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Developing Strategic Thinking Ability

A Study of the Master's in Management and a Metacognition Course

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Master's Program in Management

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Abstract

The purpose of this study is to improve the understanding of the ability of educational interventions to improve strategic thinking. It does this both by contributing to the available empirical data on the development of strategic thinking ability and by exploring potential; avenues of research, intervention designs, study designs, sampling issues and analysis problems, for future studies as part of a larger project to understand strategic thinking at Lund University. Specifically this study examines the impact of the *MiM* and the Metacognition Course on strategic thinking ability. It does this through the use of; the *CPP*, a self-report questionnaire and an analysis of the design of both interventions.

Strategic thinking is a term without a consensus definition, but for the purpose of this study it is defined, broadly, as the thinking that occurs in unfamiliar situations. This definition, while not one of consensus, is supported by a broad range of strategic management theory literature. While recognising the limitations attempting to deconstruct concepts such as strategic thinking, this study draws on previous work done by a variety of authors to understand the components of strategic thinking. This leads to a discussion of the ability to develop strategic thinking, with an acknowledgement that the available knowledge is fragmented due to the variety of understandings of strategic thinking and models of its function. Despite this there seems to be broad consensus that strategic thinking, or cognitive components that lead to strategic thinking can be developed. The majority of previous work has, however, examined this in the context of work experience. While there are studies on the impact of other interventions, including educational interventions, these studies have primarily been non-empirical or based on self-report methodologies. Therefore, this study makes an important contribution, not only to the future design of studies within *the Strategic Thinking Project*, but also to the available empirical knowledge on the ability of education to improve strategic thinking.

This study did not identify statistically significant differences in overall strategic thinking ability based on the interventions. However, interesting trends toward the improvement in overall strategic thinking ability and changes in cognitive processes that are speculatively related to the interventions tested were found.

Keywords: Developing Strategic Thinking, Cognitive Process Profile, Strategic Education, Strategic Cognition.

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1. Introduction

"Strategic behaviour is crucial for firms' growth and strong performance, especially when operating in a competitive environment" (Benito-Ostolaza & Sanchis-Llopis, 2014, p.785). Furthermore, it is argued that insufficient strategic thinking ability within management teams limits firm performance (Bonn, 2001; Casey & Goldman, 2010). Unfortunately, these abilities are posited to be lacking, among both senior managers in large corporations (Bonn, 2001), and, among business owners and managers within small to medium enterprises (Simuth, 2015).

Despite its clear importance for firm performance, the development of strategic thinking ability is not well understood. The focus of research in the field of strategy has been on understanding the characteristics of strategies that allow firms to succeed rather than fail (Porter, 1991). This has left the understanding of the processes by which a firm arrives at a strategy underdeveloped (Porter, 1991; Powell, Lovallo & Fox, 2011) even though it is regularly argued that cognition plays a role in the eventual outcome (Thomas, Clark & Gioia, 1993; Rhodes, 1996). To correct this, a greater emphasis on the individual's ability to think strategically is required (Rhodes, 1996; Felin & Foss, 2005; Powell, 2012; Nuntamanop, Kauranen & Igel, 2013). This is particularly so given there is a demonstrated variation among managers in strategic thinking ability or cognitive components thereof (Gavetti, 2005; Powell, Lovallo & Fox, 2011; Gavetti, 2012; Schmidt, 2015). To understand these variations in cognitive ability, and to understand whether this ability can be developed, there is the need for empirical studies focused on how people think when making strategic decisions and thereafter determining whether that thinking can be improved over time (Bonn, 2001; Bonn, 2005; Goldman, 2007; Powell 2012).

Given the importance of strategic skills and their apparent scarcity in business it is unsurprising that there is a growing interest in courses and programmes to develop strategic thinking ability (Easterby-Smith & Davies, 1983; Bonn, 2001; Casey & Goldman, 2010; Simuth, 2015). Yet, there have only been limited attempts to understand either the factors that contribute to the development of or the qualities that lead to effectiveness of, strategic thinking (Gavetti, 2012; Winter, 2012; Nuntamanop, Kauranen & Igel, 2013). Thus far research has focused on specific educational interventions and has unfortunately yielded variable results due to the studies' limited scope and the lack of an objective standard measure of strategic thinking ability (Goldman, 2007;

Winter, 2012). Unfortunately, developing an objective tool to measure strategic thinking ability faces a myriad of difficulties, not least of which is insufficient agreement as to what strategic thinking is (Steptoe-Warren, Howat & Hume, 2011). In this study a cognitive approach to understanding strategic thinking is pursued using a computerised assessment tool called the Cognitive Process Profile (hereinafter *CPP*). The *CPP* is a tool which its creators — Cognadev — argue provides an objective, consistent measure of an approximation to strategic thinking ability (Kleppestø, 2017a). If this is correct, then using the *CPP* allows objective measurement of differences in strategic thinking ability between populations exposed to different developmental opportunities and interventions and thus an assessment of the effectiveness of those interventions. The ability of the *CPP* to objectively measure at least something which correlates with strategic thinking ability and its cognitive components has been studied by Cognadev, the creators of the *CPP*, this research is discussed below in Chapter 5. In this study, while cognisant of the difficulties in verifying the ability of a tool to objectively measure something as complex and dynamic as strategic thinking, the effectiveness of *CPP* in this regard is assumed in alignment with a pragmatic approach (however, see further discussion below in sections 1.5 and 5.3).

1.1 The Strategic Thinking Project

This study is being conducted as part of a larger research effort called **The Foundations of Strategic Thinking** (hereafter *the Strategic Thinking Project*), led by Drs S. Kleppestø and C.-H. Nilsson (Lund University, ND). The aim of this project is to deepen the understanding of: what strategic thinking is, its cognitive elements, and how it may be developed (Kleppestø, 2017a). Its purpose is to understand strategic thinking in order to develop understanding of how managers can effectively think in an uncertain world (Kleppestø, 2017a).

There are three research aims that are being addressed by this project: first, to make a contribution to defining strategic thinking, secondly, ascertain the extent to which strategic thinking can be measured, and, thirdly, examine the extent to which strategic thinking can be developed (Kleppestø, 2017b). To do this three sub-projects have been initiated, detailed below (Kleppestø, 2017b):

- **Project 1.** *What do we mean by strategic thinking?*
- **Project 2.** *What do the best strategic thinkers do?*

- **Project 3.** *Can we develop strategic thinking ability?*

This thesis sits within project three, which examines the extent to which various educational interventions have an impact on strategic thinking ability (Kleppestø, 2017b). It is enabled by utilising the *CPP* to provide a consistent measure of an approximation of strategic thinking ability (although see discussion above, and, below at section 5.3) and is driven by increasing recognition of the importance of strategic thinking in leadership (Kleppestø, 2017a). While this study examines the Master's in Management (*MiM*) and a Metacognition Course (further information in section 1.4), other teams within the project explore different educational interventions:

- Masters in International Strategic Management, and, the Metacognition Course (Müller & Snijder, 2018); and,
- Master of Science in Engineering, Industrial Engineering and Management (Klarin & Pripfel, 2018).

All teams within project three utilise a similar methodology, examining the strategic thinking ability of students with or without a particular educational intervention using the *CPP* (Kleppestø, 2017b). Combined, the studies within this project aim to increase the understanding of the impact of educational interventions on strategic thinking ability, and through comparison between interventions, the attributes that are most pertinent to strategic thinking development. The choice of interventions, research questions and methodology of the present study has therefore been influenced by the purpose of *the Strategic Thinking Project* and the need to integrate the results of individual investigations.

1.2 The Purpose of this Study

The purpose of our study is to improve the understanding of the impact of educational interventions on the development of strategic thinking as measured by the *CPP*. Specifically this study will focus on the impact of two educational interventions, the *MiM* and a Metacognition Course, both selected as part of *the Strategic Thinking Project* and described below at section 1.4.

1.3 Research Questions

The primary research question is: **Does either the *MiM* or Metacognition Course improve the ability to think strategically as measured by the *CPP* (Current or Potential Work Environment) or a self-report questionnaire?**

In addition to examining the change in overall score, we examine whether the educational interventions have any impact on the cognitive components of strategic thinking ability. Therefore, the first secondary research question is: **Does either the *MiM* or Metacognition Course alter the cognitive processes measured by the *CPP* or a self-report questionnaire?**

An important part of understanding the impact of the *MiM* or the Metacognition Course on strategic thinking is the intention and design of the programmes, therefore the second secondary question is: **Is either the *MiM* or Metacognition Course intended or designed to improve the strategic thinking ability of the participants?**

In a previous thesis conducted within *the Strategic Thinking Project*, Sandelands and Singh (2017) found the there was negative or minimal correlation between the results of the *CPP* and the results of a self-report questionnaire developed by them. They hypothesised that this result was either due to a problem with the questionnaire, or an inability of students to accurately assess their own strategic thinking ability (Sandelands & Singh, 2017). In this study we assess students, at different times during the *MiM* using both the *CPP* and a questionnaire based on the factors identified by Sandelands and Singh (2017). Using this data we further explore the correlation between self-reported and *CPP* measured strategic thinking ability, extending on this work by Sandelands and Singh (2017). Therefore the third secondary research question is: **For *MiM* students, does self-assessed strategic thinking ability correlate with the assessment of strategic thinking from the *CPP*?** While the answer to this question does not provide direct support to the purpose of this study, it does assist the broader the *Strategic Thinking Project* by clarifying the probative value of self-report questionnaires for *MiM* students, clarifying the purpose of post-test questionnaires in future studies and providing additional empirical evidence to answer questions raised in previous projects.

1.4 Educational Interventions

The *MiM* at the Lund University School of Economics and Management is a 12 month, integrated clinical programme designed to provide hands-on managerial learning experiences (Lund University School of Economics and Management, 2016). There are four fundamental skills taught in the *MiM*: analytics, reflection (in the sense of learning about the uncertain world), synthesis ability (specifically in the face of uncertainty) and action (Lund University School of Economics and Management, 2016). While integrated the course is divided into six nominal units: leading individuals, groups and projects; functions of management; understanding management; learning, development and change in management and organisations; global challenges; and, a thesis project (Lund University School of Economics and Management, 2017).

There is evidence that metacognition forms an important part of the ability of individuals to learn any skill (Sternberg, 1998). The Metacognition Course is specifically designed to improve the strategic thinking ability of participants, particularly by increasing metacognitive ability (Kleppestø, 2018). The course runs for approximately 12 hours and includes both presentations on cognitive styles and a workshop exercise that emphasises awareness of different cognitive styles (Kleppestø, 2018). The workshops are designed to allow participants to experience using those different styles within a group setting (Kleppestø, 2018).

1.5 The Cognitive Process Profile

The *CPP* seeks to measure thinking processes and styles, potentially linked with 'strategic thinking' (Kleppestø, 2017a). During the assessment, participants use a set of digital cards to decipher a message written in non-verbal symbols; the cards have information — either helpful or unhelpful — for interpreting that message (Cognadev, 2016). The computer programme then extracts the 'externalised' thinking processes used by the participants (Cognadev, 2016). The participants are then required to provide a qualitative interpretation of the symbols in the form of running text for analysis (Cognadev, 2016). These two elements, when combined, identify how a person deals with uncertain information within a complex environment (Cognadev, 2016). In sum, the final report, analyses the participants' thinking skills, preferences and speed, as well as their learning skills and potential abilities (Cognadev, 2016). For an analysis of the theoretical underpinnings of the *CPP* see

below, section 3.2. For a discussion of the reliability, validity and limitations of the *CPP* see below, Chapter 5.

1.6 Thesis Outline

1.6.1 Strategy, Strategic Thinking, Cognitive Components, and Development of Strategic Thinking Ability

Within the context of this study strategic thinking is defined as:

"the thinking that occurs before and about making strategic decisions [where strategic decisions are those in which] we commit a substantial amount of limited resources for a long time and under great uncertainty" (Kleppestø, 2017a).

The development of the ability think strategically (as defined) could be approached from the perspective of different fields of knowledge (Goldman, 2007; Casey & Goldman, 2010). Within this study, we approach the development of strategic thinking from the field of strategy. Strategy can be usefully defined as the "alignment of potentially unlimited aspirations with necessarily limited capabilities" (Gaddis, 2018, p.25). The place of strategic thinking within the field of strategy is elucidated in:

Chapter 2 — Strategy and the Context of Strategic Thinking Development. This chapter describes a selected range of Strategic Management Theory literature in order to place this study within the broader context of strategic management. Strategic Management Theory is not primarily concerned with the cognitive aspects of creating Strategy (it being more interested in the characteristics of the strategies themselves). Yet, if the process of strategic management is considered as a continuum, there is a place for strategic thinking at the beginning, as the strategy is formed in the mind of the individual. In addition to providing this context, the primary relevant perspectives and dichotomies within the field are discussed to highlight the factors which are relevant to understanding the place of cognitive or behavioural perspectives within Strategic Management Theory.

Understanding strategic thinking, as a part of Strategic Management Theory, provides only a partial connection to the literature on on how strategic thinking ability may be developed. There are

variations of perspective on how strategic thinking should conceived and defined which shape the studies, and additionally, there is a pragmatic tendency to deconstruct the complex phenomena of strategic thinking to components. This study is not an exception and looks not only at a particular definition of strategic thinking, but also a range of cognitive components individual. The definition of strategic thinking and its dissection to components is discussed in:

Chapter 3 — Strategic Thinking: Definitions and Components. This chapter compares the definitions and components of strategic thinking that underpin this study, with other conceptions of strategic thinking. This is important because even among authors that take a cognitive perspective on strategy there is no consensus definition of strategic thinking, nor a standard list of its components. Therefore, comparison between studies of the development of strategic thinking are difficult due to the variety of different definitions and models of strategic thinking that those studies are based on. Similarly, while many of components are shared across different authors and definitions of strategic thinking there is no definitive list.

Finally, the various definitions and components of strategic thinking are assimilated to allow a survey of the literature most relevant to this study relating to development of strategic thinking ability.

Chapter 4 — Developing Strategic Thinking: A Literature Survey. This chapter describes the literature on the development of strategic thinking. It includes a description of the primary ways in which strategic thinking ability is theorised to be improved, primarily experiential models, but also games and educational interventions. Additionally, this chapter describes previous empirical studies of strategic thinking development. The primary focus is on studies of educational interventions, as they are directly comparable to this study, but also includes representations of empirical work examining work experience and games or simulations, and of the development of strategic thinking as defined within systems dynamics or game theory paradigms.

1.6.2 Empirical Study — The Impact of the *MiM* and Metacognition Course

Chapters 2–4 provide the theoretical basis for the study of the impact of the *MiM* and the Metacognition Course, first by linking it to the broader field of strategy, then by describing how strategic thinking is understood and deconstructed and finally by outlining the current state of knowledge on how it is developed. The subsequent chapters outline the tools, methods and

findings of the empirical work of this study to understand this development in the case of particular interventions.

Chapter 5 — The Cognitive Process Profile. The primary distinguishing feature of this study is the use of the *CPP* to provide an objective measure of strategic thinking. This chapter describes the *CPP* in greater depth, including its reliability and validity. The aim is to provide support in understanding the tool's capability to measure cognitive constructs. Additionally, the chapter acknowledges potential *CPP* limitations that may impact the utility of the test's findings.

Chapter 6 — Method. This section will describe the overall design of the study, its limitations and the tools used (aside from the *CPP* described in Chapter 5). This chapter clarifies the explorative paradigm within which the study is rooted and describes the approach to the confirmation of the findings. This segment also addresses how the research questions directly informed the various design choices. And, explains how the studies design, data collection, and scientific analysis, involves the use of different methods and several sample sources, targeting different research questions. Lastly, this chapter recognises various limitations of the design and samples and evaluates their potential impact on the findings.

Chapter 7 — Findings. The primary findings are presented for each research question. Ultimately, this study, as expected, does not provide statistically significant proof that either the *MiM* or the Metacognition Course improve strategic thinking. However, it does provide speculative findings, worthy of further investigation, that both interventions improve the median levels of overall strategic thinking ability, as measured by the *CPP*. Additionally, findings are presented that identify a range of potential impacts the interventions have on cognitive processes. Although it notes that currently these findings are inconsistent and require further study they do offer some insight into the potential impact of each intervention on cognition. Finally this chapter presents findings that support the conclusions of Sandelands and Singh (2017) that there is little correlation between self-reported strategic thinking ability and strategic thinking ability as measured by the *CPP* for students.

Chapter 8 — Discussion. This chapter discusses the findings in light of the literature and ongoing work in *the Strategic Thinking Project*. Specifically the chapter focuses on using the literature found on developing strategic thinking to understand both the impact that the two interventions had on

strategic thinking ability and to identify possible ways those interventions could be modified to have a greater impact. Additionally, in light of the exploratory role of this pilot study the discussion identifies study design and methodological lessons learnt for consideration in future work within the *Strategic Thinking Project*.

2. Strategy and the Context of Strategic Thinking Development

This study is conducted with the aim of understanding strategic thinking ability in the context of management. Therefore, this chapter aims to situate the study within the field of Strategic Management Theory.

2.1 Strategic Management Theory

The word strategy has its origins in classical Greece where it was used to describe the general's art of war (Freedman, 2013, p.xii). Strategy, entered the Western European lexicon during the enlightenment where the increasing scale of warfare led thinkers to believe its conduct could benefit from the application of reason (Freedman, 2013, p.xii). Although originally limited, as a word at least, to the realms of war and politics, strategy is now ubiquitous, each and every organisation needs a strategy and to act strategically is considered the pinnacle of decision-making (Freedman, 2013, pp.ix–xi). Business management is at the vanguard of this trend and the study of strategy within a management context is called Strategic Management Theory (Freedman, 2013, p.460–462).

One of the most cited strategy theorists, Porter (1991, p.95) states that the "central question of strategic management theory" is, why firms succeed or fail. Yet, in answering this question, Strategic Management Theory is pre-paradigmatic, with an array of authors arguing for a multitude of theoretical frameworks and definitions (Levinthal, 2011; Freedman, 2013). Stumpf (1989) envisaged strategy as the way people attain their objectives. Simpson (1997) in French (2009) argues that the key to good strategy is not good answers, but great questions. O'Shannassy (2005) envisages it as the way of solving strategic problems and Nuntamanop, Kauranen & Igel, (2013) as a process of building capabilities. Porter (1996) contributes with "strategy is the creation of a unique and valuable position" (p.5). Whereas Ahlstrand, Lampel, and Mintzberg, (2001) provide the definition of strategy as: plan, ploy, pattern, position and perspective. Note, not all these definitions are concerned with strategic thinking as we have defined it.

2.1.1 A Chain of Causation

One method of understanding the place of strategic thinking in discovering why a firm succeeds or fails is by dividing the question in time, to create a "chain of causality" (Porter, 1991, p.96). For any success, or failure, there is a chain of multiple causes. At the beginning of this chain lies the cognition of the individual creating the strategy. It is here, at the beginning of Porter's chain of causation, that the focus of this study is situated (Porter, 1991).

2.1.2 A Multi-Level Approach

The question of success or failure can also be divided by scale. It is possible to answer it from an; organisational, group, or individual perspective, or across multiple levels (Bonn, 2005; Felin & Foss, 2005). Given the clear interactions between scales it is unsurprising that there is support for a multi-level approach (Bonn, 2001). While understanding strategy within a multi-scale context is clearly important, most of the relevant literature has focused on organisations and industries, leaving the individual contribution under analysed (Hodgkinson, 2015). The focus of this study, on the impact of cognition on the ability of the individual to think strategically, contributes to improving understanding of an underdeveloped area.

2.2 Strategic Schools

Even within the narrowed focus on the role of individual cognition on strategy formulation there remains various perspectives on how to understand strategic thinking. A common method of categorising this variety is by schools (compare with other categorisations by Gavetti, Levinthal & Ocasio, 2007; and Porter, 1991). Ahlstrand, Lampel and Mintzberg, (2001), building on Mintzberg (1990, in Kippenberger, 1998), distil the disparate views on strategy into ten schools of strategic thought (see also the classification of French, 2009). The grand design, planning and positioning schools are primarily concerned with how strategy should be formed (Ahlstrand, Lampel, and Mintzberg, 2001). The vision, thinking, learning, culture and ideology, politics and power, and strategy imposed from the outside, schools, describe the practice of forming strategy (Ahlstrand, Lampel and Mintzberg, 2001). The final school, drawn from the authors' perspective, argues the creation of strategy is purely emergent, arising from many small decisions (Ahlstrand, Lampel and

Mintzberg, 2001). While this study could be considered to fit at least partially within the thinking, learning or grand design schools, it is not fully compatible with any of the nine schools.

Of greater relevance are the Carnegie and Behavioural Strategy schools which both concern strategic thinking but are not discussed in the ten schools construct. The Carnegie School, while interested in the cognition of individuals, tends to focus more on mathematical models for understanding the decisions those individuals using methods from game theory (Porter 1991; Gavetti, Levinthal and Ocasio, 2007). The Behavioural Strategy School is characterised by the merging of psychology, cognitive and social, with Strategic Management Theory (Powell, Lovallo & Fox, 2011; Schrager & Madansky, 2013). Unfortunately, the terminology of behavioural strategy is neither well defined nor widely used (Powell, Lovallo & Fox, 2011). Yet the aim of behavioural strategy, linking individual psychology with organisational strategy, and understanding how mental processes could affect organisations, is closely aligned with the purpose of this study (Powell, Lovallo & Fox, 2011).

2.3 Strategic Dichotomies

The division of Strategic Management Theory perspectives into schools of thought is common but not enlightening, for the purpose of providing a theoretical context for this study. The focus on individual cognition and the formulation of strategy in situations of uncertainty cuts across schools of thought (Wilson, 1998). The Behavioural Strategy School is perhaps most closely aligned to this study's perspectives but it remains underdeveloped and peripheral in the Strategic Management Theory Literature. Therefore, in order to drawout the primary relevant features of Strategic Management Theory, schools are not relied on, but rather the primary dichotomies within the literature are analysed for their impact on the study of strategic thinking.

2.3.1 The Known or the Unknown

Many of the differences in perspective from the literature stem from a difference in perspective on the nature of the world. Namely, how knowable the future is given the complexity of the environment and the time horizon of business strategy (Schmidt, 2015). There are those that view the environment as objectively knowable, a place where opportunities await discovery by those with the right tools and abilities (for example, Potter, 1991; Schmidt, 2015). Conversely, there are those that view the environment as so complex and dynamic, that it is, for all relevant purposes,

unknowable (for example; Ahlstrand, Lampel and Mintzberg, 2001; Denrell, Fang & Winter, 2003; Kim & Mauborgne, 2004; Gavetti, Levinthal & Rivkin, 2005; Levinthal, 2011). Epitomising the extremity of this perspective, McKenzie, Woolf, van Winkelen and Morgan (2009, p.210) state "leaders operate in this space, which is far from certainty and far from agreement, on the edge of anarchy and chaos".

The most widespread perspective on this question is that the world is at least partially unknowable, but, that there are options to facilitate those who wish to chart a course through that uncertainty (Leventhal, 2011). Gavetti, Levinthal and Rivkin, (2005) argue for this perspective, from the Carnegie School, calling it bounded rationality (originally coined by Herbert A. Simon, notably in Administrative Behavior (1947)), which recognises both the agency of the manager in strategy formation and the limits to managerial cognition in circumstances of uncertainty. In particular they respect the possibility of intentional strategy, while simultaneously recognising the limits of strategy created on the basis of imperfect information (Gavetti, Levinthal & Rivkin, 2005). Aligned with this perspective, the definition of strategic thinking within this study (see above, section 1.6) and the underpinning framework of the *CPP* (see below, section 3.2), is based on the idea that strategic decision making is decision making under conditions of uncertainty.

2.3.2 Planning or Thinking

The terms strategic thinking and strategic planning are often used interchangeably but have differences in meaning within Strategic Management Theory (Mintzberg 1994; Bonn, 2001; Casey and Goldman, 2010). The division centres on whether the formulation of strategy is rational or irrational, whether it follows economic or behaviour models (Casey & Goldman, 2010; Levinthal, 2011).

The exact differences between thinking and planning are not fully delineated (Heracleous, 1998). However, broadly, planning is considered an analytical, formal process, logical and linear, and often ascribed to the work of Porter (1991), although notably he uses the term strategic thinking (Heracleous, 1998; Casey & Goldman 2010; Mintzberg 1994a; Mintzberg 1994b; O'Shannassy, 2005). Mintzberg (1994a) criticises planning, stating that as analysis it can never be responsible for the creation of strategy, because creation requires synthesis. Mintzberg receives some support from proponents of strategic planning who admit that in the early years it suffered from serious design

flaws; being overly linear and simple, unable to deal with the complexity and dynamism inherent in strategy creation (Wilson, 1998; Liedtka, 2000). Conversely, strategic thinking, propounded by Mintzberg (1994a) among others, tends to recognise that strategy formation cannot, in the face of uncertainty, be logical or linear and must be more; creative, divergent, fluid and synthesising (Heracleous, 1998; Casey & Goldman 2010; O'Shannassy, 2005).

The predominant view, from the proponents of strategic thinking, has been that strategic planning is a subservient, axillary activity to the real work of strategic thinking (Mintzberg, 1994b; Heracleous, 1998; Bonn, 2001). Mintzberg (1994a) argues that strategy formulation is about synthesis, intuition and creativity and that planning, as analysis, can have no part in synthesis (see also Henkel, 2011). Yet, there are authors who argue that strategic thinking and planning are not dissimilar and both are important for strategy formulation (Heracleous, 1998; Wilson, 1998; Benito-Ostolaza & Sanchis-Llopis, 2014; Kazmia & Naaranojab, 2015).

Heracleous (1998), seeks to mediate the thinking/planning divide by arguing that both view strategy as something analogous to learning. Leidtka (2000), creates a model of generative planning processes which includes both thinking and planning at the centre. Benito-Ostolaza and Sanchis-Llopis, (2014) combine both into a concept they call strategic behaviour where thinking is the ability to create new business ideas and planning is the ability to implement strategic ideas.

2.4 Strategic Thinking and Strategic Management Theory: A Summary

The definition of strategic thinking used in this study (see above, section 1.6) places it within a particular limited context within Strategic Management Theory. Specifically this study is confined to examining individual cognition when thinking about the formulation of strategy rather than questions above the characteristics of successful strategy or organisation factors that impact strategic decision making.

Even within that narrowed focus there are many relevant perspectives from strategic management theory literature. Although the development of strategic thinking could fit within many schools (for example the Learning or Cognitive schools) it fits exclusively into none. This study sits close to the philosophical and methodological perspectives of the nascent school of Behavioural Strategy

but school not yet in wide acceptance and not fully developed. Therefore, instead of placing this study exclusively within a particular school the position relative to various dichotomies within Strategic Management Theory has been used to provide theoretical context.

It is clear the definition of strategic thinking used for *the Strategic Thinking Project* and model underpinning the *CPP* (see below, section 3.5) presume a level of uncertainty. Yet that uncertainty must not be so great as to eliminate managerial agency (as arguably occurs if ones agrees to a definition of strategy as emergent (Ahlstrand, Lampel & Mintzberg, 2001) which the authors of this study do not). Both the definition used and the *CPP* take a middle ground in the certainty/uncertainty dichotomy, arguing that while there is a large amount of uncertainty about the future, it is knowable enough that managers can make decisions if they have the cognitive ability to deal with uncertainty. Additionally, neither the definition nor the model underlying the *CPP,* make a claim that strategy formulation is either exclusively analytical (planning) or synthesis based (thinking). Rather, both (but particularly the *CPP*) acknowledge the fact that strategic thinking requires a range of cognitive processes or components which may be useful for strategy formulation in particular contexts.

3. Strategic Thinking: Models and Components

It is arguable that a concept as abstract and complex as strategic thinking can neither be exhaustive defined nor deconstructed into different cognitive components or processes. Despite the difficulties undertaking such an endeavour, a pragmatic approach to the study of strategic thinking is assisted by both definitions and the breaking down of the concept into components. Defining and deconstructing strategic thinking has been attempted by many authors and the definition of strategic thinking used within this study is not the only definition of strategic thinking (Narayanan, Zane & Kemmerer, 2011). Even among authors who use concept of strategic thinking broadly similar to that used by this study, strategic thinking is broken down into various different components. This chapter will outline two groups of strategic thinking models and the various ways in which a selection of those models deconstruct strategic thinking. Throughout, the models and components used in this study and in particular in the *CPP*, will be compared to those used by other authors. The aim of this chapter is allow comparison between the deconstruction of strategic thinking which underpins this study and the deconstructions used by other authors.

The importance of individual cognition for strategic thinking is clear (Thomas, Clark & Gioia, 1993; Heracleous, 1998; Laureiro-Martínez, Venkatraman, Cappa, Zollo & Brusoni, 2015). Yet the components and mechanisms of cognition that are important are more difficult to understand. As Mintzberg (1994a, p.7) states "[s]trategy making is an immensely complex process, which involves the most sophisticated, subtle, and at times, subconscious elements of human thinking". Fortunately some have taken on this challenge and developed models of strategic thinking (Rhodes in Garratt (ed), 1996; Narayanan, Zane & Kemmerer, 2011).

3.1 Two Groups of Strategic Thinking Models

The first group of models are process oriented, concerned with how strategic thinking occurs. Casey and Goldman (2010), working from a definition of strategic thinking which includes: conceptual thinking, systems orientation, directional thinking and opportunistic thinking, create a demonstrative model of how strategic thinking occurs. Their model is based on a non-linear process where thinking moves between: conceptualising, scanning, testing and questioning (Casey & Goldman, 2010). In their model when a person is thinking strategically they move between each of

these elements and between divergent and convergent thinking, continuously (Casey & Goldman, 2010). Kazmia and Naaranojab (2015), create a similar model of the strategic thinking process which emphasises that strategic formulation is a process of building mental models of an uncertain world. The importance of mental models of the environment to strategy formation is supported by others include, Porac and Thomas, (1990) who stated that "any explanation for strategic responses to competitive pressures must ultimately take into consideration the mental models of competitive strategists" (p.224). Gavetti and Levinthal (2000), created a mathematical model of thinking in situations of uncertainty and found that the most successful approach was to favour forward looking cognition. They found that in order to achieve better results, it was more effective to improve the cognitive model being applied, rather than to increase the quality of the inputs or analysis.

The second group of models are component based, they describe the attributes of strategic thinking. Liedtka (1998) created a model of strategic thinking which stated that strategic thinking was thinking with five specific attributes: a systems perspective, intent focus, thinking in time, hypothesis driven and intelligent opportunism. Liedtka (1998), like Heracleous, (1998), positions strategic thinking as a form of learning and as the result of development. Bonn (2005) also references systems thinking as a vital component of strategic thinking, arguing that to formulation of strategy requires view the problem and organisation as a whole, not merely as a sum of its parts. Another deconstruction is described by Brătianu, (2015) who states that strategic thinking is thinking about, time (decisions in the future), complexity (very complex), uncertainty and innovation (decisions are creative). Taking a slightly different perspective McKenzie, Woolf, van Winkelen and Morgan, (2009), create a model of conventional and non-conventional thinking, and argue non-conventional thinking is better suited to strategy formation. Their model emphases the role of dealing with uncertainty when formulating strategy and therefore aligns with this study's perspective on the degree of uncertainty in strategy formation.

The component based models rely on breaking strategic thinking down into separate cognitive processes, which, while contested, lends itself to creating a list of components of strategic thinking which can be understood and studied separately (Rhodes in Garratt (ed), 1996; Steptoe-Warren, Howat & Hume, 2011). Unfortunately, there is no agreement within the literature on a definitive list of those components, however, fortunately, there is considerable overlap (Steptoe-Warren,

Howat & Hume, 2011). Hanford (in Garratt, 1996) compared the components of strategic thinking (including for example, longer term, reflective and conceptual thinking) to those of operational thinking (including for example immediate, concrete and action thinking). Nuntamanop, Kauranen and Igel (2013) identified the relevant constituent skills as; conceptual thinking, visionary thinking, creativity, analytical thinking, learning ability, synthesising ability and objectivity. Bonn (2001) identified three elements: "a holistic understanding of the organisation and environment", "creativity" and "a vision for the future of the organisation" (p.64). The approach of Bonn (2001) is suggestive of systems and dynamics thinking identified by Jaques (1985) coupled with the necessity of creativity and vision identified by Mintzberg (1994a).

Sandelands and Singh (2017), on whose work, as part of *the Strategic Thinking Project*, our self-report questionnaire is based, compiled a list of fifteen core concepts of strategic thinking from the literature they surveyed. The fifteen competencies are: analytical, creative, conceptual, context oriented, divergent, flexible, future oriented, holistic, integrative, intuitive, process oriented, reflective, synthetic, systematic and visionary, thinking ability (Sandelands & Singh, 2017). While the literature review that they based this list on was not exhaustive, it was broad enough to be considered a representation of competencies commonly considered contributing to strategic thinking (Sandelands & Singh, 2017).

The *CPP* is based on an antecedent theoretical frameworks which include both process oriented and deconstructed component features. Therefore, its underlying theoretical basis can be compared to both of the groups of models described above. Additionally, while not making claims as to providing an exhaustive list of the constituent parts of strategic, or systemic thinking, it does measure various components which can be compared to those identified above by other authors.

3.2 The *CPP* — Strategic Thinking Models and Components

3.2.1 Overview of the Relationship between the *CPP*, *CIP* and *SST*

For a description of the mechanics of the *CPP*, see above, section 1.5. For a discussion of the reliability, validity, and limitations of the *CPP* see below, Chapter 5.

The *CPP* is a tool that aims to measure the strategic thinking ability of an individual. It does this by measuring a number of aspects related to how people complete the tasks required within the *CPP*

(Cognadev, 2016). The results of these measurements are not presented directly within the resulting *CPP* but are rather brought together in a variety of scores at an intermediate level of theorisation (Cognadev, 2016). There are three main groups of scores relevant to understanding strategic thinking: Work Environments, Cognitive Style Preferences and Information Processing Competencies (Cognadev, 2016). Work Environments are the highest level amalgamation of scores and results in both of the other groupings feed into the overall Work Environment Score (Cognadev, 2016). The measurements, groupings and report arising from the *CPP* are theoretically based on Cognadev's Information Processing Model (*CIP*) (Cognadev, 2016). In turn the underlying model of the *CPP* can be traced to a concept called Stratified Systems Thinking (*SST*) (Cognadev, 2016) that emphasizes an overall skill of strategic thinking. This section will describe each of these levels in turn, beginning with *SST*.

3.2.2 Stratified Systems Thinking

SST defines work in seven strata based on the complexity of decision making (Jaques, 1989). The *SST* model postulates individuals have different cognitive abilities to deal with complexity and further, cognitive ability becomes increasingly significant when exercising discretion in complex decision making work environments. Cognitive complexity is regarded as the degree an individual can differentiate and integrate information, are more comfortable with ambiguity and, in turn, can locate, process and integrate greater amounts during the decisional process. The model is affected by time constraints and possibly, age (Jaques, 1989). As an individual rises through the discontinuous layers, that person utilizes increased cognitive power and thus, can appropriate judgements and exercise proper discretion in environments of increasing complexity (Jaques, 1989). Jaques' theory appears to be based on the assumption an individual's cognitive capacity is limited and finite (Jaques, 1989). Jaques (1985) further argued individuals have different states of functioning when planning goal directed activities; further, the various levels of cognitive ability correlate with the ability to think farther into the future and to deal with greater levels of complexity. While *SST's* use of complexity appears relevant to strategy formulation, that theory has been criticised for being too simplistic (Boal & Whitehead, 1992). Boal and Whitehead (1992) indicate that *SST* considers only the individual's cognitive abilities, not whether that individual has the metacognitive ability to deploy them at the appropriate time.

3.2.3 The Cognadev Information Processing Model

The *CIP* assesses the styles, attributes, and processes considered by the *CPP* (Cognadev, 2016). Like the *SST* model, the *CIP* has layers of task complexity (Cognadev, 2016). The *CIP* model however is "holonically organized" meaning, it "consists of various subsystems, each of which incorporates and transcends underlying subsystems" (Cognadev, 2016, p.24). The integrated model contains six processes; these include metacognition and five performance processes: memory, exploration, analysis, structuring, and transformation (Cognadev, 2016). Each of which is required and used in strategic thinking in a dynamic, multi-layered way (Cognadev, 2016). A visualisation of the model can be seen below in figure 1.

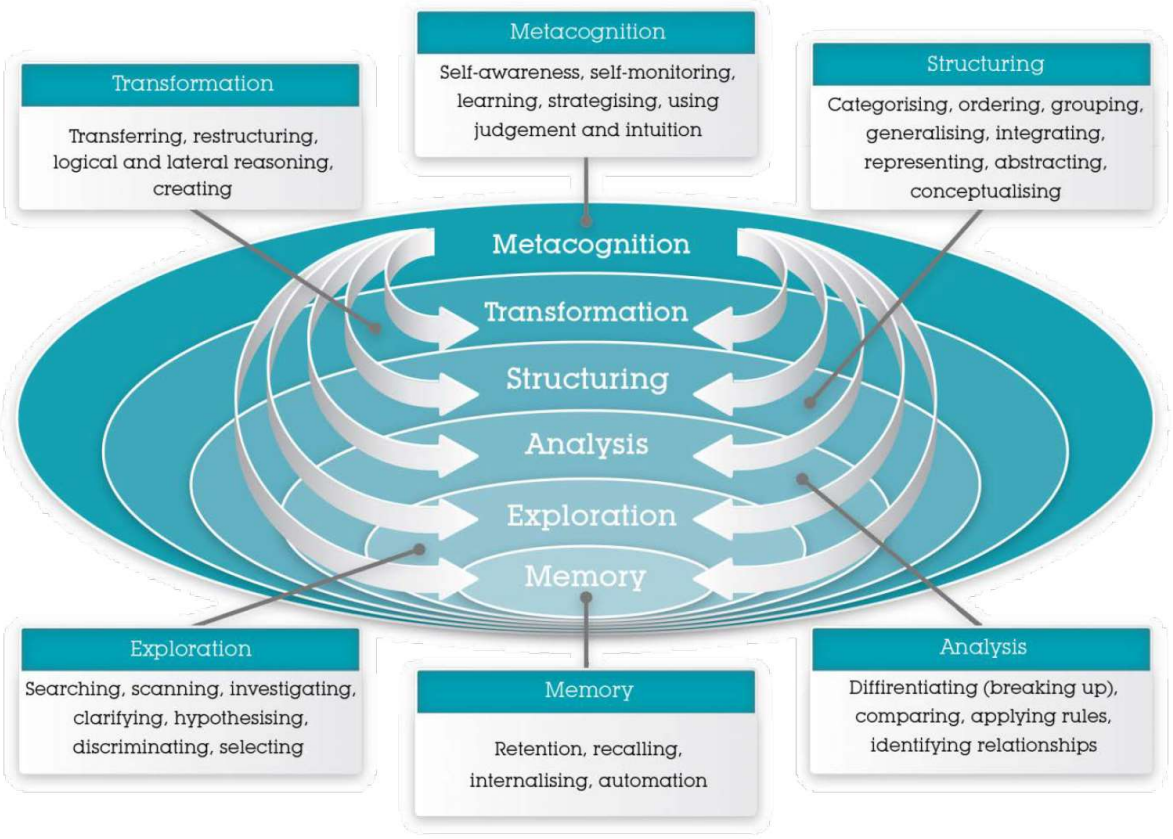

Figure 1. The Holonic Relationship of the Functional Processing Categories (Cognadev, 2016, p.25).

3.2.4 The Cognitive Process Profile

Prinsloo, while generally appearing to concur with Jacques, also highlights that different work environments require different types of thinking abilities (Cognadev, 2016). In turn, the *CPP* —

the profile which is based on the *SST* — identifies two primary work domains: the 'operational' and the 'strategic' (Cognadev, 2016, p. 11). These domains, in turn, are connected with five interrelated work environments: pure operational, diagnostic accumulation, tactical strategy, parallel processing and pure strategy (Cognadev, 2016). A visualisation of the work levels and their relationship to each other can been seen below in figure 2.

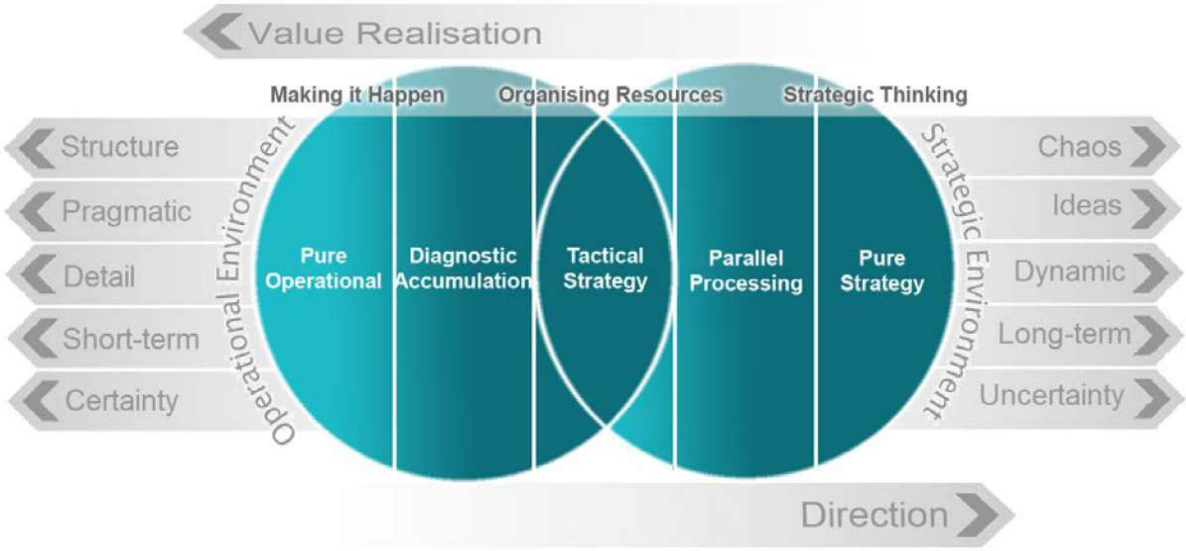

Figure 2. Characterisation of Work Environments (Cognadev, 2016, p. 12).

The work environments, shown above in figure 2 range from the purely operational to the purely strategic (numbered 1–5 respectively). With the nature of work environments changing in quality based on changes in the characteristic identified on the outside of figure 2. Those five work environments become increasingly complex and uncertain as they approach the "pure strategic" type of work domain (Cognadev, 2016, p.12). Within that context, the *CPP* assesses an individual's cognitive preferences and information processing capabilities (Cognadev, 2016). The assessment, in turn, considers the "number of elements a person keeps in mind simultaneously, the interactivity between these elements and the level of abstraction or vagueness accommodated" (Cognadev, 2016, p.11). Worth noting, Bonn's (2005) model similarly emphasizes an individual's capability to tolerate ambiguity as a critical element of strategic thinking ability. Prinsloo indicates the person's memory, used in connection with those elements, is the basis for solving problems (Cognadev, 2016).

The ability of an individual to function in any particular work environment is based on the rank order of their Cognitive Style Preferences (of which there are 14 described below, Appendix C) and

on their scores on Cognitive Information Processing Competencies (of which there are also 14 described below Appendix C) (Cognadev, 2016). The Information Processing Competencies are the basic element tested by the *CPP* therefore feed into other measures (Cognadev, 2018). The exact algorithmic relationship of these factors to the overall work environment assigned is commercial in confidence (Cognadev, 2016), but it can be representative understood in the context of the *CIP* which forms the theoretical basis for the *CPP* which can be seen in figure 1 above. Given that model, it is expected that higher scores on Information Processing Competencies associated with transformation and metacognition: Logical Reasoning, Verbal Conceptualisation, Judgement, Quick Insight Learning and Gradual Improvement Learning, correlate with higher strategic thinking ability (work environment) scores (Cognadev, 2018).

It is important to note that the assessment provided by the *CPP* highlights a person's cognitive potential but provides no timeframe for ones transition into a more complex work environment (Cognadev, 2016). In sum, the assessment provides static analysis: feedback evaluating how a participant applies the six processes noted above (Cognadev, 2016). Prinsloo acknowledges that an individual may change and, at bottom, reaching that person's cognitive potential may require more training and experience. Reaching that potential is "largely dependent on the person's current strengths and weaknesses, interest, motivation, exposure and the quality of the learning experiences encountered" (Cognadev, 2016, p.13).

Cognitive Style Preferences. The *CPP* measures preferences across fourteen cognitive styles (Cognadev, 2016). The measurement indicates that types of cognitive processing that someone uses when dealing with unfamiliar situations, although it is likely that would apply the same styles in familiar situations too (Cognadev, 2016) styles decrease the score for overall strategic thinking while others increase it (Cognadev, 2016). The *CPP* associates four styles with higher strategic thinking ability: logical, holistic, integrative and intuitive (Cognadev, 2016). Importantly, the meaning of the styles may differ somewhat from the normal meaning ascribed to the names used to denote the styles, therefore reference should be made to Appendix C (Cognadev, 2016). Note, that the *CPP* associates higher analytical ability with both operational and strategic thinking, whereas for the questionnaire it contributes fully to strategic thinking ability (Cognadev, 2016; Sandelands & Singh, 2017).

Cognitive Information Processing Competencies. The *CPP* measures a range of thinking processes, but these are presented in the *CPP* report at an intermediate level of theorising as Information Processing Competencies (Cognadev, 2016). There are fifteen Information Processing Competencies reported, but only higher scores on some of the competences contribute to strategic thinking capacity and potential for strategic growth (Cognadev, 2016).

4. Developing Strategic Thinking Ability: A Literature Survey

4.1 Introduction

The primary purpose of this study is to understand more about how strategic thinking can be developed. This is not the first study to examine this issue, there is much understood about how adults learn and develop, much of which is relevant to development of strategic thinking ability. Additionally, there have been a number of models constructed that attempt to explain specifically how strategic thinking skills are developed. Finally, there have been a number of empirical studies on the development of strategic thinking ability. These studies are similar in purpose to this study but differ in focus and method. There has been a particular focus in previous studies on the impact of work experiences on strategic thinking ability with only limited attention given to other methods such as games or educational interventions.

The aim of this chapter is to describe the most relevant previous work on the development of strategic thinking, including work which assists to understand the findings of this study and that which demonstrates that gap in knowledge which this study contributes too. This chapter will provide an overview of the previous studies, focusing on empirical studies of the impact of educational interventions on strategic thinking ability. Importantly, there is no standardised; definition, list of components or measurement method, for strategic thinking. Therefore it is not appropriate to directly compare the results of this study with others without considering the differences in underlying constructions of strategic thinking described above in chapter 3.

4.2 Development and Learning Theory

4.2.1 The Potential for Development of Strategic Thinking Ability

There are ostensibly two schools of thought on the potential to develop strategic thinking ability, those that state that it is inherent and those that believe it is learnt (Casey & Goldman, 2010; Benito-Ostolaza & Sanchis-Llopis, 2014). While initially these views may seem contradictory, Casey

and Goldman (2010) believe that they are not necessarily incompatible as both schools accept that there is potential to learn cognitive skills and the differences are only in the scale of that potential.

This study makes the preliminary assumption, based on the literature reviewed, that theoretically strategic thinking can be developed (Goldman, 2007; Casey & Goldman, 2010; Kazmia & Naaranojab, 2015; Dweck, 2006). To this end, it is important that strategic thinking ability is a skill deconstructed into various components (see above, Chapter 3), many of which are known to be amenable to learning or development (Liedtka, 1998). This means that the theory and understanding of how skills are learnt or developed in general also applies to the development of strategic thinking ability (Casey & Goldman, 2010).

4.2.2 Expertise and Adult Learning

Casey and Goldman (2010) argue that the application of learning theory to strategic thinking is underdeveloped, concluding, "[t]he three major components of adult learning theory—the learner, the learning process and the context... are underdeveloped in relation to strategic thinking." (p.2). However, many theories have been developed to explain the phenomenon of learning in general; the most relevant are briefly summarised here (Allen, 2007; Illeris (ed), 2009).

Kolb's (1984) Experiential Learning Theory, envisions learning as an adaptive process, and a "holistic and integrative activity, that combines experience, perception, cognition and behavior" (p.21). Kolb views learning as the "transformation of experience" (p.38) resulting from a "transaction" between a person and the environment (p.36). Thus, he theorizes learners are in a cyclical process who continually utilize different abilities and thus, transition between various thought processes, that is from, "actor to observer, and from specific involvement to general analytic detachment" (p.31).

Marsick and Watkins' (1990) Informal and Incidental Learning Theory considers a somewhat similar, albeit narrower concept of learning. Like Kolb, they recognize the central role of experience in the learning process. Sloan (2017) considers Informal and Incidental learning to be a major aspect of developing strategic thinking abilities. Marsick and Watkins' indicate informal learning (including incidental learning) includes "self-directed learning, networking, coaching, mentoring and performance planning" (Marsick & Watkins, 2001, pp.25–26). They however differentiate it from Kolb's "designed" learning activity on the basis that informal learning is intentional and

controlled, even if that learning is executed in a less structured context (Marisk, Watkins, Callahan and Volpe, 2009, p.572). And, they also indicate incidental learning occurs as a "byproduct of some other activity" (Marsick & Watkins, 1990, p.6–7). Both of these learning modes, informal and incidental learning, sharply contrast with formal learning which they describe as "institutionally sponsored, classroom-based, and highly structured" (Marsick & Watkins, 1990, p.12).

Expertise theory is also arguably relevant to learning skills like strategic thinking (Ericsson, 2007; Ericsson, 2008). Expertise theory is based on the concept that it is focused effort spent in deliberate practice leads to individuals acquiring a given skill rather than mere accumulation of time practicing a skill (Ericsson, 2007; Ericsson, 2008). Deliberate practice involves the focused effort to acquire a particular piece of expertise along with feedback on the learner's progress; however, providing feedback on strategic problem-solving is difficult to implement given the time horizon for finding out if a particular plan or decision was successful or not (Ericsson, 2007; Ericsson, 2008).

Sloan (2017), in a related analysis, indicates context is significant for inducing successful learning. She stresses that the environment fosters the ability to "deconstruct and reconstruct frameworks and patterns, and to challenge assumptions grounded in past experiences" (Sloan, 2017, p.53). She proposes an iterative three-stage informal learning process:

1. Preparation, consisting of two coexisting interchanging components (an emotional element and, a cognitive element);

2. Experience (including the current situation and prior successful life experiences) which involves applying that experience to new situations; and then,

3. Reflecting and re-evaluating about the situation — while reviewing prior decisions and connecting them back to the preparation stage — which, in turn, restarts the process (p.85).

4.3 Developing the Ability to Think Strategically

Liedtka (1998) is confident of the ability to teach strategic thinking, given that the elements of thinking (as described by her: a systems perspective, intent focus, thinking in time, hypothesis driven and intelligent opportunism) are amenable to teaching. Sloan (2017) argues that increasing strategic thinking ability is to increase understanding of future possibilities and requirements

(p.51). Bonn (2005) too focuses on strategic thinking ability as the ability to represent future potential situations with models, and also believes that this can be taught. But, if strategic thinking ability can be developed, the obvious question is how. Stumpf (1989), asked managers how they developed their strategic thinking skills and found that largely they could not identify the ways in which they did or might improve. Goldman, Scott and Follman (2015) found that most organisations use experiential approaches, unconnected to the recommendations from literature, to develop strategic thinking ability.

It is not only the types of education or experience which potential impact the development of strategic thinking ability. Shirvani and Shojaie (2011) argue that firm culture impacts strategic thinking ability development. Focusing on the individual, Casey and Goldman (2010), drawing on expertise theory, argue that it is not only the type of education or experience that contributes to development, but also the learning ability of the individual. Sloan (2017), provides greater specificity on how individual ability impacts development and proposes that there are five interplaying attributes which together are a "mental precondition" to developing strategic thinking ability. The five attributes identified are: having an imagination, a broad perspective, the ability to juggle, the ability to deal with things over which you have no control, and an adamant desire to win (Sloan, 2017, p.229).

4.3.1 Developing Strategic Thinking and Work Experience

Work experience is considered by many as the optimal develop way to strategic thinking ability (Tricker in Garratt (ed), 1996; Kazmia & Naaranojab, 2015; Dragoni, Oh, Vankatwyk & Tesluk, 2011; Sloan, 2017). Yet it appears that not all experience is equally valuable and not everybody is equally able to develop strategic thinking ability on the basis of experience (Dragoni, Oh, Vankatwyk & Tesluk, 2011; Gavetti, Levinthal & Rivkin, 2005).

Stumpf (1989) identified particular types of experience as highly effective at increasing strategic thinking ability: starting a business, fixing or turning around an operations, special projects, moving between line and staff positions, and experiences that provided experience in adversity. Goldman and Cahill (2009) identified a range of experiences that assisted the development of strategic thinking ability through a study based on self-reports and qualitative follow up. That work, limited to the healthcare sector, identified: participating in strategic planning, staring a major

project, monitoring performance indicators, being challenged by a colleague, relationship with colleagues outside the organisation, having a career mentor, handling a threat to organisational survival and servicing as CEO, as important experiences (Goldman & Cahill, 2009). Goldman (2007) using the perspectives of those considered (socially labelled) expert strategic thinkers identified ten experiences that contributed to strategic thinking ability: family upbringing/education, work experience, becoming a CEO, being mentored, being challenged by a key colleague, monitoring results, strategic planning, leading a key initiative, dealing with a threat to organisational survival and vicarious experiences (Goldman, 2007).

An individual's personality and cognitive attributes also impact the development of strategic thinking from any particular experience. Dragoni, Oh, Vankatwyk and Tesluk (2011) conducted a study to identify the factors that impacted on an individual's ability to learn strategic thinking from work experience. They found that cognitive ability was correlated to developing more strategic thinking ability from accumulated work experience and that extraversion was linked to the ability to accumulate work experience (Dragoni, Oh, Vankatwyk & Tesluk, 2011). Dragoni, Oh, Vankatwyk and Tesluk, (2011) found an indication that repeated experience on the same problem type at different levels of responsibility was particularly valuable for developing strategic thinking ability. Yet this finding should be caveated by the work of Gavetti, Levinthal and Rivkin, (2005) who examined more carefully the type of experience required to develop strategic thinking ability. They found that where managers had the ability to conceptualise general models from specific experience then broad work experience provided the largest increase in strategic thinking ability, but where managers lacked this cognitive ability, deep experience in one area provided the greatest impact.

These studies demonstrate that the success of interventions to improve strategic thinking ability are dependent both on the quality of the experience and learning abilities of the subject and possibly the match between experience and learner as surmised by Casey and Goldman (2010).

4.3.2 Education Interventions to Improve Strategic Thinking

Many doubt the ability of formal learning to improve strategic thinking ability, often citing the inability to transfer skills or a lack of action-orientation (Easterby-Smith & Davies, 1983; Goldman & Cahill, 2009). Despite this, in workplaces and business schools, formal education is used for the

purpose of developing strategic thinking ability. There are a number of common techniques used to try and teach strategic thinking in an educational setting, including; lectures, case studies and simulations (Easterby-Smith & Davies, 1983). Lectures are one of the most common ways of teaching but they have shown little success in teaching thinking skills or developing particular attitudes (Easterby-Smith & Davies, 1983). In relation to strategic thinking skills, Easterby-Smith and Davies (1983), state, that "it is overly optimistic to expect that lectures about a business plan will help managers understand why [a plan] has taken [a particular] form" (p.41). Contrary to this perspective Goldman (2012) conducted a study of the effectiveness of seminars to improve the strategic thinking of healthcare leadership. That study found that the seminars were partially effective, when coupled with a follow up reminders to use the techniques taught (Goldman, 2012). However, the study assessed the validity of seminars developed and taught by the author so may be subject to some bias effects. In systems dynamics paradigm, Kunc (2012) studied the use of formal teaching to improve strategic thinking. In the study 53 students were first taught a variety of system dynamic models and then specifically instruction on the process of creating their own models based on theory (Kunc, 2012). The students then had their strategic thinking scored based on a case study assignment, where closeness to the ideal solution provided by the systems dynamic model equated to strategic thinking ability (Kunc, 2012). This study, while an interesting demonstration of the power of teaching tools to develop models, is based on a very different conception of strategic thinking than used in this study. The systems dynamics perspective examined by Kunc is firmly grounded in game theory and mathematical models and the study in particular assumed the existence of an ideal solution predicted by the model (Kunc, 2012).

Reflection and mentoring have also been suggested as methods for improving strategic thinking (Casey & Goldman, 2010; Simuth, 2015). Cunningham (2008), asserts that metacognition is important for strategic thinking and practiced reflection is the best way to develop that skill. Easterby-Smith and Davies, (1983) state that mentoring, coaching and counselling, all develop strategic thinking skills, but that the exact mechanisms are unclear. However, while it is perceived that reflection and feedback are desirable, many authors argue that the most successful interventions involve active participation (Casey and Goldman, 2010).

Problem solving education is an active involvement approach to development of strategic thinking. In an example of this approach, Weaver, (2014) created an assignment that aimed to improve

strategic thinking and intuition, this assignment did this by asking students to work through cause and effect of various events through a cascade, that is — this event caused this, which caused this, which caused this and so on. While the students responded positively to the assignment and many thought that it improved their strategic thinking, the study was, as the author admits, anecdotal and of low reliability. A desire for active participation has also led to the use of simulations and games to teach strategic thinking (Easterby-Smith & Davies, 1983; Fontaine, 2008). Hornett and Lee, (2017) examine the use of seemingly unsolvable problems (wicked problems) to develop the cognitive skills necessary for strategic thinking — notably this is a similar construct to the Metacognition Course. They argue that when people solve these type of problems they have to do so holistically, aware of the surrounding context, the interaction between the context and the problem, and encompassing multiple interacting variables over a significant stretch of time (Hornett & Lee, 2017). Unfortunately, they do not provide empirical data on the impact on strategic thinking ability following the course.

4.3.2 Interventions Outside of the Business Context

Outside of a business context, there are some indicator that 'recreational activities' may have an impact on strategic thinking ability. Notably, from a preliminary survey of the literature, these include; computer gaming, creative activities, mindfulness activities and team sports. This study does not aim to investigate the impact of these activities but does control for them in the data and given the data collected allows a preliminary indication of the impact from some of these activities on students within the *MiM*.

Games offer a direct and active method to improve cognitive attributes. Henkel (2011) argues that strategic thinking ability can be developed by playing Go, a complex East Asian board game, where the aim is to control territory. This game has had a strong influence on Japanese perspectives on strategy (Henkel, 2011). Silva and Mousavidin (2015), using a competency approach, found that playing the online game World of Warcraft developed several competences relevant to strategic problem solving.

Given that many definitions of strategic thinking include a creative component, it is not surprising that there are arguments that creative, or artistic activities, improve strategic thinking (Graetz, 2002; Wang & Horng, 2002: Heath, 2004; Ryman, Porter & Galbraith, 2009; Barry & Meisiek, 2010).

Sloan asserts that participating in specific activities, such as; “photography, painting, design, or perhaps guitar or piano,” can potentially foster the ability to innovate strategy (2006, p. 207). Sloan posits the reasons are direct: engaging in creative experiences provides firsthand experience exploring different perspectives, making new associations, viewing uncommon relations and thinking in novel ways (2006). Furthermore, Sloan compares research indicating creative activities require, a “balance between chaos and order”, with complexity theory, and suggests comparable attributes are significant for the development of strategic ideas (2006, p.21). However, there is not yet sufficient empirical data to draw a conclusion as to the efficacy of the interventions suggested by Sloan. One study undertaken by Gallimore, (2004), examined the impact of creativity training on the ability to make creative strategies. The study tested the impact of creativity training on the ability to create either a resource based strategy and an environment based strategy, with the strategies assessed using a creative product semantic scale. The findings show that overall there is no reason to support the hypothesis that "[i]ndividuals trained in creativity techniques will formulate more creative strategies than individuals who have not received such training" (Gallimore, 2004). However, it should be noted it was the creativity of the resulting strategy, rather than strategic thinking which was assessed.

Mindfulness activities aim to promote; metacognition, empathy and holistic thought patterns (Ostafin & Kassman, 2012). Coinciding with a growing interesting in mindfulness generally, there are suggestions that mindfulness activities — of which there is some overlap with creative activities — may improve strategic thinking (Tijuan, 2007; Barry & Meisiek, 2010). Tijuan (2007) offers a study based on a 107 small business owners showing that the mindfulness ability of decision makers correlated to the quality of strategic decision making.

Sports, and in particular team sports, have a strategic component (Gréhaigne, Godbout & Bouthier, 2012). There is also suggestion that the skills learnt in team sports, including strategic thinking, are transferable to the business world (Liu, Srivastava & Woo, 1998).

4.4 Previous Studies of Strategic Thinking Development in a Management Education Setting

Benito-Ostolaza and Sanchis-Llopis (2014), found that experiential training improved the ability to think strategically. They tested strategic thinking using an eight agent, complex equilibrium game,

based on game-theory, and determined the level of strategic thinking by the number of strategic decisions made in each round of the game. One group participated in the game after receiving training in a four agent version of the game, the other group without any training (Benito-Ostolaza & Sanchis-Llopis, 2014). The authors found that there was a significant difference in the number of strategic decisions made by the different samples in each round of the game (Benito-Ostolaza & Sanchis-Llopis, 2014). However, this study focused on the strategic contexts definable by game theory, rather than broader strategic thinking definition used in this study.

Brătianu, (2015), conducted a study by using a questionnaire to assess the strategic thinking ability of approximately 4000 undergraduates in a Romanian business school. The questionnaire assessed the thinking style used by the student for solving problems related to four dimensions of strategic thinking (time, complexity, uncertainty and innovation) identified by the author. The students were asked to self-assess on a 47 item test out of a scale of one to five. The results were separated into graduates and undergraduates and showed improvements in the ability of graduate students to think strategically vis-à-vis undergraduate students. Brătianu (2015) found that the limitations of student strategic thinking were that they; largely focused on now and not on the future, prefer simple problems, think in a linear way and preferred deterministic thinking. He also found that students prefer clearly detailed problem descriptions and that there is a general fear toward new solutions (Brătianu, 2015). Brătianu's (2015) study has a similar purpose to this study and the reliability of a large sample. Yet, while the sample size in our study is significantly smaller, we have the benefit of using the *CPP* test to provide a more objective measurement of strategic thinking ability than the self-report surveys used by Brătianu (2015).

4.5 Summary — Developing Strategic Thinking

Given the importance ascribed to strategy formulation in the modern field of management, it is of little surprise there is such attention given how to develop the ability to think about strategy. Yet, there remains a lack of coherence in understanding how that development occurs. In part this is due divergent definitions and conceptions of the strategy formulation process. Perspectives on strategy have a direct impact on how the development of strategic thinking is perceived and understood. At the extreme, the planning perspective, with a focus on the use of analytical tools renders the question of developing strategic thinking inconsequential, of course individuals are able to be taught to use the tools of strategic planning. Conversely, at the other extreme, emergent strategy,

not created but arising organically, is not the product of human cognition, is arguably not strategy, and, is not the product of a skill that can be taught.

In between these two extremes a pattern emerges from studies described above. In general, in studies based on an analytical or planning conception of strategy — such as those from a systems dynamics or game theory perspective — where able to demonstrate improved strategic thinking ability after relatively limited interventions. Whereas those studies based on broader, definitions of strategy, more akin to that on which this study is based, found it difficult to demonstrate an impact, except over longer timeframes. Where improvements did occur they were the result of informal learning, often through broad, diverse work experience. The broad informal nature of the interventions mean that the exact aspects which lead to improvement remain difficult to identify. Except for, Brătianu, (2015) there is little previous work on whether formal education can impact on strategic thinking when conceptualised in the broad manner which use in this study. Therefore this study contributes to an understudied area within the development of strategic thinking.

Perhaps optimistically, but supported by literature, this study is conducted with the view that strategic thinking, like any skill, can be potentially developed at least in part (Goldman, 2007; Casey & Goldman, 2010; Kazmia & Naaranojab, 2015; Dweck, 2006).

5. The Cognitive Process Profile

For a description of the mechanics of th *CPP* test see above section 1.5. For an analysis of the theoretical underpinnings of the *CPP* see above section 3.2.

Given the complexity of defining strategic thinking and measuring cognitive phenomena it is not possible to definitively state that that this study directly measures the development in strategic thinking ability. Prinsloo, the creator of the *CPP*, asserts, that cognition involves an "unlimited number of characters of which only some can be isolated for scientific investigation" (Cognadev, 2011, p.4; see also the discussion in Chapter 3). Thus, our study is working with partial knowledge in an undefined domain of cognition. Despite this, it is clear through the validity studies described below, that the *CPP* test measures something meaningful about mental processes that can approximate to, and correlates with, strategic thinking ability. Additionally, it is a relatively objective test as it measures "strategic thinking" based on a consistent definition independently of the test administrator or the perspective on strategic thinking of the test taker (Cognadev, 2011).

5.1 *CPP* Reliability

Reliability, in one sense is signified by repeatability. Within the *CPP* the participant's report is generated via a fixed computer algorithm and thus, given a fixed set of inputs, the same scores will be generated. In this sense, the *CPP* is theoretically perfectly reliable.

While theoretically the *CPP* should be consistent over multiple tests, practically testing this is problematic. Test-retest reliability is highly relevant for measuring constructs that are expected to be relatively stable in most people (Morling, 2015) and various rigorous studies have undertaken participants retaking the *CPP* at different durations (Cognadev, 2016). These studies have shown (with samples ranging from 87 to thousands) scores on Cognitive Style Preferences, Informational Processing Competencies and Work Environments are stable over periods ranging from two months to five years (Cognadev, 2016, pp.28–40).

However, an objective of the *CPP* is assessing how a person deals with an entirely unfamiliar task (Cognadev, 2011). Therefore, if a participant has already taken the *CPP* and retakes the test, the latter assessment would cease to be novel and impact the validity of the evaluation. To overcome

this problem Cognadev has proposed a methodology, using an equivalent parallel version of the *CPP,* which could evaluate test-retest reliability, this has yet to be performed and is problematic given the resource requirements for developing an alternative but equivalent test (Cognadev, 2016).

Another aspect of reliability is the consistency of *CPP* measurement across different groups, sometimes referred to as equivalence. The *CPP* was tested across cultures, genders, races and educational backgrounds (Cognadev, 2016, pp.90–95). There was no difference detected across cultures and the observed differences between gender and race were attributed to sample issues and South Africa specific cultural history issues respectively (Cognadev, 2016, pp.90–95). Interestingly, in relation to educational background, those who studied natural sciences tended to have higher scores in the *CPP* (to a lesser extent those from a finance background also showed higher scores) (Cognadev, 2016, pp.90–95). This could indicated that something in natural sciences education has an impact on strategic thinking ability.

5.2 *CPP* Validity

The *CPP* technical manual states the test has been exhaustively scrutinised in a range of studies over a long period (Cognadev, 2016). As a result of this analysis, the creators of the *CPP* consider the tool has demonstrated validity (Cognadev, 2016).

Predictive validity refers to the capability of a test to estimate the concept being measured (Coleman, 2009). In the context of the *CPP* predictive validity is the ability to estimate strategic thinking (as defined within the *CPP)* according to an external accepted measurement. Alternatively predictive validity could demonstrated by the ability to estimate some other factor known to correlate with strategic thinking ability (such as job performance in strategically oriented roles). Numerous studies have evaluated the *CPP's* ability to identify core cognitive dimensions that in turn, are significant predictors of job performance in various roles in different work environments (Cognadev, 2011). These studies have verified the predictive validity of the *CPP*, through comparing *CPP* scores to other assessments, including; performance appraisals, job performance ratings and professional examinations (Cognadev, 2016). In each case high ratings for strategic thinking within the *CPP* were correlated with ratings on the other measures that suggest high strategic thinking ability (Cognadev, 2016).

Concurrent validity may indicate the extent outcomes of a particular test correspond to those of a previously established test with known validity (Coleman, 2009). Various quantitative and qualitative studies concentrating on evaluating the magnitudes of associations of *CPP* scores, indicated significant correlations to other valid assessments:

Cognitive Ability: As reported in Cognadev (2016), *CPP* test scores were compared with the: Wechsler Adult Intelligence Scale (p.41), the Psytech Critical Reasoning Test Battery (p.42) and the Figure Classification Test (a test of abstract reasoning) (pp.55–66). In all these tests a moderate to strong correlation was reported (Cognadev, 2016)

In comparison to other tests of cognitive ability there was less correlation. The Career Path Assessment Ranks and Work Level but correlations were between these tests and the *CPP* were not particularly high (Cognadev, 2016, pp.42–45). When compared to the Psychometric IQ Test, individual elements demonstrated some moderate correlation, however, Work Environment Level was not highly correlated with IQ, demonstrating that the *CPP* measurement of strategic thinking ability measures something different to intelligence/ability (Cognadev, 2016, pp.47–51). Comparison of the *CPP* to the Psytech General Reasoning Test Battery, showed some moderate correlation, but also significant variation providing additional evidence that *CPP* measures something other than general reasoning ability (Cognadev, 2016, pp.51–53). Overall, Cognadev (2016) concludes that "*CPP* attributes are clearly related to [the tests] reasoning scales, the various analyses show that there is substantive information assessed by the *CPP* which is not assessed by the ability assessments" (p.56, italics added).

Emotional Intelligence/Personality/Social Roles: As reported in Cognadev (2016), *CPP* measurements were compared to various emotional intelligence measures. First the *CPP* was compared to Myer-Briggs personality type indicators, and showed some moderate connection between the personality indicators and cognitive style as measured by the *CPP* (Cognadev, 2016, pp.57–65). The *CPP* was also compared to measurements from *Belbin's* team roles (Cognadev, 2016, pp.66–68) with not statistically significant, practically relevant, correlations reported. There were also no statistically significant, practically relevant, correlations between the *CPP* and the Hogan Personality Inventory (Cognadev, 2016, pp.68–77).

Notably in a study conducted by researchers other than the creator of the *CPP,* scores were compared with the Emotional Intelligence Attributes Questionnaire (Queripel and Thompson, 2003 in Cognadev, 2016, pp.60–62). That study found some statistically significant negative correlations between emotional intelligence measures and *CPP* scores. Specifically, measurements of motivation and emotional resilience were negatively correlated with strategic thinking ability and the ability to deal with complexity. Queripel and Thompson, (2003) in Cognadev, (2016) state that this makes sense because "people who are not necessarily intellectual giants can achieve a great deal in business by showing high levels of ambition, drive, energy and self-belief. These people are likely to see themselves and be seen by others to be "highly motivated"." (p.62), though perhaps intellectual giants should be seen as meaning those with high strategic thinking ability.

Job Performance Ratings: The *CPP* compared to measures of job performance to test not only overall correlation but to test correlation between specific styles and competencies measured by the *CPP* and their equivalents (Cognadev, 2016, p.72)

CPP measurements were compared to Job Performance Ratings — supervisor rated on a three point scale (Cognadev, 2016, p.72). Individuals with higher job performance ratings tended to have higher Current Work Environment Scores in the *CPP* (Cognadev, 2016, pp.73–74). Additionally, some styles associated with lower strategic thinking ability (particularly the random style) were strongly negatively correlated with high job performance ratings (Cognadev, 2016, p.73). The *CPP* was also compared to results from 360 degree feedback reporting and *CPP attributes were correlated to the relevant feedback scores* (Cognadev, 2016, pp.75–76). A study conducted on the *CPP* and Job Appraisal Ratings for consultants, showed that consultants with a Current Work Environment score of 3 and a Potential Work Environment of 4 received that highest feedback from clients (De Villiers, 2004 in Cognadev, 2016, pp.76–77). The *CPP* was also compared to performance at University, Annual Job Reports and Job Performance 30 Ratings with few relevant correlations identified (Cognadev, 2016, pp.77–84). Cognadev, (2016), identifies several problems with the above studies, first they are largely based on the performance of employees selected for roles in part based on *CPP* scores and there is no job performance failure group to act as a control (p.84). While it argued that demonstrating the validity of the *CPP* by comparison to job performance datasets is essentially impossible,it is pointed out that there is, overall, a small relationship between performance and higher *CPP* results (Cognadev, 2016, p.87).

Overall, the *CPP* showed, according to the creators, the expected level of correlation with the above tests or ratings and was also shown in several cases to provide additional explanation of variance in job performance measures compared to the comparison tests (Cognadev, 2016). Leading the creators to argue that the *CPP* is as valid, or more valid, than other psychometric tests with similar purposes (Cognadev, 2016).

5.3 *CPP* Limitations

The fundamental limitation of the *CPP* is that it examines strategic thinking as defined by the creators of the *CPP*, a definition that is not universally agreed upon. Therefore, it is important to be very accurate in explaining that the results are aiming to identify those individuals who demonstrate potential or ability to work in unfamiliar contexts, rather that ability in any other definition of strategic thinking. Additionally, the *CPP* analyses ability by deconstructing thinking in situations of unfamiliarity into a number of cognitive components, all weighted to have a different impact on overall ability. There is no consensus on the amenability of the concept of strategic thinking to be deconstructed, or as to whether measuring components of such a concept gives an accurate measure of the whole. Furthermore, the weighting of various components into overall strategic thinking ability and the way in which the test assesses those components remains proprietary information and therefore is not amenable to debate or assessment within this study or other independent open source research. Therefore any results from the *CPP* must be prefaced with an understanding that the test may not assess the various components in a reasonable way and may weight them in a manner that is not reasonable. The potential impact of are not able to be properly assessed or accounted for due to the proprietary nature of the nature of the information. In addition to these fundamental concerns there are also technical limitations that arise from the nature of an electronic test.

Various studies have considered the effect of test anxiety and its relationship with performance on standardised testing (Eysenk & Calvo, 1992). This research indicates test anxiety may lead to significantly poorer performance on cognitive assessments. For instance, The Yerkes-Dodson Law, explains that high arousal level in test-anxious people typically results in decreased cognitive performance (Teigen, 1994). Furthermore, highly test-anxious subjects divide their attention

between self-relevant and task-relevant variables. In sum, cognitive assessments require a participant's full-attention to accurately evaluate their abilities (Wine, 1971; Sarason, 1984).

The *CPP,* as an electronic test, could be impacted by technical measurement problems. The test measures the participants actions on the screen which relies on the accuracy or sensitivity of the input device. There is the potential that different input devices, or functions on those devices could cause inaccurate test results, for example an overly sensitive device recording movement that other devices do not.

The test relies at least in part on language ability, both specifically, in terms of writing the interpretation of the story, and in the general, in terms of linguistic abilities to understand symbols. There are a number of ways in which this may lead to inaccurate results. The running text interpretations are analysed via a computer programme, however, the textual understanding of this algorithm is not on the data available amenable to verification. While the validity studies discussed above, at section 5.2, suggest that it is generally able to understand text, it is possible that it does not function accurately for all texts and may lead to falsely low or high scores in some cases. This is particularly compounded in this study as participants took the test in English which in most cases was not the primary language of the participant. In addition to specific language skills, it is possible the test format of understanding symbols is not an effective way to test strategic thinking ability of people with some types of cognitive disorder, for example dyslexia, which may impact on reading and comprehension ability in those contexts.

6. Method

6.1 Method Philosophy

This study forms part of the larger *Strategic Thinking Project*, therefore the philosophical worldview derives from that project and this study's place in it. Currently, *the Strategic Thinking Project* is in its early stages and this study forms part of an exploratory phase. The aim of this phase is to: identify interesting questions and avenues for inquiry, develop methodologies, gain experience with and refine testing tools and interventions, and, develop preliminary findings. This context has driven both the philosophical and practical choices in methodology.

This study uses multiple practical and applied research methods for a basic reason: different research questions need to be investigated by different modes of inquiry (Saunders, Thornhill & Lewis, 2009). Thus, our research relies on philosophical pragmatism, that is, a flexible approach addressing these separate issues differently (Easterby-Smith, Thorpe & Jackson, 2015). The research questions within this study are exploratory and attempt to propose a meaningful and practical description of the world; those observations based on scientific analyses are not aimed to accurately represent objective reality.

In short, our study adopts a constructivist epistemological position that emphasizes the research process itself as the knowledge producing action (Piaget, 1971). Thus, this constructivist viewpoint is distinct from empiricism and other philosophical approaches which accept a narrower framework: that the abstraction of knowledge is derived from one's experience with the object being studied (Bhattacherjee, 2012). Hence, for purposes of this research, reality is primarily considered to be an interaction between human intelligence and one's experiences (Piaget, 1971).

Practically, the exploratory nature of this study and the underlying pragmatic perspective has implications for the conduct of this study. Firstly, it has led us to explore a larger number of research questions with less depth than we otherwise would by providing greater flexibility in the methods used and the data accepted. Secondly, it has led us to use multiple methods of collecting data. Thirdly, to enable multiple research questions and methods, it has led us to use smaller sample sizes. Fourthly, it has led us to allow less rigour in our sampling (non-random, self-selective samples and data for previous years which we do not have control information for). Fifthly, it has led us to use

tools and interventions that are not fully refined, developed or tested (for example less rigour applied to questionnaire and intervention development). Finally, our analysis is based on an exploratory approach using statistical tests to identify interesting indicators and trends, rather than only looking for significant results.

6.2 Research Design

To analyse and evaluate our research questions, we applied a mixed-method design and incorporated data from both quantitative and qualitative sources — for different research questions (Easterby-Smith, Thorpe & Jackson, 2015). For each of our research questions we identified the multiple relevant data sources which could be used, described below.

Primary Question — Does either the *MiM* or Metacognition Course improve the ability to think strategically as measured by the *CPP* (Current or Potential Work Environment) or a self-report questionnaire?

To answer this question we test three samples: at the beginning of the *MiM*, at the end of the *MiM* and at the end of the *MiM* with the additional Metacognition Course. Each sample is tested with the *CPP* and with a self-report questionnaire.

Secondary Question 1 — Does either the *MiM* or Metacognition Course alter the cognitive processes measured by the *CPP* or a self-report questionnaire?

To answer this question the *CPP* and questionnaire results of the three samples are compared, looking not at the overall score, but comparing scores for individual components.

Secondary Question 2 — Is either the *MiM* or Metacognition Course intended or designed to improve the strategic thinking ability of the participants?

To assess the design of the educational interventions, the documentation for the programmes and constituent courses is examined. All documentation was assessed for:

1. Aims or indications of design to improve strategic thinking;

2. Aims or indications of design to improve any of the subcomponents that are incorporated within strategic thinking (as included in the *CPP* or the questionnaire based on Sandelands and Singh (2017)); and,

3. Activities or teaching methods that are similar to those indicated to impact on strategic thinking.

To further assess the purpose and intention of the programmes the Program Director (S. Kleppestø in both cases) was interviewed to understand the intention and purpose of each course.

Secondary Question 3 — For *MiM* students, does self-assessed strategic thinking ability correlate with the assessment of strategic thinking from the *CPP*?

To answer this question the results of the *CPP* were compared to the answers from the self-report questionnaire for each participant. This comparison was done for both the overall score and component scores. The correlation between these scores was also aggregated to compare between each of the samples.

6.2.1 Research Design limitations

This study is explorative and based on a pragmatic approach, the aim is to; identify questions for future study, gather data that can refine the methodology and identify preliminary trends. Given these aims the research design is deliberately broad and flexible and is not designed in a way that would allow the rigorous testing of a particular hypothesis. Within this context there are some specific design limitations which exist.

First, this study draws exclusively from the population of people selected to attend the *MiM*. This selection is not random and is based on characteristics that may correlate to strategic thinking or its components as measured. There is the potential studies to use data collected from this study and additional data on students selected for the *MiM* to compare to the global dataset of *CPP* results to determine the extent of any selection bias. This study does not do that due to the small number of students tested at the beginning of the *MiM*. As such, any findings are additionally limited to only being reliably generalisable to the population of students selected for the *MiM*.

Secondly, this study is cross-sectional. This is because the *CPP* is not currently considered valid for re-testing within five years. Therefore given the time horizon of the interventions (nine months) and the limitations of the tool (inability to retest), a cross-sectional structure was needed. Generally, cross-sectional studies are not as reliable as studies where individuals are tested before and after an intervention. This is because the results are correlations that may be due to random variation in the sample, or some other factor. Reliability of cross sectional studies improves as sample sizes increase (reducing risk of random variation impacting results) and where samples are rigorously controlled for potential confounding variables. Neither of these are relevant to this study, as the sample sizes are small and not controlled for confounding variables. In future studies larger samples sizes, random assignment to an intervention and the collection of more data on extrinsic factors that can be used for control, will increase the reliability of findings. It is likely that a more complete literature review would be required, particularly of previously empirical work to identify a full list of possible confounding factors that need to be controlled for. In particularly given the variation within the *MiM* student population more detailed work would be required to control for relevant work experience which is clearly identified in the literature as having an impact on strategic thinking ability. Additionally, should the limitations on using the *CPP* for retesting be overcome, then a more reliable study methodology could be used, which would allow the rigorous testing of hypothesis explored in this phase of the study.

Finally, both the *MiM* and Metacognition Course are variable interventions, they are not precisely controlled to be exactly the same for each participant. Both courses, but particularly the *MiM* provide opportunities for students to engage more or less deeply with the course and to make choices (such as topics to pursue in an assignment, or a method for working in a team) that will impact what students learn. It is not possible (nor desirable) to rigorously control student participation in the courses to ensure that it is exactly the same for each subject. The impact of variability in the intervention would likely be smoothed with large enough samples over a number of years, and with extensive monitoring of student could potentially be controlled for. However, in the current phase of the study, large cohorts, over multiple years with extensive control for participation in interventions are not present. It is likely in the future increasing samples of data will mitigate this issue.

Specifically for the Metacognition Course , there are factors intrinsic to that course which could be more significant in inducing behavior changes than the educational interventions intended aim. The course provides extensive description of many of the underlying psychological models for the *CPP,* which could impact on the uncertainty participants feel when taking the test. The context and information provided in the course could also induce a bias in cognitive preferences. For example, the course could lead participants to value systems thinking over analytical ability. *CPP* participants could take that as a cue, to abstain temporarily from being overly analytical during testing; hence, priming individuals not to follow their ordinary behavior processes. This could be controlled for by introducing a 'placebo' Metacognition Course, which included the possible bias inducing material, but not the workshop practice being investigated to see the comparable impact on *CPP* results. However, with recruitment into this study and resources available a placebo course was not feasible. It is possible for future studies to exam this to rule out unintended bias or test-specific improvements, to determine whether there is any general strategic thinking ability improvement.

6.3 Sampling

To obtain necessary data for this study, the researchers recruited 28 Lund University Master of Science in Management students to take the *CPP* assessment. An additional six students were tested but either were outside of the parameters for a sample or did not consent to the use of their data and thus were excluded from analysis. Three sample groups were non-randomly (self-selected) to take the *CPP* within a group convenient to them:

A. *Pre-MiM*: Prior to the Master completion (N=13 (8 Male/5 Female))

B. *Post-MiM*: After the Master programme completion (N=8 (3 Male/5 Female). Additionally, data for 25 students tested after the *MiM* in 2017 is provided from previous studies (no demographic information for that sample).

C. *MiM+Metacognition*: After the Master programme and additionally exposed to a Metacognition Course (N=7 (3 Male/4 Female)).

6.3.1 Sampling limitations

There was a potential sample size of 67 students, as this is total enrollment in the *MiM.* It was hoped that recruitment into the study would be relatively high, however, interest was not as great as

expected. This lead to three problems. The first was that the small sample sizes limited that ability of the study to find statistically relevant results, the second was that given the small numbers a third intervention, a metacognition case based course, was not achievable, and the third was, that given the lack of interest, random sampling was not feasible and self-selection to the testing groups was required. While the reasons for the recruitment problems are not clear to the authors, it is expect that if the interventions and testing are more precisely integrated with the *MiM* program and students are recruited earlier to defined test and intervention times, recruitment could be higher.

As with the design, decisions on sample configuration have been influenced by our exploritoritive and pragmatic approach. First, the the sample sizes are small. Small samples mean that the impact of random variation and non-controlled confound variable is greater, giving a higher likelihood of a false result. Small samples also increase the possibility that the sample is not representative of population being studied. The small sample sizes led to the use of non-parametric statistical methods which in some cases are less reliable than other methods. Therefore, the results from this study are indicative only and should not be considered conclusive, additionally, any generalisations should be considered preliminary.

Secondly, our samples were self-selected, not randomly assigned. Given the variable schedules of students, the fact that some students needed to be tested early for their own thesis projects, and the timing of recruitment, it was not feasible to create a random assignment. This means that there are potential biases in the samples. For example, individuals interested in strategic thinking may have greater strategic thinking ability, and may have been drawn to strategic thinking thesis projects which required early testing, inflating the scores of the first group. While this is just speculation, there is a need to be cautious when drawing conclusions from the data due to potential sample bias.

Finally, as we take a pragmatic approach, we have decided to use available data even where incomplete. This means that was have included data from previous years in the absence of demographic or questionaire information, and have included data even where participants failed to complete the questionnaire. While incomplete data reduced the reliability of the results the explorative nature of the study has led us to prefer more data with a focus on generating information that can be tested rigorously at a later phase of the study.

6.4 Data Collection

6.4.1 Cognitive Process Profile

A licensed Cognadev facilitator administered the *CPP* assessment at Lund University, School of Economics and Management. Prior to the assessment subjects signed a pre-test consent form (if they wished their data to be used in research), which also provided confidentiality and anonymity assurances regarding their results and responses. The consent included permission to use their data for this study once anonymised.

The *CPP* assessment has its own proprietary data analysis method, therefore we did not have access to the complete raw data, but we were subsequently given relevant secondary data produced by Cognadev, broken down into meaningful categories for our study.

The reports consisted of data on each participant's: Cognitive Style Preference ranked on a 1–14 scale; Current and Potential Work Environment on a 1–5 scale; and Information Processing Competencies on a 1–100 scale. For a description of these outputs see Appendix C.

The way we administered *CPP* assessments has certain limitations. For example, different sample groups were tested at various times throughout the day. This is significant because researchers have indicated differences in performance for various cognitive assessments when conducted at different times (Goldstein, Hahn, Hasher, Wiprzyckaa & Zelazoa, 2007). Similarly the samples were tested at different times of the year, which potentially leads to different levels of stress from external factors. For example, some participants were tested during the thesis writing segment of the *MiM* programme; thus, additional stress possibly reduced test-taking performance. It is possible this could be partially controlled for by ensuring all groups were tested equidistant from graded assignments.

Finally, the test was conducted in English, although participants had various language backgrounds, although all participants met the requirements for university study in English (see further the discussion above at section 5.3).

6.4.2 Questionnaire

The questionnaire consisted of two segments, including 18 likert-type scale questions and 5 open-ended questions. The quantitative portion of the questionnaire investigated the participants self-perception of concepts relating to strategic thinking identified by Sandelands and Singh (2017). The reason for utilizing a four point scale was to avoid a movement toward the midpoint and encourage participant's choose sides (Nowlis, Kahn and Dhar, 2002). Furthermore, a mid-point was omitted because various researchers have noted a related phenomenon of participant's negative answers disproportionately moving toward a midpoint when the option was provided (Velez and Ashworth, 2007; O'Muircheartaigh, Krosnick and Helic, 2000).

The qualitative section of the questionnaire provided a control for the impact of other activities on strategic thinking ability. Participants were provided open-ended questions that were completed in written form. The questionnaire asked participants if they engaged in certain activities (identified above in section 4.2.2). These activities have been indicated from our literature review to influence strategic thinking, therefore including them allows for partial control during data analysis (see below the questionnaire at Appendix A).

The questionnaire has some limitations as a data collection method. Firstly, in general, the self-report questionnaire was developed without the benefit of understanding the *CPP* and before the completion of the literature survey. This was due to the requirement to have the questionnaire completed for testing of the first test group at the beginning of the *MiM* prior to the beginning of work on theses. This also meant that the questionnaire was designed without the benefit of the instruction in research methods provided in the *MiM* nor with the benefit of time to validate the questionnaire before use. Nethertheless, the collection of control and demographic data was important for all research questions and the collection of self-report assessments of strategic thinking was particularly important for secondary question three. Therefore, in accordance with the pragmatic approach, the data from the questionnaire is utilised.

There are also some specific limitations inherent to questionnaires. Self-reported data cannot generally be independently verified (Northrup, 1996). Furthermore, biases can cause self-reporting errors, thereby limiting their reliability (Garcia & Gustavson, 1997). The reliability and validity of self-reported data can be improved; by rigorously controlling the conditions under which the

questions are answered, running studies to determine if the questions or structure of the questionnaire cause a bias, and comparing the questionnaire against other validated testing methods. While the questionnaire used is based on previous work, it is not based on a previously validated questions, we did not control the conditions in which people answered the questions (normally after completing the *CPP* which may have an impact on mood and cognition) nor have we tested the questionnaire to determine whether it is valid vis-à-vis other questionnaires or causes bias. If self-report questionnaires are to be used in the future to supplement the *CPP* results resolving these issues, or using a previously validated questionnaire would add greater rigour to the results.

6.4.2 Interviews

The programme director for the *MiM* and Metacognition Course (S. Kleppestø) was interviewed to understand whether or not either programme was designed to improve strategic thinking ability. The interview was semi-structured (reference) and the questions were based on those developed for *the Strategic Thinking Project* by Müller and Snijder, 2018. The decision to use the same questions was based on the requirement of the overall project to compare the impact of different courses (the interview questions are at Appendix B). As a subjective data collection method many of the same limitations that applied to the questionnaire apply to the interview.

6.5 Data Analysis

The data collected presents as non-normally distributed, with the majority of results tending toward higher scores, across both the *CPP* self-report questionnaire. However, the number of data points collected means that we have not drawn definitive conclusions as to the distribution of the data and have as such relied on the use of non-parametric approaches (Wasserman, 2007).

Data analyses were performed in SPSS (Version 25). The tests used varied due to the type of data being examined and research questions. In all cases a standard measure of statistical significance with SPSS was used, with either a 95% confidence interval or a 0.05 measure of statistical significance.

The specific tests utilised are:

- **Kruskal-Wallis test** — this test compares distributions amongst groups and can be use where there are three or more samples to be tested (Corder & Foreman, 2009). Differences are reported at a 0.05 measure of statistical significance.

- **Mann-Whitney *U* test** — Which examines the null hypothesis by comparing random values from each sample set, importantly it is suitable only for comparing two samples at a time (Corder & Foreman, 2009). Differences are reported at a 0.05 measure of statistical significance.

- **Independent Median test** — this test determines if the median is significantly different across groups, it is considered to have lower statistical power than other non-parametric methods, but does not make the assumptions that either Kruskal-Wallis, or Mann-Whitney make (Corder & Foreman, 2009). Differences are reported at a 0.05 measure of statistical significance.

- **Spearman's rank correlation coefficient** — this test is a non-parametric method to determine the correlation between two variables (Corder & Foreman, 2009). Correlations are reported between -1 (perfect negative correlation) and +1 (perfect positive correlation) at a 0.05 measure of statistical significance.

- Given the likely non-normal distribution of the data medians were used to report central values with the 95% confidence interval of the **median** calculated using **Bootstrapping**. Bootstrapping is considered the most statistically powerful method for calculating confidence intervals for non-parametric data (Wasserman, 2007).

6.6 Method and Purpose — Summary

The design of the methodology, has been influenced by the overall design of *the Strategic Thinking Project*, the explorative phase of the study and the overarching philosophy of pragmatism. In designing the methodology the aims of question generation, methodology and intervention refinement, and generation of preliminary indicative results have been pursued.

The results from this study and subsequent conclusions are preliminary and indicative by design. The limitations inherent in the study are acknowledged and discussed above, and it is possible that

the problems identified will lead to improvements for studies conducted at later stages of the project. While the small sample sizes, the liberal inclusion of data and the lack of control for confounding variables are associated with less rigorous studies it does allow for the exploration of broad issues within tight resources constraints. Additionally, the data collected, given the alignment with other studies within the project, can be combined with data from other interventions to answer alternative questions with greater reliability and validity.

7. Findings

Neither data from the *CPP* nor the self-report questionnaire are included in this thesis or its appendices in order to preserve the anonymity of the participants. Access to the de-identified data is available for research or verification purposes through the corresponding author or supervisor. Descriptions of the *CPP* result categories can be found at Appendix C.

7.1 Sample Descriptions

A maximum total of 53 subjects are included in the analysis across three sample groups:

A. *Pre-MiM* tested at the beginning of the *MiM,* the group had a sample size of 13 (12 with questionnaire). Control Information — The average age was 27.4 and there were 8 Males and 5 Females. The number with previous education of a technical nature (science/engineering etcetera.) was 7 and the number with non-technical (education/social science) backgrounds was 6. For additional activities that may impact strategic thinking ability, within the month prior to the test: 4 individuals participated in creative activities, 9 in long-term planning, 8 in mindfulness, 6 in gaming, and 2 in team sports. One individual in this group failed to fully complete the questionnaire.

B. *Post-MiM*, tested a the end of the *MiM* (for additional information see section 7.4.1), the group had a sample size of 8 (7 with questionnaire). Control Information — The average age was 26.25 and there were 3 Males and 5 Females. The number with previous education of a technical nature was 2 and the number with non-technical backgrounds was 6. For additional activities that may impact strategic thinking ability, within the month prior to the test: 6 individuals participated in creative activities, 7 in long-term planning, 2 in mindfulness, 4 in gaming, and 0 in team sports. One individual in this group failed to fully complete the questionnaire.

   To augment the data in Group B we were provided with 25 *CPP* test results from *MiM* students at the completion of their studies in 2017. The validity and reliability of utilising this data is discussed below at section 7.1.1.

C. *MiM+Metacognition* — tested at the end of *MiM* and had also completed the Metacognition Course (for additional information see section 7.4.2), the group had a sample size of 7. Control Information — The average age was 25 and there were 3 Males and 4 Females. For additional activities that may impact strategic thinking ability, within the month prior to the test: 4 individuals participated in creative activities, 6 in long-term planning, 1 in mindfulness, 2 in gaming, and 3 in team sports. The number with previous education of a technical nature was 3 and the number with non-technical backgrounds was 4.

Overall, 34 were tested with the *CPP* for the 2018 *MiM* programme, six completed the test outside of the parameters of any group, or did not provide consent, so have been excluded from the above sample groups. Two different individuals failed to fully complete the questionnaire as noted above (questionnaire N=26) and therefore, for analysis using results derived from the questionnaire, their results have been excluded. The number of 2018 sample participants represents 47% of the population (total *MiM* students N=65).

7.1.1 Validity of Including Data From 2017 MiM Class

A *CPP* data sample of 2017 *Post-MiM* students (N=25) was provided for this study. Similar demographic data to compare the composition of the 2017 *Post-MiM* sample to the 2018 *Post-MiM* sample was not available therefore, the *CPP* results of each sample were compared to identify issues with the validity of including the previous years sample.

The medians and means were calculated using bootstrapping, with the median being the most reliable measure as the data is non-normally distributed. For current and potential work environment the medians of the 2017 and 2018 samples were similar (Medians: 2018 — 3 current, 4 potential; 2017— 3 current, 3.5 potential — 2017). Analysis of this difference indicated that is was not statistically significant. However, looking and the Information Processing Competencies separately, there was a statistically significant difference between the years in both Analysis and Quick Insight Learning.

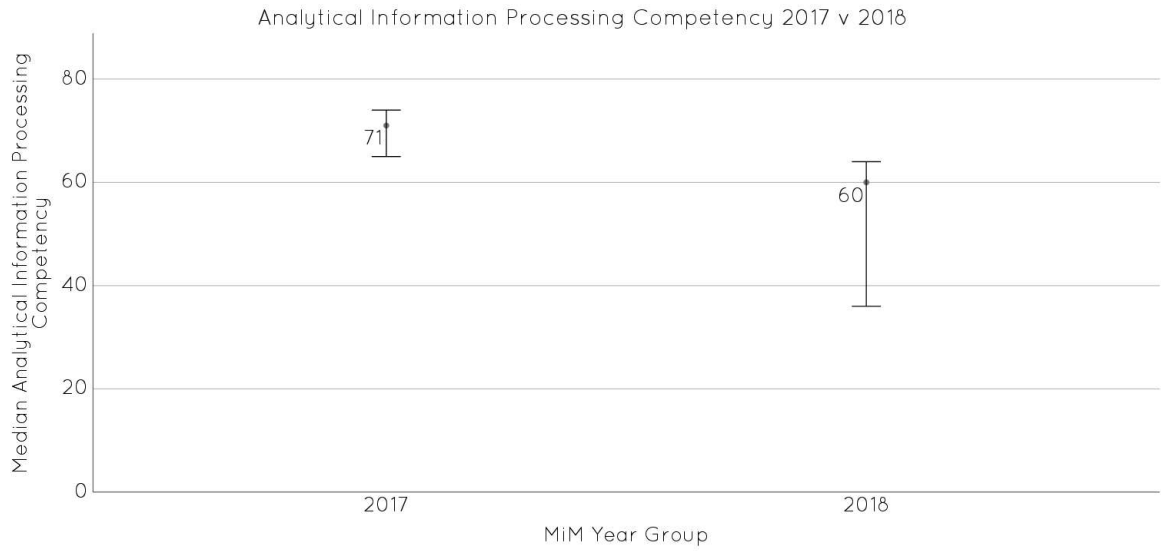

Figure 3. Information Processing Competency — Analysis. Median — *MiM* 2017 compared to *MiM* 2018. Error Bars: 95% Confidence Interval.

The difference in the Analysis Information Processing Competency score is large, 2017 has a median of 71 compared to 60 for 2018. The statistical significance of the difference is 0.004 (Independent Samples Median test), 0.001 (Mann-Whitney) or 0.002 (Kruskal-Wallis). The difference is sufficient that any results of the whole related to the Analysis Information Processing Competency must be questioned as they could be an artifact of selection differences between *MiM* year groups.

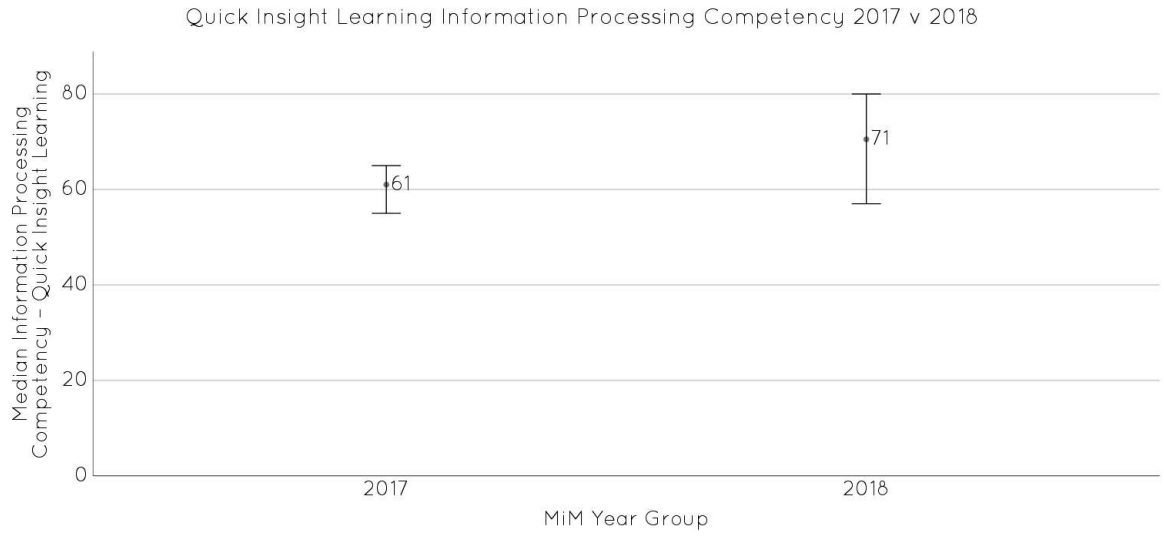

Figure 4. Information Processing Competency — Quick Insight Learning. Median — *MiM* 2017 compared to *MiM* 2018. Error Bars: 95% Confidence Interval.

The difference in the Quick Insight Learning Information Processing Competency is also significant, 0.023 (Mann-Whitney) and 0.025 (Kruskal-Wallis), however, not significant according to the Independent Samples Median test (0.100). In the case of Quick Insight Learning, the sample from 2017 shows a significantly lower result than the sample from 2018 (61—2017; 70.5—2018). Given the size and significance of the difference between the year groups any results related to Quick Insight Learning are also possibly the result of selection variation between *MiM* year groups.

7.1.2 Importance of Strategic Thinking Within the Sample

The 26 individuals that completed the relevant parts of the questionnaire were asked how important they considered strategic thinking for future employment and they answered on a scale of 1 to 4, with 1 being not at all important and 4 being very important. All answered either 3 or 4 with a mean response of 3.48, indicating that for all 2018 *MiM* students, strategic thinking ability is considered a vital skill. Additionally, all questionnaire respondents were asked how much they would like to improve their strategic thinking ability and they responded on the same scale, again all responded with 3 or 4 with an average of 3.89/4 indicating that for *MiM* students opportunities to improve strategic thinking ability are highly valued.

7.2 Primary Question — Developing Overall Strategic Thinking Ability

Does either the MiM or Metacognition Course improve the ability to think strategically as measured by the CPP (Current or Potential Work Environment) or a self-report questionnaire?

7.2.1 Differences Across The Three Groups

The *CPP* (N=53), provides two measures which approximate to overall strategic thinking ability, current work environment and potential work environment. These were analysed for differences across the three sample groups. The medians of the groups were:

- *Pre-MiM* — Current = 3, Potential = 3

- *Post-MiM* — Current = 3, Potential = 4
- *MiM+Metacognition* — Current = 4, Potential = 4

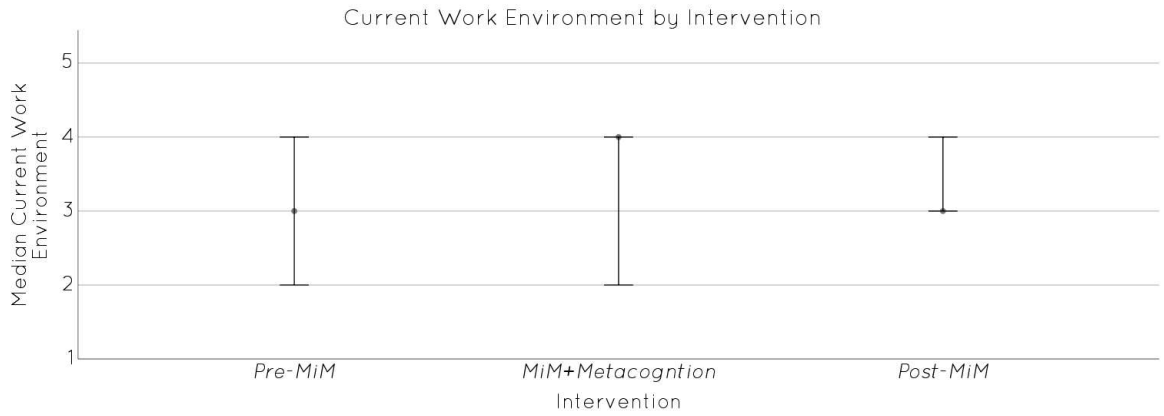

Figure 5. Current Work Environment. Median — Comparison Between Interventions. Error Bars: 95% Confidence Interval.

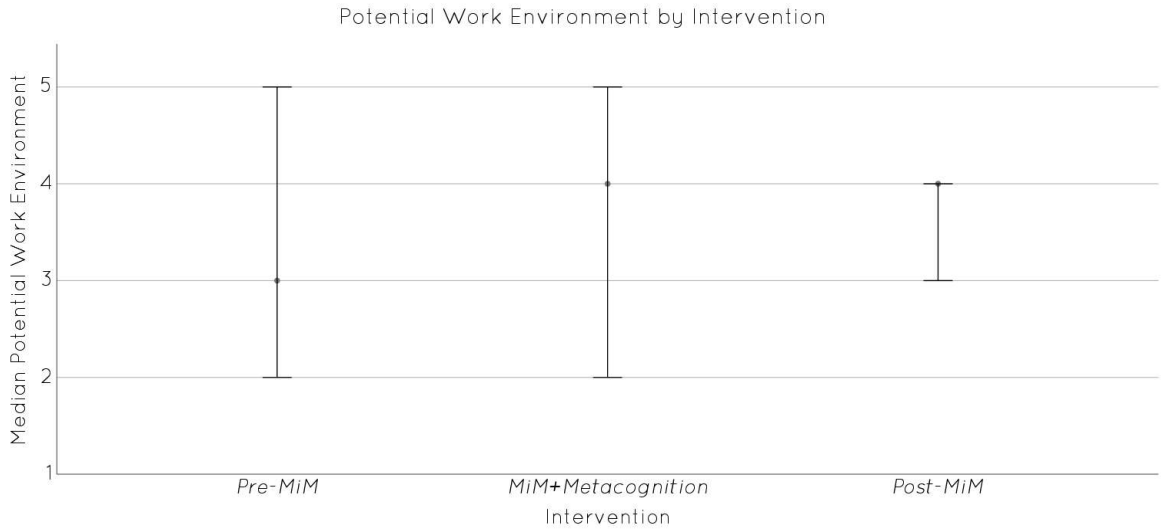

Figure 6. Potential Work Environment. Median — Comparison Between Interventions. Error Bars: 95% Confidence Interval.

These differences are not statistically significant but speculatively indicate an increasing trend in current and potential work environment scores correlating with completion of the *MiM* and the Metacognition Course. Given the differences found between the 2017 and 2018 samples, analysis

excluding the sample from 2017 (N=28) was conducted and likewise found no statistically significant variation between the groups.

In addition to the *CPP,* the self-report questionnaire (N=25) also provided information on overall strategic thinking. The relevant measures were the responses to both the question; Do you think you are a competent strategic thinker? and, to the total score of responses to questions asking about competence on the 15 elements of strategic thinking identified by Sandelands and Singh (2017). No significant difference existed between the groups for either measure and the medians (calculated using bootstrapping) were universally high across all samples.

7.2.2 The Impact of Control Variables on Strategic Thinking Ability

A subset of all 2018 groups fully completed the self-report questionnaire (N=25). The question collected data on activities that were suggested by literature to impact on strategic thinking ability and therefore could impact on the results (see above section 4.2.2). Data was collected on: gender (M/F) and (for the month previous to taking the *CPP* test), creative activities (Y/N), mindfulness activities (Y/N), long-term planning (Y/N), gaming (Y/N) and team sports (Y/N). This allowed for control analysis to determine if any of these variable may have affected the results of the *CPP* testing. For the control relevant *CPP* results were compared among groups (M/F or Y/N) to determine if any had a significant impact on overall results. None of the control variables returned a significant result.

Interestingly, participation in creative activities, did show a difference at close to the significant level. For current work environment those who participated in creative activities had a median score of 4 compared to 3 for those who did not participate, at a statistical significance level of 0.068 (Kruskal-Wallis) and 0.069 (Mann-Whitney). For potential work environment those who participated in creative activities had a median score of 4 compared to 2 for those who did not participate, at a significance level of 0.106 (Kruskal-Wallis) and 0.110 (Mann-Whitney). The split between those who had participated in creative activities and those that had not was relatively even with 11 participants and 14 non-participants.

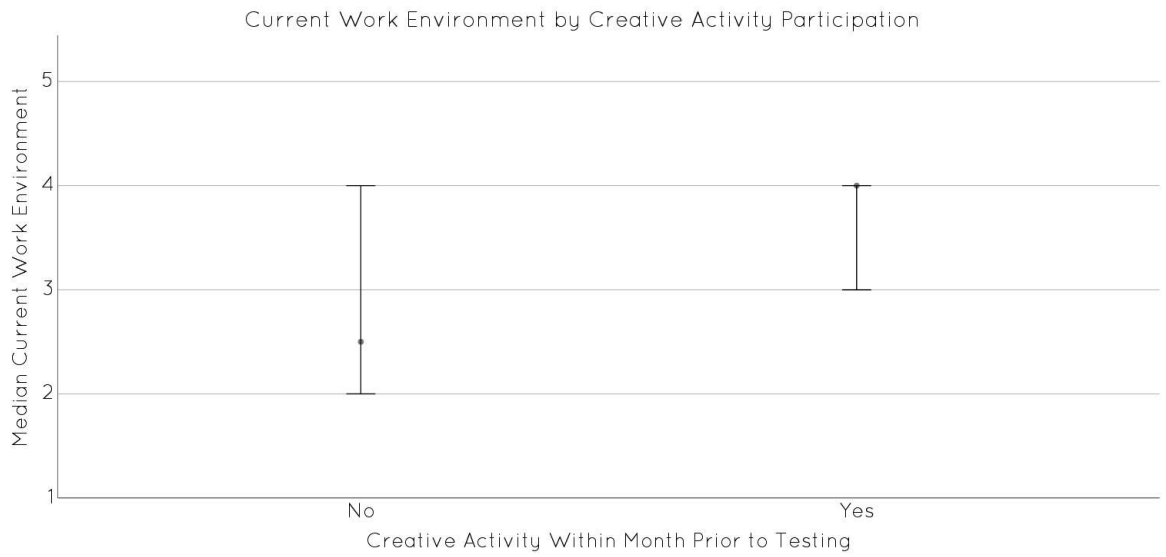

Figure 7. Current Work Environment. Median — Comparison Between Creative Activity Participants and Non-Participants. Error Bars: 95% Confidence Interval.

7.3 Secondary Question 1 – Developing the Components of Strategic Thinking

Does either the MiM or Metacognition Course alter the cognitive processes measured by the CPP or a self-report questionnaire?

Both the *CPP* and the self-report questionnaire deconstruct strategic thinking ability into a number of elements. While changes in any particular element do not necessarily indicate a change in strategic thinking ability, they may show emerging trends (see above discussion at section 5.3). Additionally, changes in individual cognitive process measures may indicate the impact of the interventions on specific cognitive processes aside from strategic thinking ability and help design more targeted interventions in the future. From the *CPP* there are 14 Information Process Competencies plus a measure of memory capability (T38), additionally there are Cognitive Preferences ranks from most preferred to least preferred (see Appendix C for further detail). From the self-report questionnaire there are the 15 components of strategic thinking derived from Sandelands and Singh, 2017).

7.3.1 Differences Across the Three Groups — *CPP Information Processing Competencies*

The results from all samples for the *CPP* Information Processing Competencies (N=53) show interesting differences.

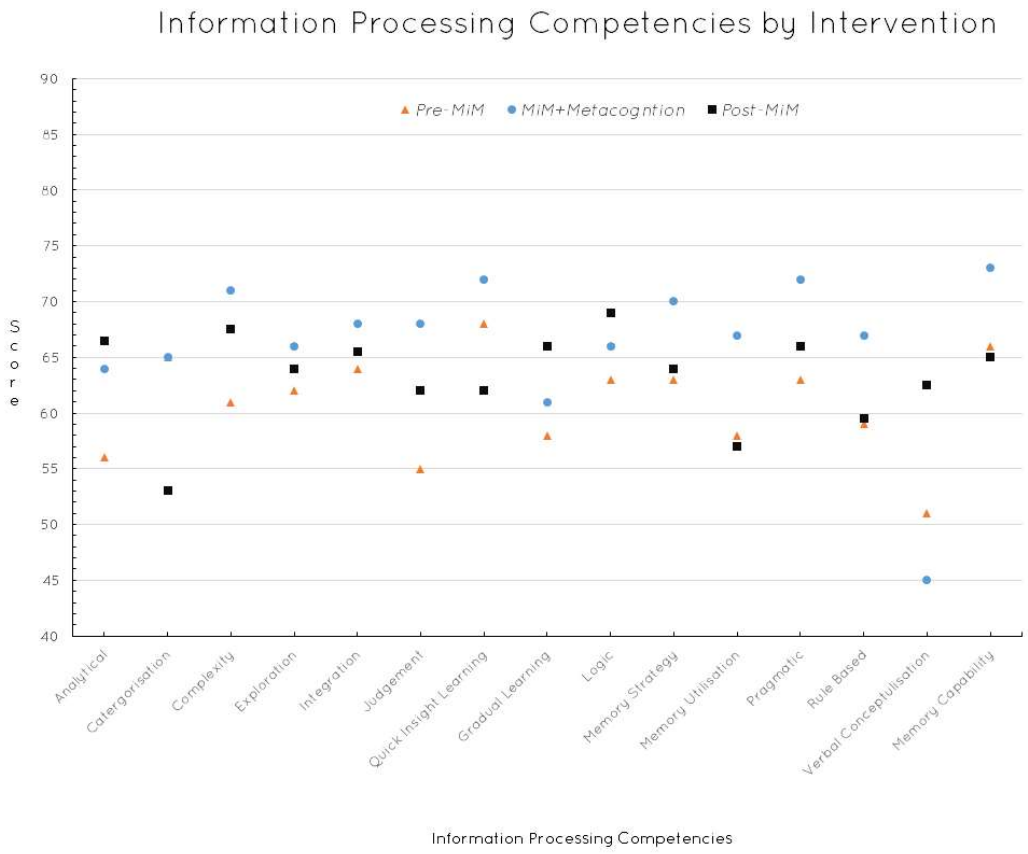

Figure 8. Information Processing Competencies. Median — Comparison Between Interventions.

- The *Pre-MiM* group has lower scores compared to both the *Post-MiM* and *MiM+Metacognition* groups on; Analytical, Complexity, Logic, Pragmatism and Memory Capability.
- The *MiM+Metacognition* group has higher scores than than both *Pre-MiM* and *Post-MiM* in: Quick Insight Learning and Memory Use.
- The *Post-MiM* group has higher scores than both others for: Verbal Conceptualisation and lowers scores for: Categorisation.

These differences were mostly not statistically significant, with the exception of:

- The lower score on Categorisation for the *Post-MiM* group was statistically significant according to the Independent Median Sample Test (0.007) but not according to the Kruskal-Wallis Test (0.085). Additionally this result is somewhat contradictory as it related to the *Post-MiM* group having a lower median than both the *Pre-MiM* and *MiM+Metacognition* groups. This is contradictory as the *Post-MiM* and *MiM+Metacognition* group had completed the *MiM* making it difficult to provide an explanation for any difference between them.

- The lower score on Logic for the *Pre-MiM* group was statistically significant according to the Kruskal-Wallis test (0.035) but not the Independent Samples Median test. However the scale of the difference was not large with medians of 63 (*Pre-MiM*), 66 (*MiM+Metacognition*) and 69 (*Post-MiM*).

- The higher score score on Verbal Conceptualisation for the *Post-MiM* group was statistically significant according to the Kruskal-Wallis Test (0.023) but not the Independent Samples Median Test. The scale of the difference was large with the *Post-MiM* medium of 62.5 compared to *Pre-MiM*—51 and *MiM+Metacognition*—45.

- The lower score for the *Pre-MiM* group for the Analytical Information Processing Competency was statistically significant according to both the Kruskal-Wallis Test (0.027) and the Independent Sample Median Test (0.019)). However, given the differences between 2017/2018 samples on this variable the results are difficult to interpret. Running the same analysis excluding the 2017 results shows no difference between the groups.

It should be noted that with the 2017 data excluded (N=28), there was no significant difference found across variables when comparing groups, but the trends in medians remained similar to those with the 2017 included (see further section 7.1.1).

7.3.2 Differences Across the Three Groups — *CPP Cognitive Style Preferences*

Within the *CPP*, the ranked order preference of Cognitive Styles is important to overall strategic thinking ability, therefore it is beneficial to consider whether a particular rank orders of Cognitive Preferences varies between interventions. Unfortunately, given that there are 14 cognitive styles

ranked within the *CPP,* there are is an extremely large number of possible permutations. Additionally, it is not possible with the information available which permutations are more or less strategic. Therefore exact analysis of whether a greater number of less or more strategic combinations occur in different groups is not possible. However, it is possible to see if a higher or lower rank on any one particular variable correlates to particular intervention. This will only show if there is a difference in how a particular Cognitive Style is ranked between groups, and not whether the overall ranking of Cognitive Styles is different.

Using the Spearman Correlation there were no statistically significant correlations observed. In particular there was not a significant positive correlation between groups and a greater preference for strategic thinking supporting cognitive styles. Nor was there a negative correlation between groups and preference for cognitive styles that anchor strategic thinking ability (for the relevant Cognitive Style Preferences see Appendix C).

7.3.3 Differences Across the Three Groups — *Self-Report Questionnaire*

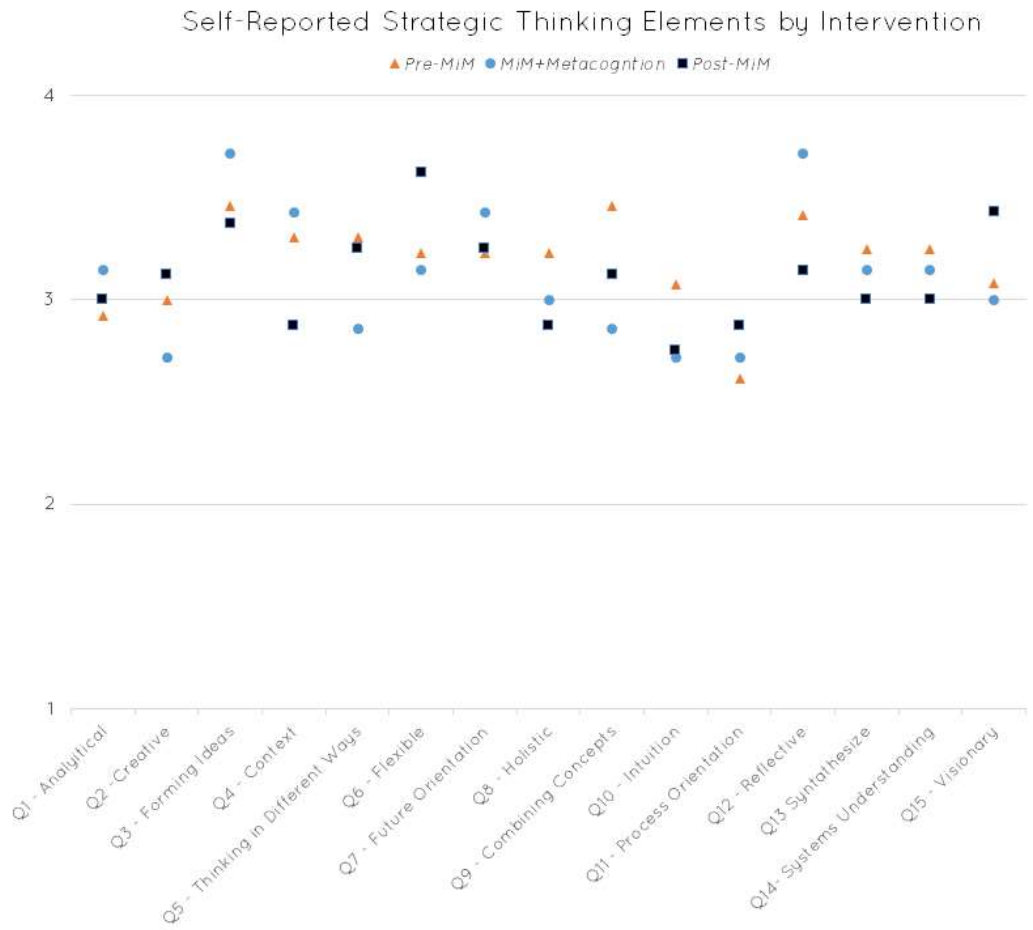

Figure 9. Self-Reported Strategic Thinking Ability by Element: Median — Comparison Between Interventions.

The relevant responses to the self-report questionnaire (N=26) when analysed show no statistically significant difference (for specific questions see Appendix A). However interestingly, the *Pre-MiM* group show scores trending higher for the questions relating to holistic thinking, combining concepts and intuition, which all related to concepts which could improve strategic thinking scores in the *CPP*. Given that the *CPP* scores were not in fact higher in the *Pre-MiM* group, this may suggest an increasing awareness of ability in these areas through the completion of the *MiM*.

7.3.4 Differences Between the Control (*Pre-MiM*) and *Post-MiM*

In addition to comparing all three groups, the interventions were also independently tested against the Control (*Pre-MiM)* this approach is akin to testing the hypothesis that the interventions created some difference, but given the limitations of the sample size is conducted with an exploratory aim. The benefit of testing the groups pairwise is that it allows more specificity in detecting any difference and enables the use of the Mann-Whitney Test.

In comparison to the *Pre-MiM* group the *Post-MiM* group showed a statistically significant higher score on the Information Processing Competencies of: Logic (Mann-Whitney 0.011), Analytical (Mann-Whitney 0.014, although noting problems within inclusion of 2017 data see section 7.1.1) and Verbal Conceptualisation (Mann-Whitney 0.021).

7.3.5 Difference Between the Control (*Pre-MiM*) and *MiM+Metacognition*

Comparing the *MiM+Metacognition* to *Pre-MiM* as a control showed a statistically significant difference in the Pragmatic Information Processing Competency (Median increase of 9 — significance 0.032 Mann-Whitney). There was no significant difference in the Pragmatic Information Processing Competency observed when comparing the *Pre-MiM* to the *Post-MiM* group, therefore it is possible this change is the independent result of the impact of the Metacognition Course in addition to the *MiM*. This aligns with the material presented in the Metacognition Course as the course had a focus on exploration and on later on considering the practical context of problems and solutions (related to the Pragmatic Information Processing Competencies). Within the *CIP* holonic model, it is not expected that high scores in the Pragmatic Information Competency is indicative of higher strategic thinking ability (Work Environment) (Cognadev, 2018).

7.4 Secondary Question 2 — The Design and Purpose of the Educational Interventions

Is either the MiM or Metacognition Course intended or designed to improve the strategic thinking ability of the participants?

The mixed method research design utilised throughout this study leans on the collection of qualitative and quantitative data to investigate different research questions. As discussed earlier, this

is an exploratory study and a pragmatic perspective was adopted, for example, data collection is utilised if it proves of practical use (Creswell & Piano-Clark, 2007; Tashakkori & Teddlie, 2003). Numerous researchers maintain interviewing is an effective method for gaining insights into interviewee's subjective viewpoints (Robson, 2002; Ho, 2006). Therefore, an interview was used to investigate the programme director's perceptions regarding the role strategic thinking ability played in the: intended design, aims and outcomes, of both the *MiM* and the Metacognition course.

7.4.1 The Master's in Management

A semi-structured in-person interview took place, May 3, 2018 at 10:30, with *MiM* programme director Stein Kleppestø. Targeted questions specifically addressed the intended objectives of the Master's programme: "The aim is to develop people that are willing and able to manage" (Kleppestø, 2018; interview, 3 May, 2018). Additionally, questions investigated the role of developing strategic thinking abilities in the design of the programme: "Increasing the ability to think strategically was not a key element of the *MiM* programme. Now, I can see there should also be room for that, but it was not part of the original design" (Kleppestø, 2018; interview, 3 May, 2018).

The *MiM* is designed to prepare students for management, an aim it shares with a wide variety of programmes, but importantly the *MiM* is designed around a definition of management as integration (Lund University School of Economics and Management, 2018), which merges with characteristics of holistic and systemic thinking. The Curriculum (Lund University School of Economics and Management, 2018), states that the *MiM* programme consists of six parts, two of which stand out in relation to strategic thinking. The first is "learning about the context of management" which clearly relates to the importance of context orientation identified by Sandelands and Singh (2017) citing Bonn (2005) and relates to the holistic cognitive style and metacognitive skill within the *CPP* (Prinsloo, 2007). The second is gaining "a better understanding of themselves" which also relates to metacognitive skill as identified in the *CPP* (Prinsloo, 2007).

The themes of integration, context awareness and self-awareness are referred to throughout the curriculum (Lund University School of Economics and Management, 2018) and are supported in developing strategic thinking by reference to experiential learning which brings the learning environment closes to work experience where effects on strategic thinking ability have been

demonstrated (see above section 4.3.1) and a focus on operativing in circumstances of uncertainty, a key aspect of strategic thinking in the *CPP* (Prinsloo, 2007). However there are also multiple references to analysis and knowledge (memory) of theories, tools and methodologies, which appear to be related to anchoring styles within the *CPP* context (Lund University School of Economics and Management, 2018; Prinsloo, 2007). It is notable that the word strategy is only used twice, both times in the context of teaching students knowledge and fundamentals of strategy, not teaching students strategic thinking skills, strategic thinking and formulating strategy, strategic cognition, are not discussed in the curriculum. (Lund University School of Economics and Management, 2018)

These trends are continued through the syllabuses for the individual courses. The syllabus for the course *Functions of Management* specifically includes the study of strategic management, but only insofar as students will have knowledge of the central perspectives of strategic management and the application of theory to management decision making (Lund University School of Economics and Management, 2016b). The course syllabus also refers to strategic positioning and the strategic process, but not strategic thinking, or the cognitive aspects of cognition (Lund University School of Economics and Management, 2016b). The syllabus for that course includes neither the term *strategic thinking* nor *strategic cognition* and does not suggest that the course is in anyway designed to improve the ability of students to formulate strategy (Lund University School of Economics and Management, 2016b). However, the course did include a real world based assignment where students were required to develop a forward looking business plan for a real company (Hörby Bruk) based on real problems and data. The syllabus for *Global Challenges* does not discuss strategy, strategic thinking, or cognition, although it does talk about providing context for management which could develop holistic, context oriented cognitive styles which increase strategic thinking in both the questionnaire and the *CPP* (Lund University School of Economics and Management (2016c). In the syllabus for *Management: Leading Individuals, Groups and Projects* neither the term strategy not strategic thinking appear and there is scant reference to the development of skills or styles that link to those measured in the questionnaire or *CPP* (Lund University School of Economics and Management (2016d). The syllabuses for *Management: Learning, Development and Change in Management and Organisations* does not discuss strategy or strategic thinking, but is focused on learning and awareness of strengths and weakness and therefore could contribute to metacognitive awareness (Lund University School of Economics and Management, 2016e). Neither

the syllabus for *Understanding Management*, nor the *Management Thesis Project*, make reference to strategy or strategic thinking, but they both discuss self-awareness and for *Understanding Management*, cognition and context (Lund University School of Economics and Management, 2016; Lund University School of Economics and Management, 2015). Importantly, *Understanding Management* included a real world assignment (the Organisational Management Project) where students were required to work in large (approximately 30 students) groups to deliver a real world project of realistic complexity and with goals only loosely defined.

7.4.2 The Metacognition Course

The Metacognition Course was designed "specifically for developing strategic thinking" abilities based on the assumption that increasing awareness of cognitive function, will allow better deployment of that function (Kleppestø, 2018; interview, 3 May, 2018). The course expects to provide to participants the increased ability to adopt cognitive processes to the information context (operational to strategic) as directly tested in the *CPP* (Kleppestø, 2018). To that extent it is specially designed to increase strategic thinking ability as measured by the *CPP* and in particular improve metacognitive ability as measured by the *CPP*.

7.5 Secondary Question 3 — Comparing the *CPP* Measurement of Strategic to the Self-Reported Measurement

For MiM students, does self-assessed strategic thinking ability correlate with the assessment of strategic thinking from the CPP?

Using the data from participants that both completed the self-report questionnaire fully and *CPP* (N=26) results can be compared to see correlations between self-reported strategic thinking ability (approximations for overall and by component) and the measures of similarly labeled abilities in the *CPP*.

The current and potential Work Environment scores were assessed for correlation with the answer to the question: Are you a competent strategic thinker?, and the total score from answers to

questions on the elements of strategic thinking. No statistically significant correlation was observed (Spearman Correlation).

In relation to correlation between individual elements, the answer to Q3. of the questionnaire: are you able to form ideas and concepts in order to understand problems? Had a statistically significant correlation (correlation of approximately 0.4, but up to 0.68, significance of below 0.05 as measured by the Spearman Correlation, showing that the answer to the question explain approximately half the variance) with the majority of Information Processing Competency scores from the *CPP*. The answers to questions Are you Flexible? And Are you able to Recognise the Context of Problems Easily? Also had significant correlations with some components from the *CPP* (at approximately 0.4–0.6). However, given the small range (1–4) for the self-report questionnaires and the clustering of results at the top end of that range these correlation between individual elements are unreliable and are speculative only.

8. Discussion

8.1 The Impact of the MiM on Strategic Thinking Ability

No statistically significant difference in overall strategic thinking ability measures were found when comparing students tested at the beginning of the *MiM* programme to those tested at the end. The lack of statistically significant results is not unexpected given the; limited sample sizes, the small spread (1–5) of strategic thinking scores, and the distribution of the data. This study was not intended to prove whether the *MiM* improved strategic thinking; instead, we sought to explore and uncover, issues with methodology, research questions and tools, as well as find preliminary results to guide future research. Because of this we looked for trends — even if they were not statistically significant — to indicate where further examination might be warranted.

When comparing the students tested at the beginning of the *MiM* with those tested at the end, there was an increase in the median level of potential work environment, from 3 to 4 (tactical strategy to parallel processing). However, there was no commensurate increase in current work environment (median of 3 in both groups). The increasing trend in strategic thinking is supported by results from students tested at the end of the *MiM* (plus Metacognition Course) as those students also had an increase in median scores. The differences observed were not statistically significant, but remained constant when the 2017 data was excluded, and when the data was bootstrapped, leading to an assessment that for an indication of trend it is relatively robust.

This small increase in strategic thinking ability potentially reflects the design of the *MiM* programme itself. While the *MiM* is neither intended nor designed to improve strategic thinking ability (see above section 7.4), elements of the curricula suggest it aims to improve the ability of students to use cognitive processes which, in turn, contribute to strategic thinking as envisaged by the *CPP*.

Within the *MiM*, strategy is explicitly taught only by providing students with knowledge and tools used to analyse or create strategic. While authors, such as Porter (1996), envisage that instruction in using strategic planning tools may result in increasing an individual's strategic thinking, that instruction provides no support for strategic thinking in the context of uncertainty as examined by

the *CPP*. The specific instruction in strategy does not cover cognitive elements of strategic thinking, either theoretically, or practically.

Liedtka, (1998), suggests that if the components are improved, the ability to think strategically is also improved, and, outside of explicit instruction in strategy, the *MiM* does seem to focus on improving several cognitive attributes or skills which could lead to improved strategic thinking. There are parts of the course that aim to increase: the ability to think holistically; to examine the context of issues; to engage in metacognitive self-appraisal abilities; to better use learning abilities and to integrate different ideas and areas of knowledge. If the *MiM* were successful in improving students' abilities in all these areas, the overall strategic thinking score would improve and/or relevant Information Processing Competencies would increase. While some significant differences occurred between groups on the individual components of strategic thinking (notably for the *Post-MiM* group involving lower median scores for Categorization and higher median scores for Logic and Verbal Conceptualization), the scores — where changes were observed — do not correlate with the cognitive attributes identified for improvement by the course documentation.

There are a number of factors that may impact the ability of the *MiM* to improve Information Processing Competencies, or overall strategic thinking scores as measured by the *CPP*. Numerous authors doubt the ability of formal education methods to improve strategic thinking ability (Easterby-Smith & Davies, 1983; Goldman & Cahill, 2009). Additionally, those authors generally study how improving strategic thinking ability is aided by work experience (Tricker in Garratt (ed), 1996; Marisk et al. 2009; Kazmia & Naaranojab, 2015; Dragoni, Oh, Vankatwyk & Tesluk, 2011; Sloan, 2017). While the *MiM* includes some elements which provide relatively realistic approximations to work (notably, the Operational Management Project (OMP) and the Horby Bruk Business Plan Assignment (see above, section 7.4), these elements are not a major part (in terms of time allocation) of the programme which remains, like most university education, based on formal learning. Given the perspectives in the literature (section 4.3 above), it seems likely including a greater amount of realistic work experience like activities would increase the potential of the *MiM* to develop strategic thinking ability. Finally, in the activities that are part of the *MiM,* increasing student participation by having them take on a variety of roles at different levels, may, considering the work of Dragoni, Oh, Vankatwyk and Tesluk, (2011), improve strategic thinking ability outcomes.

Creating a education programme solely based on work experience is, however, not likely to be a viable option for the *MiM*. The literature nonetheless suggests some approaches potentially applicable to formal learning environments which may be useful. Several such approaches — even if not yet supported by empirical evidence — could be included in the *MiM*. These might include; unsolvable problems (similar to the process used in the Metacognition Course); similarly, or creative activities — the impact of which is supported by this study (see above section 4.3.2).

Significantly, the programme is only one part of the story. The ability of individuals to learn from particular experiences varies; thus, the capacity of students to learn from deliberate practice also varies (see section 4.2 above) The *MiM* programme already includes a component which teaches students about learning from experience (see above section 7.4.1). That component could be expanded to include teaching students how to engage in deliberate practice as well as to apply learning techniques to develop strategic thinking in the context of more realistic projects and thinking tasks such as solving wicked problems (Hornett & Lee, 2017).

It is possible that the *MiM* is too removed from work to cause strategic thinking effects to cross over into the work environment (Easterby-Smith & Davies, 1983; Goldman & Cahill, 2009). However the present study offers no insight into that question. There is the potential to test this is the case by concurrently studying students in similar programmes taught on an executive basis (while people are working) or testing a workplace leadership development intervention that shares aspects with the *MiM*.

Finally, while the *MiM* programme includes approximately nine months of instruction, that period of time may be insufficient to measure any development in strategic thinking skills. Notably, the literature (see sections 4.2 and 4.3.1, above) tends to highlight those benefits as resulting from longer interventions such as work experience.

8.2 The Impact of the Metacognition Course on Strategic Thinking Ability

The impact of the Metacognition Course is difficult to measure in isolation because the students in our sample who completed the course also completed the *MiM*. Therefore any conclusions about the Metacognition Course are impacted by the *MiM* programme.

Overall, the median potential and current work environments increased from 3 to 4 comparing *Pre-MiM* to *MiM+Metacognition*. However, this change was not statistically significant. As above, given the eventual level of recruitment and the nature of the *CPP* data, statistically significant results were not feasible. Nethertheless, the trend results was consistent with bootstrapping and stronger (for current work environment) than the result for completion of the *MiM* alone.

The Metacognition course is specifically designed to improve *CPP* measured strategic thinking and there is support for the idea that wicked or unsolvable problems (as included in the Metacognition Course) improve strategic thinking ability (Hornett & Lee, 2017). While this study supports further speculation as to the impact it can not be considered definitive proof.

The Metacognition Course was, as the name suggests, directed toward improving the cognitive components of metacognition. However, when the results are broken down into individual cognitive process components there is no evidence that the course improved metacognitive ability as measured by the *CPP*. There was no significant difference between the *MiM+Metacognition* and the *Pre-MiM* samples for either that Quick Insight Learning, Judgement or Gradual Learning, the contributing processes to metacognition in the *CPP*. Therefore, this study offers no support for the Metacognition Course improving metacognitive ability.

Interestingly, there was a statistically significant increase in the score for pragmatism for those in the *MiM+Metacognition* group. Within the *CPP*, Pragmatism relates to understanding the practical and real world context of problems and looking for real world solutions (see Appendix C). It is possible that the use of a realistic problem set (problems facing the world in the next thirty five years) and a focus on identifying solutions, was a catalyst for improving pragmatism (see above, section 7.4.2). Importantly, pragmatism is not supportive of overall strategic thinking ability within the *CPP*, so this could indicate that the focus of the Metacognition Course is currently misplaced.

The authors expect a greater emphasis on deliberately practicing metacognitive skills within the context of strategy formation — such as identifying currently used cognitive processes, assessing their appropriateness, developing realistic judgments and focusing on learning skills — could cause the Metacognition Course, and particularly, the wicked problem solving section, to improve strategic thinking ability (Hornett & Lee, 2017). Further, for workshopping of problem-solving to

work, the individual may need to attempt to solve multiple problems over an extended period of time; perhaps coming back to the same problems in different roles to fully develop the different cognitive skills (Dragoni, Oh, Vankatwyk & Tesluk, 2011).

Even more so than for the *MiM,* the impact of the Metacognition Course is limited by its short duration — approximately 12 hours. Potentially compounding this problem is the fact that *CPP* testing occurred sometime after the intervention.

8.3 Lessons for *the Strategic Thinking Project* and Future Studies of Strategic Thinking Ability

Based on the results of this study, it can only be speculated that the *MiM* and Metacognition Course offer some promise of improving strategic thinking ability as measured in the *CPP*. To rigorously test that theory, given the distribution of data and the small scale of *CPP* results, it is expected that sample sizes of at least 30 per intervention will be required. It is also likely that testing will need to occur in a more rigorously controlled conditions (for example, same time of day, precisely similar instructions). Further, the *Pre-MiM* sample will need to be tested much closer in time to the start of the programme than we were able to achieve.

Using a cross-sectional study design with small samples and a population with as varied background as the individuals within *MiM* (with varying educational, experience and age backgrounds) leads to potential unnecessary variations and, in turn, potentially masks results. Self-selection to interventions may have caused certain personality types to predominate in particular groups or to have those with particular strategic thinking abilities to cluster. Such potential distortions should be eliminated from further studies. Additionally, To assist in resolving this, in the absence of a test-retest ability, allocation of participants to interventions will ideally be random. One method of doing so could be achieved by including the testing and the interventions within the *MiM* programme.

This study used self-report questionnaires as an additional measure of strategic thinking ability. The results of this study as well as the work by Sandelands and Singh (2017) support the conclusion that there is little correlation between self-reported strategic thinking ability and actual strategic thinking ability as measured by the *CPP* with one exception: that exception relates to the high

correlation between responses to the question whether the participant could form new ideas and the related *CPP* measures. The authors could not identify the reason for this correlation across groups or why this question appeared to predict related *CPP* test results. The participants largely responded at the higher end of the scale use, which, in turn, led to all groups being clustered at the highest strategic thinking ability. Given the low correlation, if *CPP* results are accepted, then it is likely that self-report measures are not useful for future studies of student samples.

The literature (see section 4.3.2 above) suggests a range of activities may impact strategic thinking although empirical evidence does not provide conclusive evidence. That point impacts any attempt to understand whether the interventions improved strategic thinking for a basic reason: students in the *MiM* or the Metacognition Course do not live in a vacuum. Instead, as they indicated in the self-report questionnaire, they participated in a range of activities during the prior month; these included hobbies, sports, work, leadership roles in student bodies, etcetera. Many students indicated they had participated in multiple activities. Participation in these activities, if the literature is correct, may, have confounded the results. Comparing strategic thinking scores between participants, or non participants for the different activities revealed no statistically significant results. Nonetheless, participation in creative/artistic activities appeared to provide a relatively large increase in current and potential work environment at a close to statistically significant level (see section 7.2.2 above), supporting the literature discussed at section 4.3.2 above.

These observations raise two implications:

- First, self-report questionnaires should focus on collecting more control information, including demographic information and information on the participants' activities which highlight the potential impact on strategic thinking. For example, those questionnaires should include more rigorous identification of the type and level of participation than used by this study. Additionally, a more nuanced way of coding the responses about participation should be developed so a standardized methodology could be employed to compare the results of various studies;

- Second, given the strong linkage between creative or artistic activities and strategic thinking ability, we believe testing this linkage should be considered within the management/business school context. This could be with either a stand-alone business

creativity intervention or alternatively, with options being provided for creative or artistic practice and expression in the *MiM* or Metacognition Course.

Besides the potential for individual learning abilities and interests having a major impact on strategic thinking ability can also impact strategic thinking ability (section 4.2, above). Thus, we suggest that future studies include testing of learning styles and learning ability to allow the impact of the *MiM* and Metacognition Course on different types of learners to be better understood. It is possible that while these interventions may have a limited impact on the general population, some specific types of learners may derive a substantial benefit in strategic thinking ability from formal instruction.

8.4 Implications for Testing and Teaching Strategic Thinking

This study did not provide evidence demonstrative that the interventions tested conclusively impacted strategic thinking ability as measured by the *CPP*. Despite the absence of conclusive evidence, we nonetheless believe similar studies should continue since important policy and ethical issues are at stake.

The *CPP* test, by identifying areas for development and potential work environments, appears to assume strategic thinking can be improved. This assumption, supported by literature by unproven empirically, may comfort those taking the test that they will be able to ultimately develop the necessary skills they need even if they receive a low score. Further, such tests as the *CPP* are not be useful for development where those tests are only sort individuals into categories, that is for jobs they can and cannot do. If strategic thinking skills cannot be practicably developed or if the test is only used for categorisation there are clear ethical implications for the standard of validity and reliability evidence provided for the *CPP*.

CPP testing is also problematic for other reasons. Initially, the literature on strategic thinking strongly suggests, by its divergence on most of the key issues, there is little agreement on the basic nature of a concept as complicated as strategic thinking. Further, there is no strong consensus on how strategic thinking relates to individuals forming a strategy. And additionally, there is strong disagreement whether that concept can be broken down into components and if so, what those

components might be (see Chapter 2 above). Moreover, the variety of components suggests that individuals have varied ways of becoming strategic thinkers; and despite variations in cognitive skills, those individuals can still engage in competent strategic thinking. Finally, whether a particular type of competence in strategic thinking ability is useful is likely to be highly context-dependent; the context can involve among other factors the nature of the problem at issue; the audience involved; and the team involved in formulating the strategy.

The foregoing discussion suggests that measuring a skill as complicated as strategic thinking rests on a gestalt of factors. In sum, different cognitive profiles are indicative at best; they are probably not applicable in all contexts. The evidence provided for the validity of the *CPP* is limited: that test can reliably measure some factors correlated with performance and often associated with strategic thinking. That test however cannot measure strategic thinking applicable to all contexts of formulating strategy. Therefore current tests should not be used to exclude people from particular roles or education; instead, such tests should serve as one data point to be combined with many others.

Educators within the *MiM* have a daunting challenge: teaching students to utilise strategic thinking where those students have potentially dramatically different personal experiences and learning abilities. Indeed, the variety of students in a *MiM* programme makes designing a single intervention difficult and perhaps impracticable. Nonetheless, the students surveyed indicated they, parallel to the literature, perceive the importance of strategic thinking and thus, desire to improve those abilities (see Chapter 1 above). To meet such student expectations in a programme like the *MiM* further studies are required to understand the characteristics of interventions that can improve strategic thinking ability and to further understand how to match those interventions to individual differences in learning ability.

9. Conclusion

Strategic thinking ability is perceived to be important for managing organizations (Benito-Ostolaza & Sanchis-Llopis, 2014; Bonn, 2001; Casey & Goldman, 2010; Simuth, 2015). And the participants in this study concur (section 7.1.2, above). Nonetheless, even if strategic thinking is considered to be important, there are disagreements as to the definition and deconstruction of strategic thinking (Chapter 2 above). This makes the measurement and study of strategic thinking ability difficult. Given this, it is unsurprising that little empirical evidence exists on developing strategic thinking ability (section 4.3, above). Additionally, most empirical work has focused on the impact of work experience and thus the impact of formal education is understudied (sections 4.4 and 4.5 above).

This study used the *CPP* — a computer-based assessment which delivers demonstrably consistent results — to analyse various aspects of strategic thinking ability by examining two interventions: the *MiM* and a Metacognition Course. To do so, we used three samples; a sample of students from early in the *MiM* programme; a sample of students from the end of the *MiM* programme (including an additional sample from 2017); and a sample of students from the end of the *MiM* programme who had taken a Metacognition Course. The *CPP* was used to test each group to assess their strategic thinking ability and cognitive preferences. A self-report questionnaire provided an additional measure of strategic thinking ability and allowed the correlation between self-perception of strategic thinking ability and the *CPP* assessment to be examined. To control confounding factors, we collected demographic and information on participation in activities suspected to impact strategic thinking ability. Finally, we examined the, intent, design and execution, of the interventions through course documentation.

The study findings provide some tentative answers to the research questions posed. In answer to the primary research question: **Does either the *MiM* or Metacognition Course improve the ability to think strategically as measured by the *CPP* (Current or Potential Work Environment) or a self-report questionnaire?** The findings provide tentative evidence that both interventions increase median overall strategic thinking scores as measured by the *CPP*. However, these increases are not statistically significant. Additionally, there is no difference between the sample groups' responses to the self-report questionnaire.

In answer to the first, secondary research question: **Does either the *MiM* or Metacognition Course alter the cognitive processes measured by the *CPP* or a self-report questionnaire?** The findings indicate that there are changes in some Information Processing Competencies (measured by the *CPP*) as a results of the interventions. Notably, the *MiM* appears to cause an increase in both the Logic and Verbal Conceptualisation competencies. While the *MiM+Metacognition* appears to cause an increase in the Pragmatism competency. These results showed statistical significance but do not appear to indicate improvements in strategic thinking ability. There were other speculative changes observed, but these appeared unreliable due to sample biases or analysis reasons.

In answer to the second, secondary research question: **Is either the *MiM* or Metacognition Course intended or designed to improve the strategic thinking ability of the participants?** The findings indicate that the *MiM* is not specifically designed to improve strategic thinking, but does aim to improve a range of cognitive attributes that could improve strategic thinking as measured by the *CPP*. The Metacognition Course, on the other hand, is designed to improve strategic thinking ability (especially through improved metacognition) and uses teaching methods that are suspected to be supportive of that aim.

In answer to the third, secondary research question: **For *MiM* students, does self-assessed strategic thinking ability correlate with the assessment of strategic thinking from the *CPP*?** The findings support the previous work of Sandelands and Singh (2017) that there is limited correlation between students self-perceived strategic thinking ability and strategic thinking ability as measured by the *CPP*.

This study provides some interesting observations to assist refine the design of future empirical work within *the Strategic Thinking Project.* Specifically, future studies should attempt to recruit larger samples and participants should be tested in a more controlled manner. Samples should be randomly assigned or the feasibility of a test-retest protocol investigated. Additional information on the activities students pursue outside of those interventions — whether undertaken before or during the interventions — should also be gathered to control the impact of confounding variables.

Despite the difficulties involved in studying strategic thinking ability, we believe that the topic is important. The participants agreed and they expressed desired to improve that ability (section 7.1.2,

above). There is therefore, a need to offer educational interventions that have a positive impact on strategic thinking ability. Currently no conclusive evidence indicates business school education positively impacts strategic thinking ability. Therefore we need to understand more about how formal education can improve strategic thinking ability and thereafter use that information to design programmes that have a demonstrable impact on that ability.

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Appendix A — Self-Report Questionnaire

Post-Test Questionnaire

This questionnaire collects some basic information to provide demographic and control context to the CPP Results. Additionally a series of questions aiming to understand your self-perceived strategic thinking ability are asked. Your name is collected so the results can be linked to the CPP results. After initial data entry your results will be de-identified. .

Date:

Name: Age: Gender:

Current Program: Previous Areas of Study:

In your own words please describe strategic thinking:

For the following questions please circle a number 1-4, with 4 being highly/very, and 1 being not at all.

How important do you think strategic thinking is for your future employment? 1 2 3 4

Do you consider yourself to be a competent strategic thinker when making decisions that will affect your future (such as which job offer to accept, or which university to apply to)?

1 2 3 4

Are you analytical? 1 2 3 4

Are you creative? 1 2 3 4

Are you able to form ideas and concepts to understand problems? 1 2 3 4

Are you able to easily recognise the context of problems? 1 2 3 4

Do you have the ability to think in many different ways? 1 2 3 4

Are you flexible and adaptable? 1 2 3 4

Are you forward thinking? 1 2 3 4

Are you more often than not able to view a situation holistically? 1 2 3 4

Do you have the ability to combine concepts, thoughts or ideas? 1 2 3 4

Are you intuitive? 1 2 3 4

Are you process oriented? 1 2 3 4

Are you reflective with an ability to draw upon and learn from past experiences? 1 2 3 4

Do you have the ability to synthesize (blend) ideas, information, or processes? 1 2 3 4

Do you have the ability to understand systems and connections? 1 2 3 4

Are you visionary and able to provide a sense of direction? 1 2 3 4

How much would you like to improve your strategic thinking ability? 1 2 3 4

In the last month have you spent time engaged in creative activities (please list)?

In the last month have you spent time planning for or making decisions about things that will occur in the future (>five years) (please list)?

In the last month have you spent time practicing meditation or mindfulness (please indicate frequency of practice) ?

In the last month have you spent time playing video/board games (please indicate frequency of gaming)?

In the last month have you participated in team sports (please indicate frequency)?

Thank you for your assistance

Appendix B — Interview Questions

General

Strategic thinking

1. What is your definition of strategic thinking?
2. What elements would you identify facilitate strategic thinking?
3. What elements can you imagine hinder strategic thinking ability?

Development of strategic thinking

1. To what extent is it developable?
2. Which activities do you think facilitate in the development of strategic thinking?

Impact of educational interventions

1. Do educational interventions have an impact on strategic thinking?
2. How do educational interventions in your opinion impact strategic thinking?

Educational Interventions

Targeted learning objectives of educational interventions

1. What were the intended aims of the *MiM* programme?
2. What were the intended aims of the Metacognition course?

Candidates

1. What were the selection criteria for candidates?

Form of education

1. Do you consider one year enough to reach targeted learning outcomes?
2. What are your thoughts on the best suitable form of education?
3. Is there a certain aim for balance between non-curriculum vs curriculum workload?

Curriculum

1. If you would have the possibility to change elements/courses of the programme, what would they be?

Appendix C — CPP Result Interpretations

The CPP measures an individual cognitive style preferences. These mainly represent the cognitive response tendencies an individual exhibits most frequently when dealing with unfamiliar information (Cognadev, 2018).

Cognitive Style Preferences: Interpretation Guide

Explorative Style — "Characterised by an emphasis on the investigation of a problem".

Structured Style — "Characterised by an emphasis on the rules of the task and the careful grouping and ordering of the information".

Reflective Style — "The tendency to explore, carefully consider information, exhibit spontaneous comparative behaviour, continually integrate new elements into existing information structures".

Reactive Style — "Associated with inadequate pacing and an emphasis on the speed".

Trial-and-error Style — "Characterised by a vague, unsystematic and unplanned approach".

Memory Style — " The tendency to internalise and automate already acquired knowledge and skill / past information".

Learning Style — "Characterized by an emphasis on exploration, memory functions, integration of feedback, understanding and self-monitoring".

Metaphoric Style — "Characterised by the tendency to view a situation abstractly and symbolically".

Analytical Style — "A tendency to apply rules, work systematically, break the whole into subcomponents and identity interrelationship between components".

Intuitive Style — "The tendency to tune into an insight and sense possibilities in vague situations".

Integrative Style — "The integrative style refers to the tendency to combine, synthesize and structure information as it is encountered to make sense of it".

Logical Style — "The tendency to apply rule-based arguments in a rigorous and intentional manner to generate convergent and/ or divergent solutions".

Holistic Style — "The tendency to see the big picture whilst being aware of the relevant subcomponents and their interconnections".

Quick insight Style — "An efficient / insight problem-solving style is characterised by effective task and goal orientation, quick processing and integration of information, using effective reasoning and memory strategies".

(Cognadev, 2018. p . 34–40)

Cognitive styles associated with Operational or Strategic Thinking (Cognadev, 2018, p. 41)

Operational Thinking	Either or Both	Strategic Thinking
Explorative	Memory	Intuitive
Structured	Learning	Integrative
Reflective	Metaphoric	Logical
Reactive	Analytical	Holistic
Trial-and-error		

Information Processing Competencies: Further information on the following page.

Information Processing Competencies: In addition to preferences above the CPP measures Competencies. The CPP reports on 14 constructs and they are measured on an 0–100 scale. Specific sub-competencies potentially "facilitate strategic growth" and higher scores suggest "stronger strategic capacity" (Cognadev, 2018, p. 57). The competencies measured and their groups are detailed in the diagram below (from Cognadev, 2018).

Processing competency		Description
Memory	Use of memory	Reliance on memory
	Memory strategies	Effectiveness of memory strategies
Exploration	Pragmatic	Practical orientation (asking whether things will work in practice). Determining relevance in structured contexts
	Exploration	The effectiveness, depth and width of exploration
Analysis	Analysis	Working systematically, independently. Detailed and precise in differentiating between, and linking, elements
	Rules	A focus on rules
Structuring	Categorisation	Creating external order, categories and reminders. Structuring tangibles
	Integration	Synthesis of ambiguous / discrepant / fragmented information
	Complexity	The preferred level of complexity and the unit of information used
Transformation	Logical reasoning	The disciplined, logical following through of reasoning processes
	Verbal conceptualisation	Unusual / flowery / creative and / or abstract verbalisation and conceptualisation
Metacognition	Judgement	Capitalising on intuitive insights to clarify unstructured and vague information
	Quick insight learning	The tendency to grasp new concepts and acquire knowledge and understanding relatively quickly
	Gradual improvement learning	A preference for practical or experiential learning

While the relationship between scores on specific competencies and strategic thinking is complicated given the dynamic nature of the *CIP*, additionally, the relationship is not described in detail within relevant Cognadev manuals (Cognadev, 2018). However, given the description of the

CIP it is expected that in general higher scores on the competencies of: Logical Reasoning, Verbal Conceptualisation, Judgement, Quick Insight Learning and Gradual Improvement Learning; are supportive of strategic thinking ability (Work Environment).