**	**Glasersfeld 2001**	**Murphy (1997, pp. 11-13)**	**Phye (1997, p. 596)**	**Fosnot (1996, pp. 29-30)**	**Honebein (1996, p. 11)**
Title	12 Learning Principles of constructivism	Five main principles for teachers engaged in constructivist environment	18 characteristics associated with constructivist learning and teaching ideas summarised from literature reviews	Five constructivist principles for the teacher	Seven general learning principles of constructivism	Seven principles for the design of constructivist learning environments
Principles	Students learn by participating in activities that enable them to create their own version of knowledge. This includes creating their own rules, definitions, and experiments.	"Teaching does not being with the presentation of sacred truth, but creating opportunities to trigger the students' own thinking…prerequisites… teachers believe that students can think"	Multiple perspectives and representations of concepts and content are presented and encouraged.	Influence or create motivating conditions for students	Learning is not the result of development; learning is development. It requires invention and self-organization on the part of the learner. Thus teachers need to allow learners to raise their own questions, generate their own hypotheses and models and possibilities, and test them for viability	Provide experience with the knowledge construction process;

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
	Students learn when they teach others, explain to others, or demonstrate a concept to others.	Teachers need not only be familiar with subject matter, but have a “repertoire of didactic situations” (Glasersfeld, 2001, p. 10) to facilitate learners to build concepts in class through spontaneous interest.	Goals and objectives are derived by the student or in negotiation with the teacher or system.	Take responsibility for creating problem situations	Disequilibrium facilitates learning. 'Errors" need to be perceived as a result of learners' conceptions and therefore not minimized or avoided. Challenging, open-ended investigations in realistic, meaningful contexts need to be offered, thus allowing learners to explore, and generate many possibilities, both affirming and contradictory. Contradictions, in particular, need to be illuminated, explored, and discussed.	Provide experience in and appreciation for multiple perspectives;

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
	Students learn when they create products from the real world that involve narratives, explanations, justifications, and dialogue.	Teachers are misguided if they predict work done by students to be wrong. Students "effort must be acknowledge and effort made to understand where in the thinking process has the student not comprehend the concept or solution effectively.	Teachers serve in the role of guides, monitors, coaches, tutors and facilitators.	Foster acquisition and retrieval of prior knowledge	Reflective abstraction is the driving force of learning. As meaning-makers, human seek to organize and generalize across experiences in a representational form. Allowing reflection time through journal writing, representation in multi symbolic form, experiences or strategies may facilitate reflective abstraction.	Embed learning in realistic and relevant contexts;

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
	Knowledge comes in multiple forms, and its development is not uniform; hence, students must be given the opportunity to develop each intelligence or domain.	Teachers must have an "inkling of the students' present ideas and theories" (Glasersfeld, 2001, p. 11) to facilitate student thinking and construction of knowledge or concept.	Activities, opportunities, tools and environments are provided to encourage metacognition, self-analysis regulation, reflection & awareness.	Create a social environment that emphasizes the attitude of learning to learn… The learning process not the product of learning is the primary focus of constructivism…	Dialogue within a community engenders further thinking. The classroom needs to be seen as a 'community of discourse engaged in activity, reflection, and conversation' … The learners (rather than the teacher) are responsible for defending, proving, justifying, and communicating their ideas to the classroom community. Ideas are accepted as truth only so far as they make sense to the community and thus rise to the level of 'taken-as-shared.'	Encourage ownership and voice in the learning process

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
	Students learn when class activities stimulate multiple senses.	The “formation of concepts requires reflection, teachers must have available some means to provide it” (Glasersfeld, 2001, p. 11). The easiest way is to get students to talk about what they are thinking.	The student plays a central role in mediating and controlling learning.		Learning proceeds toward the development of structures, As learners struggle to make meaning, progressive structural shifts in perspective are constructed -- in a sense, 'big ideas' … These 'big ideas' are learner-constructed, central organizing principles that can be generalized across experiences and that often require the undoing or reorganizing of earlier conceptions. This process continues throughout development.	Embed learning in social experience;
	A student learns by creating knowledge at different levels of complexity and thinking.		Learning situations, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural			Encourage the use of multiple modes of representation;

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
			complexities of the 'real world'.			
	A student learns by connecting new experiences with existing knowledge or connecting previously discrete experiences to each other.		Primary sources of data are used in order to ensure authenticity and real-world complexity.			Encourage self-awareness in the knowledge construction process.
	Students learn when they are continuously presented with problems, questions, or situations that force them to think differently.		Knowledge construction and not reproduction is emphasized.			

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
	Students learn by making connections through the "Standard Six": compare and contrast, hypothesize and predict, express understanding in multiple modes, find patterns, summarize, and find personal relevance.		This construction takes place in individual contexts and through social negotiation, collaboration and experience.			
	A student regulates his learning by (1) knowing his own ability and learning style preference, (2) analyzing tasks and appropriate strategies, (3) choosing and analyzing appropriate goals, (4) analyzing and appraising his individual level of performance, and (5) managing his time effectively.		The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.			

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
	Students learn by working with other people who are the source of their contradiction, different perspectives, and confirmation.		Problem-solving, higher-order thinking skills and deep understanding are emphasized.			
	Modern society provides the source of authentic products for students to produce.		Errors provide the opportunity for insight into students' previous knowledge constructions.			
			Exploration is a favoured approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals.			
			Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and			

Author	Pelech & Pieper (2010, pp. 32-41)	Glasersfeld 2001	Murphy (1997, pp. 11-13)	Phye (1997, p. 596)	Fosnot (1996, pp. 29-30)	Honebein (1996, p. 11)
			knowledge acquisition.			
			Knowledge complexity is reflected in an emphasis on conceptual interrelatedness and interdisciplinary learning.			
			Collaborative and cooperative learning are favoured in order to expose the learner to alternative viewpoints.			
			Scaffolding is facilitated to help students perform just beyond the limits of their ability.			
			Assessment is authentic and interwoven with teaching.			

Cont'd – Principles of Constructivism

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
Title	Six major characteristics of constructivist teaching	Six requisite for constructivist teaching	Six theoretical underpinnings of constructivism	Eight design principles to facilitate knowledge construction	Seven characteristics of constructivist learning environment	Nine learning principles of constructivism in the Museum	Four principles central to constructivist learning and teaching
Principles	Active Learning. In order for students to create their own meanings and build their own understanding, they must be mentally and physically engaged in their work.	The phenomenon students are asked to think about needs to be interesting, worthy of engaging their time and attention.	Sensitivity toward and attentiveness to the learner's previous constructions;	Provide multiple representations of reality;	Provide experience in the knowledge construction process	Learning is an active process in which the learner uses sensory input and constructs meaning out of it. The more traditional formulation of this idea involves the terminology of the active learner (Dewey's term) stressing that the learner needs to do something; that learning is not the passive acceptance of knowledge, which exists "out there" but that learning	Embed learning in a rich authentic problem-solving environment;

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
						involves the learner s engaging with the world.	
	Work in Context. Meaningful learning that is conceptual rather than procedural occurs in authentic situations, not from memorizing facts and skills to be transferred and applied later.	It should offer a variety of avenues for exploration, various routes of approach.	Diagnostic teaching attempting to remedy learner errors and misconceptions;	Represent the natural complexity of the real world	Learners must actively seek information in the case, organise it, analyse it, interpret it and draw conclusions or recommendations based on this process	People learn to learn as they learn: learning consists both of constructing meaning and constructing systems of meaning. For example, if we learn the chronology of dates of a series of historical events, we are simultaneously learning the meaning of a chronology. Each meaning we construct makes us better able to give meaning to other sensations which can fit a similar pattern.	Provide for authentic versus academic contexts for learning;

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
	Student Autonomy. Students cannot create their own learning in tightly controlled situations. Thus, teachers should allow students to take more control of their learning by choosing their own books to read and topics to write about, selecting the materials from which they learn and setting up tier own investigations. Students in innovative classrooms do most of the thinking and talking, the teacher provides	Once these parameters are established, the teacher needs to listen carefully to students' interpretations of the data, paying particular attention to any individual's conundrums, puzzlements, confusions.	Attention to metacognition and strategic self-regulation by learners;	Focus on knowledge construction, not reproduction	Embed learning in realistic and relevant contexts	The crucial action of constructing meaning is mental: it happens in the mind. Physical actions, hands-on experience may be necessary for learning, especially for children, but it is not sufficient; we need to provide activities which engage the mind as well as the hands. (Dewey called this reflective activity.)	Provide for learner control

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
	guidance.						

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
	Social Learning. The construction of knowledge is greatly enhanced through discourse, in which ideas are discussed and 'proven'. (Fielding & Pearson, 1994; NCTM, 1991; Peterson & Knapp, 1993)	And the teacher equally needs to pay attention to differences of opinion within the class, giving equal respect to each one, for as long as any student takes it seriously.	The use of multiple representations of mathematical concepts;	Present authentic tasks (contextualizing rather than abstracting instruction);	Encourage ownership and voice in the learning process	Learning involves language: the language we use influences learning. On the empirical level. Researchers have noted that people talk to themselves as they learn. On a more general level. There is a collection of arguments, presented most forcefully by Vygotsky, that language and learning are inextricably intertwined. This point was clearly emphasized in Elaine Gurain's reference to the need to honor native language in developing North American exhibits. The desire to have material and programs in	Use errors as a mechanism to provide feedback on learners' understanding.

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
						their own language was an important request by many members of various Native American communities.	

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
	Teacher as Facilitator. In such learner-centered classrooms, the teacher moves away from dispensing information and towards guiding students' efforts to make sense of their work. The teacher designs situations that allow the students to learn by doing and that actively promote the students' thinking and investigating.	By focusing on puzzlements and contradictions, the teacher establishes the notion that ideas are complicated and worthy of time and consideration and that each student is capable of formulating interesting ideas.	Awareness of the importance of goals for the learner, and the dichotomy between learner and teacher goals;	Provide real-world, case-based learning environments, rather than pre-determined instructional sequences;	Embed learning in social experience	Learning is a social activity: our learning is intimately associated with our connection with other human beings, our teachers, our peers, our family as well as casual acquaintances, including the people before us or next to us at the exhibit. We are more likely to be successful in our efforts to educate if we recognize this principle rather than try to avoid it. Much of traditional education, as Dewey pointed out, is directed towards isolating the learner from all social interaction, and towards seeing education as a one-on-one relationship between the learner and the objective	

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
	On-going Assessment. Individually constructed meanings cannot be measured within the constraints of standardized tests. Innovative classrooms permit learning to be continuously assessed as student work, not through contrived questions at artificial checkpoints.	Further, the teacher acknowledges that 'not knowing' is a state that is important to live with….	Awareness of the importance of social contexts, such as the difference between folk or street mathematics and school mathematics (and an attempt to exploit the former for the latter).	Foster reflective practice;	Encourage the use of multiple modes of representation	Learning is contextual: we do not learn isolated facts and theories in some abstract ethereal land of the mind separate from the rest of our lives: we learn in relationship to what else we know, what we believe, our prejudices and our fears. On reflection, it becomes clear that this point is actually a corollary of the idea that learning is active and social. We cannot divorce our learning from our lives.	

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
				Enable context- and content dependent knowledge construction	Encourage self-awareness in the knowledge construction process	One needs knowledge to learn: it is not possible to assimilate new knowledge without having some structure developed from previous knowledge to build on. The more we know, the more we can learn. Therefore any effort to teach must be connected to the state of the learner must provide a path into the subject for the learner based on that learner's previous knowledge.	

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
				Support collaborative construction of knowledge through social negotiation.		It takes time to learn: learning is not instantaneous. For significant learning we need to revisit ideas, ponder them try them out, play with them and use them. This cannot happen in the 5-10 minutes usually spent in a gallery (and certainly not in the few seconds usually spent contemplating a single museum object.) If you reflect on anything you have learned, you soon realize that it is the product of repeated exposure and thought. Even, or especially, moments of profound insight	

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
						can be traced back to longer periods of preparation.	
						Motivation is a key component in learning. Not only is it the case that motivation helps learning, it is essential for learning. This idea of motivation as described here is broadly conceived to include an understanding of ways in which the knowledge can be used. Unless we know "the reasons why", we may not be very involved in using the knowledge	

Author	Heuwinkel (1996, p. 30)	Julyan & Duckworth (1996, p. 70)	Ernest (1995, p. 485)	Jonassen (1994, p. 35)	Cunningham, Duffy, & Knuth (1993)	Hein (1991)	Wilson and Cole (1991, pp. 59-61)
						that may be instilled in us. even by the most severe and direct teaching.	

Appendix 3 Interview Questions

Questions to Ask	*Prompts*	*Duration*
Preamble		3 mins

- Thank you for coming for the interview
- In order to meet ethical standards I need to outline the interview process so that you understand what is involved. I also need to give you a chance to ask any questions and finally, if you are happy to continue I will invite you to sign a participant consent form.
- My research is focused on polytechnic education and pedagogies -

  (Title of thesis: ***Polytechnic Education in Singapore. An exploration of pedagogies for a polytechnic***)
- The interview process:
  - With your permission, I will be recording the interview using two devices (show device – i.e. digital recorder and phone recorder)
  - Be assured that all responses will be anonymised in the write up and participants will not be identified in any way.
  - I will also destroy all the recordings 6 months after my graduation.
  - The interview will be between 30-45 mins. You can stop it at any time if you wish to do so.
  - You can skip any of the questions that I ask and there is no need to provide a reason. You can also seek clarification on the questions at any time.
  - You can also ask me questions if you wish.
  - Are you fine with the arrangements before we begin?

General Questions: **3 mins**

- How long have you been teaching at the polytechnic and what are your major academic roles now?
    - What were your academic roles previously?

- Subject leader; Section Head; Committee chair; School Pedagogy Lead, curriculum designer etc

- Are you familiar with the ASPIRE & SkillsFuture initiatives in Singapore?
    - In your opinion, how would you relate SkillsFuture and ASPIRE initiatives to polytechnic education?

- If NO – show them two sets of notes on ASPIRE and SkillsFuture
- If YES – any general comments on these initiatives? (Show the details as well)

RQ 1 - What pedagogical approaches are commonly practised in the polytechnic? **8 mins**

- What are some key pedagogies practises that you have used in the polytechnic?
- What are some other key pedagogies that are practices in the polytechnic to the best of your knowledge?

If there is a pause or seek to understand pedagogies better – (State – pedagogies such as PBL; Blended Learning; Experiential Learning; Project Based learning; Active learning, elearning, enterprise learning, project-based learning; workshop, simulation, work-based learning, workplace learning, etc)

- Which of these pedagogies do you believe are critical for polytechnic education and why?

RQ2 - Who are the key stakeholders and what is their influence on the pedagogies practised in the polytechnic? **8 mins**

- In your opinion, who are the key stakeholders of the polytechnic?

(Such as parents, industry, students, lecturers, MOE, Ministries, poly management, policy makers etc)
If need clarification on meaning of

stakeholder, do provide examples and clarify.

- What influences, in your opinion, do these stakeholders (that you have mentioned), have on the pedagogical practices in the polytechnic?

- In your opinion, who has the greatest influence, least influence? Why?

- Is this influence appropriate or useful in your opinion?
- Should there be any other stakeholders involved, influencing the polytechnic academic processes?

RQ 3 - What are the pedagogies that the key stakeholders wish to see practised in the polytechnic? **12 mins**

Looking at Singapore's polytechnic education in the future, with ASPIRE and SkillsFuture initiatives:

- What specific pedagogies should be deployed for polytechnic education, in your view?

Why do you say this?
What has led your thinking on this?

- What are your aspiration or hope of pedagogies for the polytechnic in the future?
    - What would these pedagogies, you mention bring to polytechnic education?

- Why do you think this or these pedagogy(ies) you mentioned above are critical to polytechnic education?

Prompt and probe for examples if none is given.

- Do you think these pedagogies are adequate for
    - Practice-based Education (PBE)?
    - Work-based Learning?
    - Workplace Learning?
    - Lifelong learning?
    - Skills mastery?

- In your view, are there any pedagogic design features or strategies that are particularly appropriate in polytechnic education?

- In your view, is there clarity on pedagogies adoption at:
    - Polytechnic * School * Diploma

- What do you foresee as the major challenges facing polytechnic education in terms of pedagogy?

3 mins

RQ4 - How can the polytechnic accommodate the key stakeholders' expectations on pedagogies?

- In your opinion, should the polytechnic accommodate the different stakeholders' expectations with regards to pedagogy?

General Wrap-up Questions **5 mins**

- Are there guidelines or indicators of pedagogies usage in your School/Diploma/Centre?
    - If so, can be elaborate
    - If no, should there is any?

- From your experience in teaching at the polytechnic, how would you describe students learning process and behaviour?

Conclusion **2 mins**

- Are there any other comments you would like to put forth with regards to the research I am undertaking? Refer to research question sheet again)

End of Interview

- Thank you for taking the time to share your thoughts with me.
- I will email you the verbatim transcript of the interview to enable you to check it if you wish to do so.
- Feel free to make corrections or additions to the transcript. I will only use the final version for my analysis and everything will be kept anonymous.
- Is there someone whom you can suggest that I should interview for my research?

Total **44 mins**

Appendix 4 Participant Information Sheet

Polytechnic Education in Singapore: An exploration of pedagogies for a polytechnic

I would like to invite you to participate in my research. This information sheet provides pertinent details about my research and your participation requirements. Please take time to read the following information and discuss it with others if you wish. I hope you will decide to support the research. Thank you for your time.

Project Proposal: ***(background, aim and duration of the project)***

Background

This research is done in partial fulfilment of the University of Sheffield's Doctor in Education (EDD) programme in which I am involved. Temasek Polytechnic is sponsoring my studies. The Principal & Chief Executive Officer (PCEO) has given his approval for me to carry out the research and interview the staff at the polytechnic.

Aims

The aims of the study are:

- To establish an understanding of current pedagogies practised within the polytechnic and the changes that will be needed to adopt the new directions being emphasized by the government for polytechnics in Singapore.
- To establish new pedagogical directions for polytechnic education in Singapore.

Why have I been chosen?

Pedagogic leaders, experienced staff, industry partners and those involved in polytechnic education are the targeted participants for my research. Your rich experience in polytechnic education will assist my study and hence I'm approaching you for your support. Your participation is purely voluntary and at your discretion in supporting my research.

If you decide to participate, you will be asked to sign a consent form. You are free to withdraw from the research even after signing the consent form at any time without providing any details. Participation is voluntary.

Duration of Research:

The research is projected to end by 30th April 2017. If for some reason, the research has to be stopped, I will keep you informed and provide the reason(s) for it as well.

What will happen if I take part?

Your participation will entail having a one-on-one interview with me (the researcher). The interviews will last for approximately 45 mins. You may also choose to end the interview earlier. The interview would be scheduled at your convenience.

The interview will be audio recorded and a verbatim transcript produced for your verification. Any recommended changes to be made to the transcript will be verified with the audio recording. If the recommendations are accurate, the changes will be made to the transcript. If the recommendations consist of new information that you wish to add on, these will be tagged as post interview information in the transcript. Such post interview details will be considered as such for the purpose of analysis. You also have the liberty of not answering any questions raised at the interview.

All evidence generated from the interview will be kept anonymous and confidential. No identification of participant will be made known to anyone. Only I will know the details. Analysis of evidence and findings will not disclose details of participants nor contain any details that may reveal the participants' identity. Hence, I do not foresee any risk incurred due to your participation in the research. All data collected inclusive of audio recordings will be destroyed 6 months after my graduation.

I hope the details provided would be sufficient for your decision on participating in the research. I truly appreciate your reading of this information sheet and look forward to hearing from you.

Feel free to contact me for any further details. If you have any complaints or concerns on any research matters, you could raise it with me or with my supervisor, Dr Jon A Scaife (j.a.scaife@sheffield.ac.uk). If the complaints or concerns raised are not dealt with in a satisfactory manner, you can write to the Chair of Ethics in the School of Education, University of Sheffield, Dr David Hyatt (d.hyatt@sheffield.ac.uk).

Thank you.

N.Vijayan
98313041
vijayan@tp.edu.sg

Appendix 5 Participant Consent Form

Title of Research Project:

Polytechnic Education in Singapore: An exploration of pedagogies for a polytechnic

Researcher: N.Vijayan (98313041/vijayan@tp.edu.sg)

Participant Identification Number for this project: ☐

Please tick the box

1. I confirm that I have read and understand the information sheet dated 19 Sep 2016 explaining the above research project and I have had the opportunity to ask questions about the project. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. ☐
3. I understand that my responses will be kept strictly confidential. I give permission to the researcher to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. ☐
4. I agree for the evidence generated from me to be used in future research and publication. ☐
5. I agree to take part in the above research project. ☐

_____	_____	_____
Name of Participant	Date	Signature

To be signed and dated in presence of the participant

_____	_____	_____
Researcher	Date	Signature

To be signed and dated in presence of the participant

Copies:

Once all parties have signed this participant should receive a copy of the signed and dated participant consent form, the letter/pre-written script/information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be placed in the project's main record (e.g. a site file), which must be kept in a secure location.

Appendix 6 Transcript tagged with post transcript details

VJ	Where do you think lifelong learning fits in?
RG 20:46	I believe in that deeply. I am practicing them. I am learning everyday literally online learning and a lot of other stuff, I believe. I don't think life long learning is necessarily within the SkillsFuture framework. Because lifelong learning is essential skills for all levels for JC students poly students for uni students. To me it is a very much stand-alone important stuff. I think it is definitely important and it is vital for personal growth vital for the national economy and everything. It is just a a find it is not so easy *<I mean it is not so easy to follow through>* because it depends on your motivation depends on your own capacity and your self-regulation a lot of things involved. If you just ask me if it is important, is it relevant definitely lah.

Appendix 7 Ethics Approval

Downloaded: 14/12/2016
Approved: 13/12/2016

Vijayan Narayananayar
Registration number: 120119291
School of Education
Programme: EdD in Educational Studies

Dear Vijayan

PROJECT TITLE: Polytechnic Education in Singapore: An exploration of pedagogies for a polytechnic
APPLICATION: Reference Number 011287

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 13/12/2016 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 011287 (dated 02/12/2016).
- Participant information sheet 1023072 version 3 (02/12/2016).
- Participant consent form 1023073 version 2 (27/10/2016).

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Yours sincerely

David Hyatt
Ethics Administrator
School of Education