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The Ability to Think Strategically: Can it be Developed via Academic Education?

A Study of the Program Industriell Ekonomi at Lund University, Sweden

by

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Abstract

Purpose - Due to a need of the ability to think strategically in today's business world, the purpose of this study is to examine on the question whether strategic thinking can be developed via academic education.

Methodology - Two samples of the program *Industriell Ekonomi*, fifth-year students and first-year students, were tested regarding their ability to think strategically. The test was conducted using a tool called Cognitive Process Profile (CPP), which measures a person's intellectual functioning and cognitive preferences. The results were compared to the contents of the academic program to infer whether the differences arise from the impact of the academic program.

Findings - The results showed a higher ability to think strategically in the fifth-year students compared to the first-year students of the program. Significant differences have been found regarding their *Potential Levels of Work* as well as in the *Information Processing Competencies* said to facilitate strategic thinking.

Conclusion - The higher ability to think strategically of the fifth-year students can be a result of the impact of the program, since the structure of the program is designed in a way, that can be said to facilitate strategic thinking.

Contribution - This study contributes to new insights on the topic of strategic thinking in general, and particularly in connection to the development of strategic thinking via academic education.

Keywords - strategic thinking, development of the ability to think strategically, academic education, cognitive process profiling, teaching techniques

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1 Introduction

Strategic thinking is a fairly novel topic in management research, which became a field of interest in the 1970's and the beginning of the 1980's (Allio, 2006). The business world is changing in a faster and more unreliable way than ever before (Brătianu, 2015; Weaver, 2014), due to technological innovations, emerging economies and shifting political alliances (Sloan, 2017). Therefore, markets nowadays are characterized by high velocity, constant change and high competition (Allio, 2006; Bourgeois & Eisenhardt, 1998; Brătianu, 2015; Eisenhardt & Brown, 1998; Haines, 2000; Sloan, 2017). To ensure long-term success in this fast-changing business environment, organizations need a new way of strategy making (Sloan, 2017). Individuals who possess the ability to think strategically, can be seen as a central element for companies to establish and maintain a competitive advantage that makes long-term success possible (Liedtka, 1998b, found in Graetz, 2002). Likewise, the ability to think strategically can be considered as a necessary attribute in managers and other individuals who are responsible for making strategic decisions or leading a company (Brătianu, 2015; Davies & Easterby-Smith, 1983; Zabriskie & Huellmantel, 1991; Weaver, 2014). The assumption that strategic thinking is a necessary attribute in individuals who make strategic decisions is also strengthened by earlier findings, which show a correlation between managers possessing the ability to think strategically and good firm performance (Bonn, 2001; Mason, 1986; Zabriskie & Huellmantel, 1991). However, even though the advantage of having individuals with the ability to think strategically in an organization is recognized, it can be said that there is a lack of strategic thinking among individuals on multiple levels in organizations (Bonn, 2001; Garratt 1995a cited in Bonn, 2001; Mason, 1986; Moon, 2013; Zabriskie & Huellmantel, 1991). In other words, companies are in a need of individuals who possess the ability to think strategically, to ensure long-term success.

Simultaneously, however, a lack of strategic thinking in individuals has been identified and it can be assumed that a thorough understanding of how the ability to think strategically is developed would be beneficial to businesses (Brătianu, 2015; Casey & Goldman, 2010; Sloan, 2017). Different authors agree that strategic thinking can be developed (Argyris, 1991; Benito-Ostalazo & Sanchis-Llopis, 2014; Brătianu, 2015; Fontaine, 2008; Sloan, 2017; Stumpf, 1989;

Weaver, 2014). Nonetheless, convergent views exist on how strategic thinking can be developed. Research to date on whether academic education can develop strategic thinking has not led to generalizable conclusions. Therefore, further research is needed in this area.

1.1 The Strategic Thinking Research Project

This study is part of a larger research project, whose purpose is to create new insights to the topic strategic thinking (hereafter, Strategic Thinking Research Project), conducted at the School of Economics and Management at Lund University (LUSEM). This study follows the understanding of Maretha Prinsloo (cited by Kleppestø, 2017) about what strategic thinking is. Therefore, strategic thinking is interpreted as a way of thinking that is required in situations characterized by high uncertainty, high unfamiliarity, high complexity or high ambiguity. The keyword in the context of strategic thinking is unfamiliarity.

The Strategic Thinking Research Project is divided into three sub projects:

- Project 1: Defining the concept of strategic thinking
- Project 2: Examining if strategic thinking can be measured
- Project 3: Examining if strategic thinking can be taught or developed in individuals through education (Kleppestø, 2017).

This study is contributing to project three by looking at one specific academic program and its impact on the development of the ability to think strategically. For project three, a tool called Cognitive Process Profile (CPP) is used to measure the level of strategic thinking in the individuals participating in the project. The selected program for this study is *Industriell Ekonomi* (Eng.: Industrial Engineering & Management), a five-year long program, which combines engineering and management studies. The program is taught at the Faculty of Engineering, Lunds Tekniska Högskola (LTH), at Lund University, Sweden. Graduating from the program leads up to a Master of Science in Engineering, Industrial Engineering and Management (LTH, 2018a). The program is designed to give the students a good foundation for a future career within areas such as business development, marketing, management consulting, project leading or general business management (LTH, 2018b). For this study, students from the first year of the program, subsequently from the last year, will be tested using the CPP, and the results regarding their ability to think strategically will be compared.

Simultaneously, within the scope of project three, two master's programs at LUSEM are tested for the same purpose, namely: MSc in International Strategic Management and MSc in Management. The background for testing different programs is that an accumulation of the data could allow to derive more general conclusions for project three.

1.2 Research Aims and Purpose

To contribute to new insights to the topic of strategic thinking, this study aims at examining if the ability to think strategically can be developed via academic education. To reach this aim, the ability to think strategically will be measured in students enrolled in the program *Industriell Ekonomi*. The students' ability to think strategically will be measured by the CPP, which to best knowledge is the only tool to measure the level of strategic thinking in individuals. The intent is to answer the following research questions:

1. Is there a difference in the ability to think strategically between the first and the fifth-year students of the program *Industriell Ekonomi*, as measured by the CPP?
2. How can the differences/similarities between the first and the fifth-year students' ability to think strategically, as measured by the CPP, be explained in terms of the academic program *Industriell Ekonomi*?

The purpose of this study is to improve the understanding if academic education has an impact on the ability to think strategically, appreciating that other determinants might be influential on the development of the ability to think strategically. Within this study however, only the impact of academic education will be taken into consideration. The theoretical contribution will be to create a deeper understanding of what strategic thinking is, and if it can be developed via academic education. Furthermore, the study may contribute practically to the design of the curriculum for the program *Industriell Ekonomi*, and for any educational institution that wants to design an academic program that helps to develop strategic thinking. The findings moreover might prove valuable for prospective students, who face the decision of enrolling in the program *Industriell Ekonomi*, and finally for the students themselves who participated in conducting this study. Every participant receives an individual report about their own cognitive abilities, which may give indications about e.g. the work environment that would suit them best.

1.3 Introduction of the Cognitive Process Profile (CPP)

The tool used within this study, the CPP, is a test developed by Dr. Maretha Prinsloo from Cognadev UK Ltd. (Cognadev UK Ltd., 2016), a South African company specializing in developing assessment methodologies and applying those in work environments as well as developing people and organizations (Cognadev UK Ltd., 2018a). The CPP is a computer-based test, measuring:

"a person's intellectual functioning in terms of constructs such as judgement and decision-making, strategising, generalist versus specialist orientation, creativity, complexity preferences and other thinking and problem-solving factors related to professional, managerial and executive functioning" (Cognadev UK Ltd., 2016, p. 8).

In other words, the CPP is a standardized and computerized tool to measure a person's intellectual functioning and cognitive preferences (Cognadev UK Ltd., 2016). The CPP tracks and gathers data about the participant's thinking process. When exposed to the CPP, the task for the participant is to interpret a message conveyed by symbols. Clue cards, displayed on the computer screen, provide information on how to read the symbols. The task for the participant is to interpret eight stories of increasing difficulty. The clue cards can be turned, moved, eliminated and re-added as often as desired. The task is in the end to write one sentence about the message the symbols convey as interpreted by the participant. The test records how the candidate uses the pointer device to explore, clarify, link and structure the provided information. All actions taken by the participant are recorded by the system, tracking how, when, where and what movements of the clue cards the participant executes.

The CPP gives information about the individual's intellectual functioning in three different dimensions: the individual's current and potential *Levels of Work,* his/her preferred *Cognitive Styles*, and his/her *Information Processing Competencies* (Cognadev UK Ltd., 2016). More detailed information about the different dimensions will be given in chapter 2.2. Since strategic thinking is not defined in one clear way, it is difficult to know how to measure it. The definition of strategic thinking within the scope of this study however, is seen as being in close association to the definition of strategic thinking as defined by Maretha Prinsloo, the designer of the CPP. Evidence is missing however, that the CPP factually measures strategic thinking, and therefore the assumption that the CPP is measuring strategic thinking cannot fully be considered true. Nevertheless, based on previous research about the validity of the CPP (Cognadev, 2016),

recent research (Kleppestø, 2017b; Sandelands & Singh, 2017) and best knowledge, the CPP is considered as a reasonable tool for measuring an individual's' ability to think strategically.

1.4 Outline of the Thesis

Chapter two will discuss convergent views of the term strategic thinking since there is no agreement upon the definition of strategic thinking (Goldman et al., 2017), and the term is often used interchangeably with similar terms. A clear distinction from related terminologies therefore is necessary. Additionally, the core characteristics of strategic thinking will be discussed in relation to the dimensions of the CPP. Subsequently, it will be outlined how strategic thinking can be developed in general, and via academic education in particular. Previous studies examining on the topic of developing strategic thinking via academic education will be reviewed, to get an insight about what teaching techniques previous research has identified as potentially developing strategic thinking. The outcome of chapter two will be a clear understanding of the term strategic thinking as understood in this study, an outline about how strategic thinking can be developed in general, and in academic education in particular. Chapter three will set out the methodology used for this study. Chapter four will show the findings from the collected data, which subsequently will be analyzed and discussed in chapter five. Chapter six will conclude the study and provide suggestions for future research.

1.5 Delimitations

Strategic thinking can be approached from different angles. In this study a strategic approach is chosen, since this study is conducted in the master's program *International Strategic Management*, and hence the degree of interest is greater for the strategic point of view than for e.g. the cognitive point of view. This study will therefore not discuss upon topics in closer relation to cognition, e.g. about different forms of thinking or the purpose of thinking.

The course outline of the program *Industriell Ekonomi* offers a range of specialization tracks that the students choose from, which leads to a potential difference of educational backgrounds of the fifth-year students. However, this study will not consider the effect that the individual

composition of courses might have on the students' ability to think strategically, considering it nevertheless beneficial to analyze the students from this program as being from the same population, disregarding their separate tracks.

2 Theoretical Background

The aim of chapter two is to contribute to the understanding of strategic thinking. Chapter 2.1 will compromise convergent views of strategic thinking, leading to a listing of six core characteristics of strategic thinking. Chapter 2.2 will discuss the relation of the CPP to the core characteristics of strategic thinking, which will lead to a comprehension about why the CPP is a useful tool for measuring the ability to think strategically. Chapter 2.3 will discuss the development of strategic thinking in general and chapter 2.4 the development of strategic thinking in academic education. Chapter 2.5 will summarize the key takeaways briefly.

2.1 Convergent Views on Strategic Thinking

Literature does not provide one clear definition of strategic thinking and the characteristics attributed to it (Nuntamanop, 2013; Tavakoli & Lawton, 2005). However, from the literature reviewed within this study, the six characteristics presented in Table 1 (holistic, visionary, reflective, creative, analytical, intuitive) have been identified as being recurrent characteristics in previous research discussing strategic thinking. These characteristics will be further referred to as the core characteristics of strategic thinking. Table 1 aims for providing the reader with an overview about the convergent views of strategic thinking. The convergent views will be discussed more in depth in the following paragraphs. Some of the core characteristics compile different terms, which can be interpreted as having synonymous meanings, e.g.; holistic as synonymous to having a systems perspective, and synthesis. Additionally, Table 1 provides a definition of each characteristic to provide clarity about what is meant by each term. Furthermore, the authors complying with the characteristics being part of strategic thinking, are named in the table.

The definitions of the core characteristics are derived from definitions and opinions of the authors discussed in the following subchapter. The definition of the core characteristic analytical is a result of the interpretation of the authors themselves, since no clear definition

could be found within the considered body of literature. The interpretation of the term analytical therefore arises out of combining points of view considered in the reviewed literature, complemented with best knowledge.

Characteristics	Definition used from now on	Terms incorporated in the respective characteristic	Authors allocating the respective characteristic to their Definition
Holistic	"… an understanding of how different problems and issues are connected with each other, how they influence each other and what effect one solution in one particular area would have on other areas" (Bonn, 2001).	Systems perspective Synthesis Integrated perspective	Allio (2006); Bonn (2001); Fontaine, 2008); Graetz (2002); Kaufmann (1991); Liedtka (1998); Prinsloo (2016); Senge (1990)
Visionary	Conveying a sense of direction and providing the focus for all activities within the organization (Bonn, 2001).	Future-oriented Goal-oriented Long-term focus Intent-focused	Bonn (2001); Davies & Easterby-Smith (1983); Liedtka (1998); Sloan (2017); Zabriskie & Huellmantel (1991)
Reflective	"Dialogue with others and the cyclical process of double-loop learning are necessary to understand and then alter existing mental frames so new strategies can be imagined" (Casey & Goldman, 2010)	Double-loop learning Dialogue Transform experiences into learning	Brătianu, (2015); Casey & Goldman (2010); Heracleous (1998); Marone et al. (2016); Sloan (2017);
Creative	Think outside of the box and search for new and alternate ways of doing things (Bonn, 2001).	Divergent Imaginative Hypothesis-driven Question-driven Innovative thinking	Bonn (2001); Graetz (2002); Heracleous (1992); Liedtka (1998); Mintzberg (1994); Sloan (2017)
Analytical	"A systematic examination and evaluation of data or information, by breaking it into its component parts to uncover their interrelationships. Opposite of synthesis."	Research-driven Convergent	Allio (2006); Liedtka (1998); Moon (2013); Nasi (1991); Porter (1991); Zabriskie & Huellmantel (1991)
Intuitive	"The judgments and choices made through immediate cognition and without significant reflection" (Kahneman, 2013 cited in Weaver, 2014).	Subconscious	Fontaine (2008); Graetz (2002); Mintzberg (1994); Sloan (2017); Weaver (2014)

Table 1: Core Characteristics of Strategic Thinking

The relevance of the six core characteristics, is further strengthened by the fact that similar findings were made in previous research, i.e. in a study conducted by Sandelands and Singh (2017). In the study conducted by Sandelands and Singh (2017), 15 core concepts of strategic thinking are presented as being agreed upon by multiple authors to be evidential to the ability to think strategically (compare Appendix A). The 15 concepts are; Visionary, Analytical, Intuitive, Creative, Synthetic, Conceptual, Divergent, Systematic, Flexible, Context Oriented, Process Oriented, Integrative, Holistic, Reflective. As recognizable, the concepts identified by Sandelands and Singh (2017) are to some extent similar to the characteristics presented in Table 1, with the difference that this study has grouped some synonymous terms into one characteristic.

2.1.1 A Broad Perspective

Strategic thinking can be defined in fairly broad terms, like done by Nasi (1991 cited in Liedtka, 1998), where strategic thinking covers basically all attributes termed strategic (Nasi, 1991 cited in Liedtka, 1998). Strategic thinking hence includes various fields of strategy, like strategic analysis, planning, organization, control, and leadership (Nasi, 1991 cited in Liedtka, 1998). When defining strategic thinking in such broad terms however, it is important to draw distinctions to related terminologies like strategy, strategy making and strategic planning. Strategic thinking, referring to the definition of Mintzberg (1994), one of the pioneers in strategic thinking (Liedtka, 1998), is an innovative thinking process, involving *intuition* and *creativity*. Whereas strategic planning is an analytical thinking process (Mintzberg, 1994). Strategy can be defined as "a pattern of purposes and policies which are unique to the firm" (Andrews, 1971, p. 36), and strategy making can further be understood as the activities to form those patterns.

However, sometimes the different terminologies are used interchangeably to each other (Liedtka, 1998). Porter, for example, discusses strategic thinking by emphasizing a convergent and analytical focus over the creative and synthetic one (Heracleous, 1998). Therefore, Porter's view of strategic thinking corresponds to what Mintzberg (1994) calls strategic planning. To clearly differentiate between the two terms, strategic thinking and strategic planning can be considered as two different ways of thinking, which are "interrelated and complementary" (Heracleous, 1998, p. 482). The two terms are not antithetical to each other but complementary ways of thinking which should be balanced in the overall process of making strategy (Sloan, 2017). Hereafter, the focus will be on discussing strategic thinking, and not the related terminologies.

2.1.2 A Particular Way of Thinking

Liedtka (1998) takes a different approach in comparison to Nasi (1991 cited in Liedtka, 1998). She defines strategic thinking more narrowly, describing it as particular way of thinking. She characterizes strategic thinking by five attributes, which are; having a systems perspective (seeing the connections between different entities from various angles), being intent-focused (being able to concentrate and focus the effort in the right direction until the goal is reached), applying intelligent opportunism (the intention must be flexible enough to be able to switch to

new strategies that are emerging), thinking in time (using information from the past and the present to think about and design the organization's future) and being hypothesis-driven (forming and testing hypothesis as well as making use of both creative and analytical thinking sequentially). Fontaine (2008) also defines strategic thinking as a way of thinking, building upon Liedtka's definition of the term. He describes this thinking process as an intuitive, creative and synthetic way of thinking (Fontaine, 2008). Moreover, in line with Liedtka (1998), he states that a strategic thinker has a *holistic* view on the big whole as well as on the interrelations of the pieces themselves, and that strategic thinking is the outcome of a continuous learning process (Liedtka, 1998; Mintzberg 1994; Sloan, 2017).

2.1.3 A Synthesis of Intuition and Creativity

The way that Mintzberg (1994) defines strategic thinking, as a synthesis, involving intuition and creativity, is supported by Bonn (2001), Graetz (2002) and Heracleous (1998). Graetz (2002) describes strategic thinking as a thinking process happening in the right side of the brain, where creative and intuitive thinking processes take place. Heracleous (1998) states that strategic thinking is a creative and divergent thought process with the purpose of discovering new, imaginative strategies, which can lead to strategic repositioning. Bonn (2001) as well emphasizes creativity as an important attribute when defining strategic thinking. Hence, it can be said that the views of Bonn (2001), Graetz (2002) and Heracleous (1998) build upon the view of Mintzberg (1994), all emphasizing on creativity and intuition as being crucial characteristics of strategic thinking, while Porter's contradicting view on strategic thinking does not seem to be further supported by other authors. Langer additionally (year cited in Weaver, 2014), makes the connection between intuition and creativity by saying that "creativity arises through an "intuitive experience of the world" (Langer year cited in Weaver, 2014, p. 114). In other words, intuition sparks creativity, leading to the ability to new mindsets in favor of old mindsets and approaches.

2.1.4 A Systems Perspective

Apart from creativity, Bonn (2001) uses two other main elements to describe strategic thinking, namely; having an integrated understanding of the organization and its environment and having a vision for the organization's future (Bonn, 2001). In other words, this can be expressed as

having a holistic and *visionary* view of the enterprise. Having a holistic view can be understood as seeing and understanding various parts of the organization and their interconnections with each other (Bonn, 2001). Kaufmann (1991) takes a similar approach, saying that strategic thinking includes the skill to shift from seeing the organization in isolation to seeing the organization as an integrated system, connecting individual parts to the big whole. Bonn's (1998) and Kaufmann's (1991) views comply with the view of Mintzberg (1994) who argues that strategic thinking includes to have an "integrated perspective of the enterprise" (Mintzberg, 1994, p. 108).

The need to have a holistic view, put forward by Bonn (2001) as well as Kaufmann (1991), can be understood as being synonymous to the systems thinking approach by Senge (1990). Systems thinking explained as a conceptual approach to clarify patterns and to identify how to effectively change them (Senge, 1990). Having a systems perspective can help people to distance themselves from situations they are involved in, which is helpful in strategic thinking, because being part of something can impede to see the patterns but just snapshots of individual parts, which in turn may hamper problem solving (Senge, 1990). The opinion that having a systems' perspective is part of strategic thinking is also shared by Liedtka (1998), who includes the systems perspective in her five attributes describing strategic thinking. Prinsloo (2016) accordingly argues that strategic thinking includes to see and to understand the integrated, interactive, dynamic and complex world as one entity and not just its separate parts. She furthermore states that systems thinking helps to focus on the overall context, its specific elements, the interdependencies among those and the complexities of the interactions (Prinsloo, 2016). Hence, it can be said that systems thinking is understood synonymously with having a systems perspective, which is one element of strategic thinking (i.e. holistic).

2.1.5 A Combination of Analysis and Creativity

As aforementioned, the opinion of Porter (1991), describing strategic thinking as being first and foremost an analytical thought process, is rather contradicted than supported by the other authors considered in this study. However, there are authors emphasizing both analysis and creativity in their definition of strategic thinking. Sloan (2017) sees strategic thinking as a reflective thought process including both intuition and analysis, aligned with Moon (2013) who defines strategic thinking as "a way of solving strategic problems that combines a rational and convergent approach with a creative and divergent thought process to find alternative ways of

competing and providing customer value" (Moon, 2013, p. 1699). In other words, Moon (2013) emphasizes analysis, creativity and divergence as being crucial elements of strategic thinking. The need for analysis to think strategically is also put forward by Zabriskie and Huellmantel (1991), who explain that when executing strategic thinking, leaders make use of their intuition, combined with research about future trends, and needs that can affect the markets of tomorrow (Zabriskie & Huellmantel, 1991). Particularly, Zabriskie and Huellmantel (1991) opine that neither intuition nor analysis is sufficient to think strategically but that a synthesis of both is needed.

2.1.6 A Reflective Way of Thinking

Additionally, to the synthesis of intuition and analysis, Sloan (2017) as well as Graetz (2002) mention the ability of being *reflective* as an important element of strategic thinking (Graetz, 2002; Sloan, 2017), which furthermore can be seen in close relation to transforming experiences into learning and dialogue (Sloan, 2017). The ability in individuals to reflect on their experiences, by themselves as well as in a dialogue with other people, helps to learn from one's own behavior and mistakes and hence is helpful for developing strategic thinking. This process of reflection on experiences is called double-loop learning and will be explained in 2.2.4.

To sum up on the convergent views of strategic thinking, it becomes clear that some characteristics are more recurrent than others in previous research when discussing strategic thinking. The six characteristics presented in Table 1 (holistic, visionary, reflective, creative, analytical, intuitive) are the ones identified by this study as being the core characteristics of strategic thinking.

2.2 The CPP in Relation to Strategic Thinking

As indicated in chapter 1.3, the CPP provides information about an individual's intellectual functioning in three different dimensions: the individual's *Current* vs. *Potential Levels of Work*, his/her preferred *Cognitive Styles*, and about his/her *Information Processing Competencies* (Cognadev UK Ltd., 2016). The results in the two dimensions *Levels of Work* and *Cognitive Styles* arise out of the *Information Processing Model (Figure 2),* which is the underlying model

of the CPP (Cognadev, 2018b). All three dimensions will be explained in detail to provide the reader with an understanding of what the CPP factually measures, and how the results give information about an individual's ability to think strategically.

For the sake of coherence and an easier understanding for the reader, the *Levels of Work* will be discussed first, followed by the *Cognitive Styles* and the *Information Processing Competencies*, since this is the order how the results will be analyzed and discussed later.

2.2.1 Levels of Work

The dimension *Levels of Work,* gives insight about the individual's most suitable current and potential work environment. The CPP distinguishes between five different levels of work, reaching out from purely operational to purely strategic, namely; pure operational, diagnostic accumulation, tactical strategy, parallel processing and pure strategy. The different levels are illustrated in the model *Levels of work*, see Figure 1.

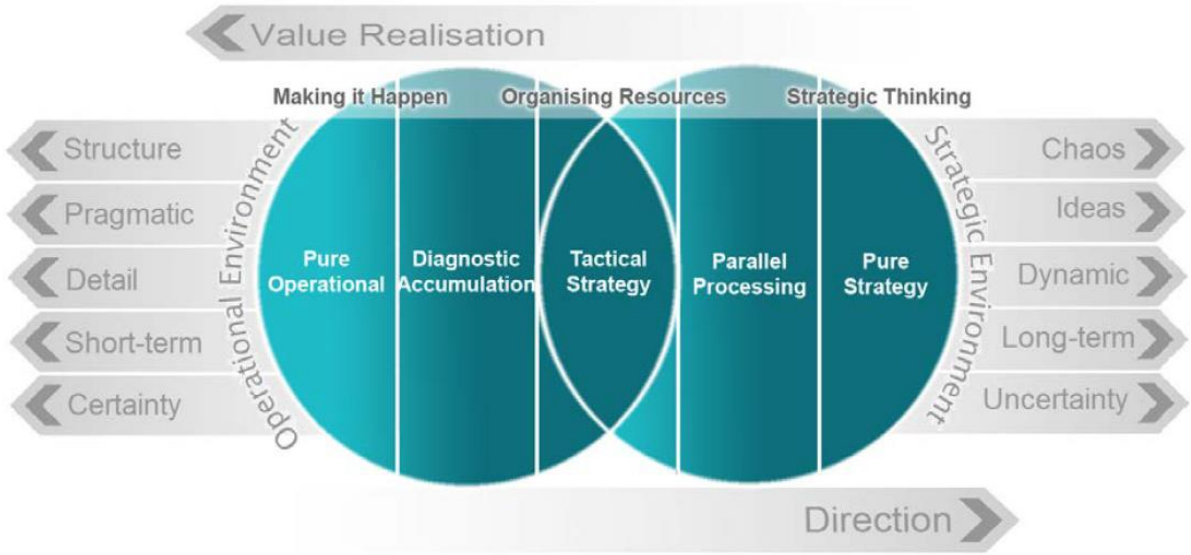

Figure 1: Levels of Work (Cognadev UK Ltd., 2018b, p. 25)

The model *Levels of Work* is divided into two domains, an operational (left circle) and a strategic domain (right circle), which in turn creates the five work environments, i.e levels of work. The model illustrates that work environments change from being purely operational (structured, pragmatic, detailed, short-term and certain) to being purely strategic (chaotic, imaginative/ideas, dynamic, long-term and uncertain). The change of work environments, from

operational to strategic, is not a linear process, but it is rather a gradual change, sliding from operational to strategic.

For the dimension *Levels of Work,* the individual taking the CPP will get two different scores between one and five (from purely operational (1) to purely strategic (5)). The first score is referring to the individual's *Current Level of Work,* which is the type of work environment where the individual currently is most suitable for to work in according to his/her cognitive abilities. The second score, the individual's *Potential Levels of Work,* is referring to the work environment the individual has a potential to work in with respect to the current cognitive abilities, he/she has shown when taking the CPP. A person can for example score 3 in the *Current Levels of Work,* and 4 in the *Potential Levels of Work,* meaning that the person currently is most suitable to work in a *Tactical Strategy* environment, but when taking the CPP, the person showed that he/she as well has cognitive abilities suitable for a *Parallel Processing* work environment. In other words, the person showed that he/she has those cognitive abilities, however only using them in a hesitantly way.

The strategic environment, as characterized in Figure 1, seems to be similar to the description of today's business world, characterized by volatility and unpredictability. Furthermore, the characteristics put forward by the CPP as being required in a strategic environment are similar to the core characteristics of strategic thinking, e.g. having a vision and seeing the whole not just its parts. Hence, the CPP is not only able to measure if an individual applies the core characteristics, but also to measure to what level the individual makes use of the core characteristics. The higher the score is that an individual reaches in the *Levels of Work*, the higher his/her ability to think strategically. The composition of the scores in the dimension *Levels of Work* underlies a specific algorithm, however, which is not disclosed and therefore, the influencing factors of the score cannot be analyzed in detail. It is known, however, that the other two dimensions *Cognitive Styles* and the *Information Processing Competencies* reveal additional information about the person's ability to think strategically.

2.2.2 Cognitive Styles

Cognitive Styles refer to the cognitive response tendencies an individual shows when dealing with unfamiliar information (Cognadev UK Ltd., 2018b). The cognitive response tendencies an individual shows in unfamiliar situations, however, most likely are equal when dealing with familiar situations (Cognadev UK Ltd., 2018b).

The CPP differentiates between 14 *Cognitive Styles*, which are ranked for each individual regarding one's cognitive preferences while taking the CPP. Cognadev UK Ltd. (2018b) allocates the different *Cognitive Styles* to three different categories: operational thinking, either or both and strategic thinking, depending on whether they facilitate operational thinking, strategic and/or operational thinking or just strategic thinking. Table 2 shows the allocation of the *Cognitive Styles* to the three categories as made by Cognadev UK Ltd (note: Cognadev just allocates 13 out of 14 Cognitive Styles to the respective categories).

Cognitive Styles Associated with Operational or Strategic Thinking

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

Table 2: Cognitive Styles Allocated to Operational and/or Strategic Thinking (Built upon Cognadev UK Ltd., 2018b, p. 41)

Different *Cognitive Styles* are suitable for different work environments, depending on whether the work environment is characterized as more operational or more strategic (Cognadev UK Ltd., 2018). A linear connection between one's preferred *Cognitive Styles* and the best suitable work environment for an individual has not been proved, however, the preference of one's *Cognitive Styles* indicates how he/she deals with unfamiliar information. Hence, if an individual's preferred *Cognitive Styles* rather comply with those assigned to strategic thinking, it can be said that he/she thinks more strategically.

Cognitive Styles and the Core Characteristics of Strategic Thinking

The *Cognitive Styles* can also be connected to the core characteristics of strategic thinking. The connection was made using the *Cognitive Styles: interpretation guidelines* provided in the "Manual for The Cognitive Process Profile (CPP) Assessment" (Cognadev UK Ltd.., 2018b). All the *Cognitive Styles* in the category strategic thinking, as well as two *Cognitive Styles* in the category either or both can be connected to the core characteristics of strategic thinking. The interpretation of strategic thinking as made by the CPP therefore is similar to the interpretation of strategic thinking within this study, which can be interpreted as an evidence that the CPP factually measures the ability to think strategically. Table 3 shows how the *Cognitive Styles* can be connected to the core characteristics of strategic thinking.

Cognitive Styles Associated with Operational or Strategic Thinking

Operational Thinking	Either or Both	Core Characteristics associated with either or both	Strategic Thinking	Core Characteristics associated with Strategic Thinking
Explorative	Memory	-	Intuitive	Intuitive
Structured	Learning	Reflective	Holistic	Holistic
Reflective	Metaphoric	-	Integrative	Holistic
Reactive	Analytical	Analytical	Logical	Creative, Visionary
Trial-and-Error				

Table 3: Cognitive Styles in Connection to the Core Characteristics (Table 1) of Strategic Thinking

For a more detailed explanation between the *Cognitive Styles* and their allocation towards strategic or operational thinking, please consider Appendix B.

2.2.3 Information Processing Competencies

As previously indicated, the scores in the dimensions *Levels of Work* and the *Cognitive Styles* arise out of the *Information Processing Competencies*, which are presented in the *Information Processing Model*, Figure 2.

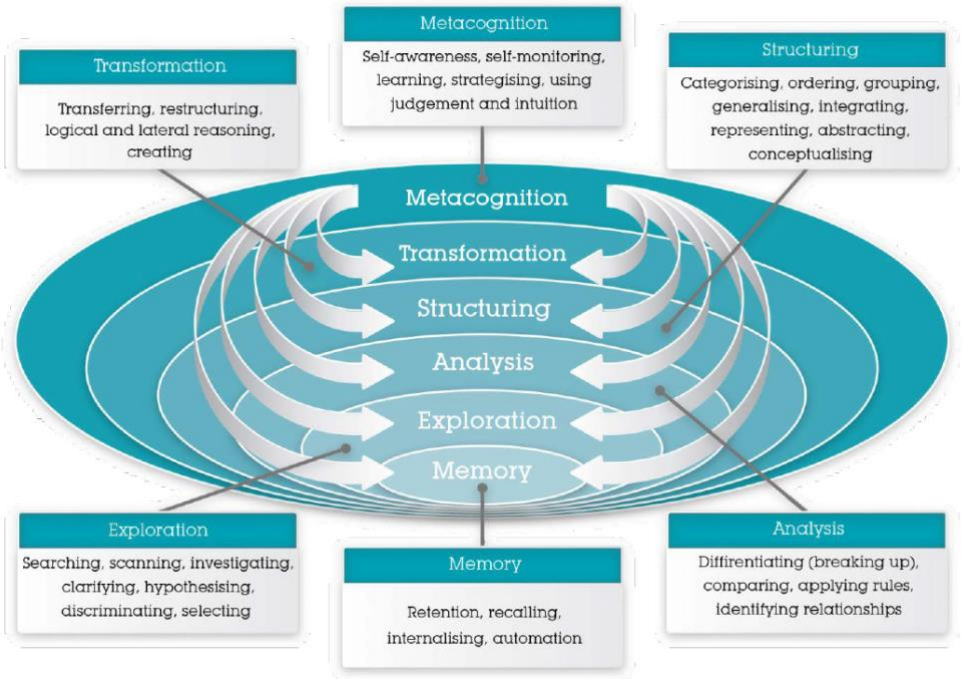

Figure 2: Information Processing Model (Cognadev UK Ltd.., 2018b, p. 56)

The *Information Processing Model* presents six *Information Processing Competencies*; memory, exploration, analysis, structuring, transformation and metacognition. These thinking

processes can be understood as "functional information processing categories" (Cognadev UK Ltd., 2016, p. 24), which, taken together, represent a complete thinking process. The six *Information Processing Competencies* are organized in a "soft-hierarchy", meaning that there is no strict hierarchy nor linearity, but the *Information Processing Competencies* are highly integrated and increasingly complex (Cognadev UK Ltd., 2018b). Hence, the model is organized as a holon, referring to a system consisting of different subsystems, incorporating and transcending each other (Cognadev UK Ltd., 2016). The holonic structure shows that the CPP does not categorize one's intellectual functioning into stages or phases but presents that the process of making sense of information is a non-linear thinking process, consisting of various competencies (Cognadev UK Ltd., 2016).

Relations within the Information Processing Model

In more detail, an individual uses memory as the foundation for solving a problem, subsequently explores, analyses, structures and transforms the information, based on knowledge and experience, into a solution (Cognadev UK Ltd., 2016). This process is guided by metacognitive awareness, metacognition referring to self-awareness. The more complex/uncertain the situation, the higher the inclusiveness of the six *Information Processing Competencies* (Cognadev UK Ltd., 2018b). Neither competency is less needed than the others, but the extent to which the competencies are needed in a thinking process is dependent on the unfamiliarity of the situation. For example, memory plays a different role in an operational environment than in a strategic environment. The interaction between the individual competencies increases the more unfamiliar a situation becomes. This is aligned with the findings from the theoretical background, which revealed that unfamiliar situations require strategic thinking, which in turn requires analytical as well as systems thinking to a certain extent, although not determinable to what extent in particular.

The six *Information Processing Competencies* as shown in Figure 2 are further divided into various sub-competencies (hereafter, information processing sub-competencies), which will be discussed in the next subchapter.

2.2.4 Information Processing Sub-Competencies

As indicated, the *Information Processing Competencies* are subdivided into several sub-competencies (compare Table 4).

Processing Competency	Sub-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 / Integration	Categorization	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 Conceptualization	Unusual / Flowery / creative and/or abstract verbalization and conceptualization
Metacognition	Judgement	Capitalizing 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.

Table 4: Information Processing Competencies (based on Cognadev UK Ltd., 2018b, p. 58)

The *Information Processing Competencies* and their sub-competencies (compare Table 4) are interrelated and, taken together they represent an entire thinking process. Although all the information processing sub-competencies are needed to some extent for strategic thinking, some sub-competencies are explicitly facilitating strategic thinking (Cognadev, 2018; Kleppestø, 2017).

The sub-competencies that are said to facilitate strategic thinking (compare Table 5, highlighted in yellow) are sub-competencies of the *Information Processing Competencies*; structuring, transformation and metacognition and the relevant sub-competencies are; *Integration*, *Complexity*, *Logical Reasoning*, *Verbal Conceptualization*, *Judgement* and *Quick Insight Learning*. In the following, it will be explained how those sub-competencies facilitate strategic thinking.

Structuring

The processing competency *Structuring* consists of three sub-competencies, namely categorization, integration and complexity, where *Integration* and *Complexity* are said to facilitate strategic thinking.

Structuring is described as ordering and integrating information about a situation, in order to being able to establish relationships between certain elements and to put together a meaningful

whole (Cognadev UK Ltd., 2018b). In other words, in this phase of the thinking process, individuals build up a network of concepts, and "explore and expand [their] knowledge" (Cognadev UK Ltd., 2018b, p. 62). This can be connected to what Liedtka (1998) refers to as building up a repertoire of tools, which she means is an essential part of developing strategic thinking (see Chapter 2.3.2). Hence, it can be said that the processing competency structuring, on an overall level, facilitates strategic thinking.

On a more detailed level, the sub-competency *Integration* refers to "synthesis of ambiguous/discrepant/fragmented information" (Cognadev UK Ltd., 2018b, p. 58), which can be connected to the core characteristic holistic (compare Table 1) of strategic thinking. *Complexity* refers to the level of complexity the individual prefers, and the level of complexity of the information he/she uses (Cognadev UK Ltd., 2018b, p. 58), and as mentioned, as the environment of today's business is getting more complex, individuals with the ability to think holistically and to handle an increased complexity are required. Hence, the higher the score an individual reaches in those two sub-competencies, the higher their ability to think strategically. *Categorization* is not explicitly facilitating strategic thinking since there is of no help to categorize unknown things/use categorization to make sense out of an unknown situation, since unknown information cannot be categorized.

Transformation

The information processing competency *Transformation* can be described as including convergent (one right answer) and divergent (different alternatives) thinking. Relating *Transformation* to the core characteristics of strategic thinking, it can be said that both sides of strategic thinking, the analytical (convergent) and the creative (divergent) side are incorporated in *Transformation*, and that this processing competency hence facilitates strategic thinking. It consists of the two sub-competencies *logical reasoning* and *verbal conceptualization* (Cognadev UK Ltd., 2018b), both said to facilitate strategic thinking.

Furthermore, *Transformation* can be described as having the ability to change, restructure and adjust an existing structure of information when this information is no longer adequate for a certain context (Cognadev UK Ltd., 2018b). It can therefore be assumed that it is especially useful to possess the *Transformation* competency in an unpredictable and volatile environment, since it leads to logical reflection about, and creative adjustments of, old information, so that it helps to make sense of a current environment. On a more detailed level, the sub-competency *logical reasoning*, refers to "the disciplined, logical following through of reasoning processes"

(Cognadev UK Ltd., 2018b, p. 58), and the sub-competency *Verbal Conceptualization* is defined as "unusual/flowery/creative and or abstract verbalization and conceptualisation" (Cognadev UK Ltd., 2018b, p. 58).

Metacognition

The processing competency *Metacognition* is meant to be the most important requirement in order to think effectively (Cognadev UK Ltd., 2018b). Metacognition refers to self-awareness, self-monitoring and self-evaluation, to plan strategies and to learn from mistakes (Cognadev UK Ltd., 2018b). Hence, it can be connected to what literature calls double-loop learning. Double-loop learning is the ability to reflect upon one's experiences (Heracleous, 1998), reflection in turn is said to develop strategic thinking (Sloan, 2017).

Furthermore, *Metacognition* refers to the usage of intuition, another core characteristic of strategic thinking and hence relates to strategic thinking. The three sub-competencies of Metacognition are *Judgment, Quick Insight Learning* and *Gradual Improvement Learning.* The first two of these sub-competencies are said to facilitate strategic thinking. *Gradual Improvement Learning* does not facilitate strategic thinking, because it relies on practical and experiential learning. In unfamiliar environments, situations are novel, and no practical experience exists that can be used to make decisions. *Judgment* is defined as "capitalising on intuitive insights to clarify unstructured and vague information" (Cognadev UK Ltd., 2018b, p. 58), and *Quick Learning Insight* is defined as "the tendency to grasp new concepts and acquire new knowledge and understanding relatively quickly" (Cognadev UK Ltd., 2018b, p. 58). Intuitive insights, unstructured information and the ability to acquire new knowledge [...] relatively quickly, are key capabilities in strategic thinking. Therefore, the two sub-competencies *Judgement* and *Quick Insight Learning* are likely to facilitate strategic thinking. Hence, a high score in those sub-competencies implies a high level of the ability to think strategically.

As the discussion shows, the ability to think strategically, or at least something which can be said to be in close association to strategic thinking, can be measured by the CPP. However, it is of major interest in this study to see whether the ability to think strategically can be developed via academic education. Hence, the following chapter will review literature about how strategic thinking can be developed and whether the teaching techniques used in academic education can be useful in the development of strategic thinking.

2.3 Development of Strategic Thinking

Different authors agree upon that strategic thinking can be developed (Argyris, 1991; Benito-Ostalazo & Sanchis-Llopis, 2014; Brătianu, 2015; Fontaine, 2008; Sloan, 2017; Stumpf, 1989; Weaver, 2014). However, differences can be seen in the understanding of how strategic thinking is developed (Sloan, 2017). Traditionally, the development of strategic thinking has evolved around formal learning such as strategy courses and conferences (Davies & Easterby-Smith, 1983; Sloan, 2017). However, some authors argue that it is rather informal learning that contributes to the development of strategic thinking (Mintzberg, 1994; Sloan, 2017). Others in turn, question that informal learning itself can develop strategic thinking, but rather believe that a combination of informal learning and experience is required to develop strategic thinking (Casey & Goldman, 2010; Sloan, 2017).

In the following, formal learning and informal learning, will be discussed regarding their usefulness in the development of strategic thinking. Furthermore, key components of the development of strategic thinking will be pointed out. Moreover, common teaching techniques used in academic education will be assessed, and previous studies examining the development of strategic thinking will be discussed. The aim hereby is to get an understanding about how strategic thinking can be developed.

2.3.1 Different Approaches to Strategic Thinking

One opinion about the development of strategic thinking is that formal learning techniques like strategy conferences or courses, do not help to develop strategic thinking in individuals, but that rather informal learning like e.g. traveling or thinking about world affairs, is influential on the development of strategic thinking (Sloan, 2017). Formal learning is defined as "structured, planned, preprogrammed, and institutionally sponsored or classroom-based learning where a trainer, teacher, manager, professor, or some other "education agent" is responsible for planning, implementing, and evaluating the learning that occurs" (Sloan, 2017, p. 42). Formal learning includes techniques that evolve around a single event e.g. lectures and strategy courses (Sloan, 2017). Informal learning, in turn, is seen as "learning that is predominantly unstructured, unplanned, experiential, non-institutional, and non-routine [and] takes place as people go about their daily activities at work or in other areas of life" (Sloan, 2017, p. 42), e.g. traveling.

Contradictory to formal learning, informal learning is the outcome of a continuous learning process, not evolving around single events (Casey & Goldman, 2010; Mintzberg, 1994; Sloan, 2017; Weaver, 2014), and is a way of learning that happens outside of formal settings (Bull et al., 2008). In other words, informal learning is an implicit, unintended and unstructured way of learning, which takes place in informal settings without e.g. a teacher being present (Eraut, 2004).

Formal learning techniques, e.g. lectures and readings can be considered useful for transferring knowledge and information, and for developing skills for making rational decisions and analysis but are not enough to develop strategic thinking skills (Davies & Easterby-Smith, 1983; Sloan, 2017). Sloan (2017) supports this view with the argument that formal learning techniques are ritualistic, mechanistic, and emphasize analysis (Sloan, 2017), and therefore are not efficient in developing strategic thinking. The assumption that informal learning rather than formal learning develops strategic thinking is reflected in various studies.

Formal training seems irrelevant in the development of strategic thinking (Sloan, 2017). Sloan (2017) builds her opinion on the results of in-depth interviews she has conducted with business executives from around the world. The interviews showed that formal training neither had a positive nor a negative effect on the development of the executives' ability to think strategically (Sloan, 2017). Similar results were found in a study made by Davies and Easterby-Smith (1983), who examined how strategic thinking, seen as an essential ability for managers to lead the strategic agenda of their company, can be developed. Within the scope of the study, 60 managers were asked about the factors, which in their opinion, had contributed to the development of strategic thinking in their role as managers. In the interviews, none of the managers mentioned formal development techniques i.e. strategy courses as a helpful mean. A similar study was conducted by Marshall and Stewart (1981 cited in Davies & Easterby-Smith, 1983), where 86 managers were interviewed about influencing factors on the perception and execution of their job, showed similar results; formal education and training were not seen as being influential. The results of those studies can be said to support Sloan's (2017), as well as Mintzberg's (1994) view that formal learning on its own, does not develop strategic thinking in individuals.

In contrast, many of the executives surveyed in the aforementioned study conducted by Sloan (2017), mentioned traveling as one factor that had contributed to the development of their ability to think strategically. Sloan (2017) explains how traveling can be connected to

developing to think strategically as follows; when traveling, people are confronted with new and unfamiliar situations that challenge one's own assumptions. In situations of unfamiliarity new ways of making sense of those novel circumstances need to be developed (Sloan, 2017). In the process of making sense of these unfamiliar circumstances, strategic thinking is developed. Hence, traveling can be interpreted as being an informal type of learning (Sloan, 2017). Mintzberg (1994) as well argues that the process of developing strategic thinking is informal, as well as chaotic and experiential.

The development of strategic thinking can be interpreted as an iterative learning process characterized by informal learning, rather than deriving from single events (formal learning) (Casey & Goldman, 2010; Mintzberg, 1994; Sloan, 2017; Weaver, 2014). Therefore, the following subchapter discuss key components, identified as being influential on the development of strategic thinking, with the aim of providing a thorough understanding of what fosters the development of strategic thinking.

2.3.2 Key Components of the Development of Strategic Thinking

Different authors agree that the development of strategic thinking is an iterative process (Casey & Goldman, 2010; Davies & Easterby-Smith, 1983; Liedtka, 1998; Sloan, 2017). In this study, knowledge, experience, interaction and reflection have been identified as key components of the development of strategic thinking (compare Table 5). In the following section, these components and their role in the development of strategic thinking will be discussed.

Key Components of Developing Strategic Thinking	
KNOWLEDGE Theoretical Practical	**EXPERIENCE** Work Experience Daily Life Experiences
INTERACTION Exchange of Experience Cross Fertilization	**REFLECTION** Self-Reflection Double-Loop Learning

Table 5: The Four Key Components of the Development of Strategic Thinking

Knowledge

It can be said that *knowledge* is a recurrent component when discussing the development of strategic thinking. However, opinions diverge on the question of what type of knowledge supports the development of strategic thinking. Some authors (Hsueh et al., 2006; Liedtka, 1998) argue that *theoretical* knowledge is required to develop strategic thinking. Casey and Goldman (2010) on the other hand refer to four types of knowledge about how to do things, which therefore is seen as practical knowledge (factual, conceptual, procedural and self-concern).

Factual knowledge refers to having a systems perspective, which can be directly connected to strategic thinking, and further it means to have knowledge about how individual parts of a whole are interconnected (Casey & Goldman, 2010). The *procedural* knowledge refers to knowledge about e.g. how to write down hypotheses and how to develop ideas (Casey & Goldman, 2010), which furthermore can be connected to the core characteristic *creative* (See Table 1). The *conceptual* knowledge refers to understanding that by taking different views, various ideas can be formed (Casey & Goldman, 2010), which is connectable to the core characteristics *creative* and *holistic*. Lastly, to possess the ability to be *self-concerned* about one's strengths and weaknesses in strategic thinking is a crucial knowledge for an individual to be able to develop his/her ability to think strategically (Casey & Goldman, 2010), which as well is connected to strategic thinking and the importance of being *reflective*. In other words, one needs to be aware of his/her lack of competencies t in order to improve those.

Other authors (Hsueh et al., 2006; Liedtka, 1998) emphasize that theoretical knowledge is important to develop the ability to think strategically. Hsueh et al. (2006) argue that students develop their ability to think strategically by learning about different strategy frameworks. Accordingly, Liedtka (1998) takes the view that frameworks, techniques and concepts are means that help individuals to broaden their view of the world, and subsequently help to develop new ideas (Liedtka, 1998). She says that individuals need to set up their own repertoire, a set of tools, from which they can pick the concept which is best suited for solving a certain strategic issue (Liedtka, 1998). Subsequently, those frameworks, techniques and concepts can be seen as a helpful toolkit to support people's strategic thinking in situations of solving strategic problems.

Sloan (2017) identifies revision of existing knowledge as a part of strategic thinking, saying that gathering and analyzing data is relevant to study new situations. Subsequently, Sloan

(2017) sees the revision of existing knowledge as part of the process of strategic thinking (Sloan, 2017). Hornett and Lee (2017) refer to the integration of knowledge from different sources as important in developing strategic thinking, and Weaver (2014) takes the position that strategic thinking evolves over time through the application of theoretical knowledge gained by relevant experience (Weaver, 2014).

In sum it can be said, that accumulation of theoretical and practical knowledge, as well as the revision and integration of knowledge from different sources seem to be important in the development of strategic thinking and therefore knowledge is identified as one key component of the development of strategic thinking.

Experience

Experience is another crucial factor in the development of strategic thinking (Casey & Goldman, 2010; Davis & Easterby-Smith, 1983; Dragoni et al., 2011; Dragoni et al., 2014; Liedtka, 1998; Sloan, 2017). However, different types of experience are discussed in relation to the development of strategic thinking. Casey and Goldman (2010), Davies and Easterby-Smith (1983), Dragoni et al. (2011) and Dragoni et al. (2014) for example, see work experience as one type of experience developing strategic thinking. Dragoni et al. (2014) explicitly put forward a positive correlation between the amount of time spent working abroad and an individual's level of strategic thinking (Dragoni, 2014).

Other authors (Davies & Easterby-Smith, 1983; Liedtka, 1998; Sloan, 2017) take the view that experience gained in daily life e.g. when doing business, going to school or from private life is rather beneficial in the development of strategic thinking. In other words, experience that is gained in situations of informal learning and not explicitly in contexts or situations with the aim for developing strategic thinking (Sloan, 2017). This is supported by the findings of Sloan's (2017) study, discussed earlier, where executives mentioned traveling as a main factor contributing to the development of their strategic thinking ability (Sloan, 2017), not their working experience.

Interaction

Another key component of the development of strategic thinking is interaction. That interaction is developing strategic thinking can be seen as a reasonable assumption, since learning from each other (e.g. through teamwork or discussions) can help to; create new ideas, detect new patterns, enable thinking outside the box and foster cross fertilization of each other's opinions (Schilling, 2017). Davies and Easterby-Smith (1983) for example take the view that support

from senior management and the interaction between senior and junior management can be helpful in order to foster knowledge creation and enable experience (Davies & Easterby-Smith, 1983). For example, a collaboration between junior staff and senior employees can foster strategic thinking early on in the careers of junior employees (Davies & Easterby-Smith, 1983).

Liedtka (1998) supports the view that interaction is an important part in the development of strategic thinking. Furthermore, interaction between people from various backgrounds is important to ensure a variety of opinions and different perspectives on a situation (Davis & Easterby-Smith, 1983; Liedtka, 1998).

Reflection

Lastly, reflection is essential in the development of strategic thinking (Casey & Goldman, 2010; Sloan, 2017). The importance of reflection can be explained by the benefits gained from having the ability of double-loop learning. Double-loop learning is a way of learning, which is characterized by questioning existing assumptions and plans (Heracleous, 1998). In other words, double-loop learning is a process about reflecting on external circumstances as well as on one's own behavior, leading to the ability to learn from one's mistakes and experiences (Argyris, 1991). Hence, it can be said that reflection is a key component of the development of strategic thinking (Argyris, 1991; Sloan, 2017). Reflection is what helps individuals to change their way of learning from single-loop learning, referred to as pure problem solving, finding and rectifying mistakes in external issues (Argyris, 1991), to double-loop learning, which in turn develops strategic thinking.

To sum up, it can be said that a combination of the key components knowledge, experience, interaction and reflection fosters the development of strategic thinking. Certainly, the degree to which those components are accumulated and integrated with each other might have an effect on the development of strategic thinking. Clearly, other elements might exist that additionally can influence the development of strategic thinking positively but within this study, the four components knowledge, experience, interaction and reflection have been identified as the most important ones.

2.4 Development of Strategic Thinking in Academic Education

Teaching techniques applied in academic education today are mainly formal (Sloan, 2017). In the following section, lectures, case studies and business simulations, all being common teaching techniques used in academic education, will be discussed regarding their effectiveness in developing strategic thinking. Furthermore, studies examining on the topic of developing strategic thinking via those techniques will be discussed.

Lectures

Lectures can be an efficient mean to introduce concepts such as a mission or vision (Stumpf, 1989), or what strategic thinking is, as well as transferring other pieces of information or knowledge (Davies & Easterby-Smith, 1983). However, according to Davies and Easterby-Smith (1983), Stumpf (1989) and Weaver (2014), lectures are not sufficient to develop strategic thinking. Davies and Easterby-Smith (1983) specifically criticize lectures for not being able to help individuals to understand why e.g. a business plan is designed in a particular way. It has also been shown to be hard for individuals to understand how to transfer the knowledge derived from a lecture to another situation, as well as managing to later relate the knowledge they gain through a lecture to their individual actions (Stumpf, 1989).

Case Studies

The method of using case studies has been an appreciated tool by educators to use when teaching students about business (Davies & Easterby-Smith, 1983; Fontaine, 2008; Hsueh et al., 2006; Weaver, 2014). The following advantages of using case studies in academic education is however found. First, it is an opportunity for students to learn strategy making in the form of role-plays (Hsueh et al., 2006), which gives students an insight about how the business landscape of today looks like (Weaver, 2014). Second, case studies can integrate different business areas, such as marketing, finance and logistics, hence students learn to display a situation holistically (Hsueh et al., 2006). Third, students interact with each other (Hsueh et al., 2006), which, as discussed, is a key component of the development of strategic thinking. Fourth, students are taught frameworks that help them analyzing the case as well as lead to the attainment of skills and knowledge that can be applied in real business scenarios (Hsueh et al., 2006).

However, there are some limitations to the application of case studies in academic education. Davies and Easterby-Smith (1983) see the problem with case studies, that the teacher often has a preferred way of solving the case and students most often quickly pick up the cues of the teacher's behavior indicating that they are on the right track. Subsequently, they rather solve the case in a way to get to the solution expected by the teacher than solving it in an independent way, "they learn to conform to the accepted wisdom" (Davies & Easterby-Smith, 1983, p. 41). However, it can be said that relying on accepted wisdom might not be enough when making strategies in an unpredictable environment.

Hsueh et al. (2006) argue that case studies are vulnerable to judgement biases as e.g. confirmation bias and groupthink, which can lead to the belief that there is only one right solution to the case (Hsueh et al., 2006). Lastly, case studies do not provide any possibility to test hypotheses since it is not possible to simulate different scenarios (Hsueh et al., 2006).

Furthermore, Weaver (2014) means that case studies are not enough to develop strategic thinking because case studies do not develop intuition and an understanding of cause and effect. An understanding about cause and effect is important however, to develop strategic thinking because it teaches students to react accurately when conditions change due to unexpected events. Intuition is further defined as "the judgments and choices made through immediate cognition and without significant reflection" (Kahneman, 2013 cited in Weaver, 2014, p. 113), sparking creativity and the ability to challenge old mindsets (Weaver, 2014). Therefore, case studies seem to not be effective in the development of the ability to think strategically.

As discussed above, case studies can be an effective tool in academic education to teach students about e.g. strategy. Previous research however, seems to agree upon the fact that case studies are not sufficient in developing strategic thinking since it can lead to groupthink, conforming to an accepted wisdom, and that case studies miss out on providing the student with the opportunity to critically reflect over possible alternatives, test various hypotheses and develop their intuition.

Business Games and Simulations

Fontaine (2008) sees a synthesis of creativity and intuition (similar to Liedtka, 1998 and Mintzberg, 1994) as well as a systems perspective, as important characteristics of strategic thinking. He as well takes the view, that case studies are not effective in developing strategic thinking because they do not develop a systems perspective. However, Fontaine (2008) has experienced that the use of business simulations can teach students how to make use of

hypotheses before making a strategic decision, and develop their systems perspective, which subsequently improves their ability to think strategically. To analyze the students' level of strategic thinking, Fontaine provides MBA students with a business simulation where the players pretend to manage a restaurant chain. The players set up hypotheses and subsequently test them via the business simulation software. First the players do not have any information about how the resources of the restaurant impact each other, but after a few rounds the players are shown a resource map explaining the relationship between the different components. According to Fontaine (2008), the players start to make better strategic decisions and the results imply that the players' level of strategic thinking increased by engaging in the business simulation. Whether the result from Fontaine's study is generalizable for business simulations can be questioned, since he is only referring to one particular type of business simulation. The point of view that business games and simulations are effective to develop strategic thinking however, is supported by other authors (Benito-Ostolaza & Sanchis-Llopis, 2014; Hornett & Lee, 2017; Reeves & Wittenburg, 2015).

Benito-Ostolaza and Sanchis-Llopis (2014) support the argumentation that business games and simulations can develop strategic thinking, meaning it is thanks to the similarities between business games and real-life situations. Since they refer to strategic thinking as analyzing a firm's strategic situation and creating new approaches to outperform competitors (Benito-Ostolaza & Sanchis-Llopis, 2014), it cannot certainly be said that their approach counts for academic education, however, it can be assumed that business games are effective in academic education as well. In their study, two groups of individuals with the same qualifications were given a case to solve; only one group receiving instructions and training in advance. The group that received training before the game, played strategically from the beginning, making more strategic decisions than the group that did not receive any training beforehand. However, their actions became more strategic throughout the game (Benito-Ostolaza & Sanchis-Llopis, 2014), indicating that strategic thinking was developed throughout the game as they got more experienced.

It can be questioned, however, if the knowledge gained from business games is transferable to other contexts. Past research takes opposing views on this issue. Davies and Easterby-Smith (1983) question that the learning effect can be transferred from the game context to a business context, whereas Sloan (2017) takes an opposing view, referring to the outcome of her study, where the executives she interviewed, meant that they first and foremost developed their ability

to think strategically in a non-work environment, and then transferred this ability into a work environment.

2.5 Summary of the Theoretical Background

This study has identified the following characteristics as being the core characteristics of strategic thinking; holistic, visionary, reflective, creative, analytical and intuitive. These core characteristics have been connected to the dimensions measured by the CPP (levels of work, cognitive styles and information processing competencies). The interpretation of strategic thinking as made by the CPP is similar to the interpretation of strategic thinking within this study, which indicates that the CPP factually measures the ability to think strategically.

It can be said that strategic thinking can be developed. Furthermore, informal learning techniques seem to be more effective than formal learning techniques, but the combination of informal and formal learning techniques might be the most effective way to develop strategic thinking. Either way, it can be said that knowledge, experience, interaction and reflection are key components of the development of strategic thinking. When looking into the common teaching techniques used in academic education, like lectures, case studies, business games and simulations, lectures and case studies are criticized for not being effective in developing strategic thinking, whereas business games and simulations seem to be effective.

Furthermore, previous research about the development of strategic thinking has mainly focused on business executives and managers in a business context (Bonn, 2001; Davis & Easterby-Smith, 1983; Graetz, 2002; Liedtka, 1998; Sloan, 2017; Zabriskie & Huellmantel, 1991), but not on students in academic education. Hence, it can be said that evidence exists that strategic thinking can be developed in individuals. However, up until now, research does neither confirm nor disprove the assumption that the ability to think strategically can be done through academic education. Due to the need of individuals possessing the ability to think strategically in today's business world, it is of interest to examine whether academic education develops the ability to think strategically in students, which will be done by examining the program *Industriell Ekonomi.*

3 Methodology

The following chapter will describe the methodology of this study. First, an overview about the process of reviewing the theoretical background will be given. Second, the research philosophy, approach and design will be discussed. Third, the method for collecting data will be explained as well as the approach of the data analysis. Finally, the validity and reliability of this study will be discussed.

3.1 About the Theoretical Background

The theoretical background (Chapter 2) helped to understand what until today has been discussed about the topic strategic thinking. In more detail, it provided an understanding about the different interpretations of the term strategic thinking as well as about the existing knowledge about the development of strategic thinking. Literature was searched for by scanning the library of Lund University School of Economics and Management (LUSEM) as well as its online databases (e.g. LUBsearch) and external online databases such as Google Scholar. The focus has been on articles published in academic journals since this can be taken as an indication for high quality (Easterby-Smith et al., 2015). A traditional literature review approach was taken (Easterby-Smith et al., 2015), focusing on summarizing and analyzing the most important body of literature upon the topic in question. The literature was summarized and organized in a summary record, which allowed for comparison and analysis of different views (Easterby-Smith et al., 2015) on the topic of strategic thinking.

The theoretical background revealed a gap in the literature regarding the development of strategic thinking via academic education, since the majority of the previous studies about the development of strategic thinking relies on studies conducted in business surroundings, on executives and managers. The limited amount of studies, as identified by this study, that focus on examining the relation between education and strategic thinking focus on examining the effectiveness of different teaching methods, such as lectures, case studies or business games

and simulations. Those studies are however not taking into consideration the overall impact of academic education on the development of strategic thinking. In order to examine whether academic education can have an impact on the development of the ability to think strategically, students enrolled in the program *Industriell Ekonomi* at Lund University were tested by the means of the CPP.

3.2 Research Philosophy and Research Approach

The research philosophy of this study is a combination of positivism and pragmatism. Knowledge about the underlying philosophical factors of a study is helpful in order to clarify what research design is suitable to answer the research question (Easterby-Smith et al., 2015). The first research question originates from the belief that the ability to think strategically can be measured, and is by that taking a positivism approach, whereas the second research question is about finding out the reasons of a certain issue, taking a pragmatic approach.

A multiple methods approach was taken for the data collection. An advantage of choosing different methods within the same study is, that different methods can address different purposes (Saunders et al., 2009). The two research questions of this study required different pieces of information to be answered.

The multiple methods approach in this study included one set of quantitative data, the CPP, and one set of qualitative data, an in-depth interview. The quantitative data, gathered via the CPP, was used to answer the first research question ("Is there a difference in the ability to think strategically between the first and the fifth year students of the program *Industriell Ekonomi* as measured by the CPP?"), the qualitative data from the interview with the program leader was used to answer the second research question ("How can the differences/similarities between the first and the fifth-year students' ability to think strategically, as measured by the CPP, be explained in terms of the academic program *Industriell Ekonomi*?"*)* Both research questions were addressed by a deductive research approach, since the objective of this study is to test, not to create theory, which would have been an inductive approach.

3.3 Research Design

This study chose a quasi-experimental research design, with the purpose to overcome the issue of random assignment, which e.g. experimental methods are connected to (Easterby-Smith et al., 2015). In quasi-experimental studies the participants are not allocated randomly to the experimental and the control group, but due to specific criterions (Easterby-Smith et al., 2015). This type of research design bears the advantages of clarity, transparency and repeatability (Easterby-Smith et al., 2015). More precisely, a cross-sectional comparison was used. A cross-sectional comparison is about comparing two groups, one having experienced a certain thing that the researcher is interested in (experimental group), the other group not having experienced the same thing (control group). The results of the two groups are compared with the purpose to view potential differences that allow conclusions about causality (Easterby-Smith et al., 2015). The aim is that the two groups do not differ in any other criterion than the planned intervention (Saunders et al., 2009), otherwise no solid conclusions about the cause-and-effect interrelation of the respective groups can be reached (Easterby-Smith et al., 2015).

In this study, two groups of students from two different years of the same academic program were tested to see whether participation in the academic program *Industriell Ekonomi* has led to differences in their ability to think strategically. The control group is a group of first-year students attending the program *Industriell Ekonomi*, the experimental group is a group of fifth-year students of the same program. The difference between those groups is that the members of the experimental group have completed most of the program *Industriell Ekonomi* when taking the CPP, while the participants of the control group recently have started the program. In this case, however, it is not possible to say that the only difference between the two groups is that the fifth-year students have come further in their education, since the students' experiences apart from their academic education most likely vary as well. In other words, it is not possible to completely eliminate alternative explanations for the differences in the test results of the two groups identified in the data (Easterby-Smith et al., 2015).

3.4 Motivation for Choosing the Program Industriell Ekonomi

As aforementioned, the selected program for this study is *Industriell Ekonomi,* taught at LTH at Lund University. The five-year long program integrates mathematics, engineering, economics and management, aiming at educating students to become skillful leaders and decision makers in roles on the borderline of engineering and business (LTH, 2018a). The motivation for choosing this program derives from various aspects.

First, the graduates from the program will most probably throughout their career take on roles as key decision makers, such as managers, project leaders, business developers (LTH, 2018b). As seen from existing literature, possessing strategic thinking abilities nowadays is a necessity, or at least a helpful element, for executing those positions successfully. The need of strategic thinking makes it interesting to examine on whether students already possess the ability to think strategically when they start their academic program, and furthermore if the ability is developed throughout their academic career, or whether no differences are shown between the first-year and the fifth-year students' ability to think strategically. Second, the program was ranked as the twelfth most competitive academic education to get admitted to in Sweden 2017 (Antagningspoäng, 2018a). Similar statistics about the admission to the program holds for the last five years. The competitiveness to get admitted to the program allows the assumption that the admitted students have above average cognitive skills and a motivation to learn, implying that if the program can develop strategic thinking, there should be a visible effect in these students.

3.5 Data Collection Method

As explained above, data was collected by using two different methods. The quantitative data was collected in the way that both samples of students took the CPP with the purpose to see whether there is a difference in the ability to think strategically between the first and the fifth-year students. The qualitative data was collected by an in-depth interview with the program leader of the program *Industriell Ekonomi,* Eva Berg. The interview provided information about

the structure of the program, its content and the teaching techniques used throughout the five years. The interviewee consented to be mentioned by her name.

The following subchapter describes: the sampling method used for acquiring participants for the CPP, the conduct of the CPP, and the structure and execution of the interview. Additionally, the identified limitations with the methods will be pointed out.

3.5.1 Sampling Method for the CPP

To acquire participants for the control group, probability sampling was used. Probability sampling (also representative sampling) is most commonly used when inferences from the sample about the population are desired (Saunders et al., 2009). The sample for the control group was needed to make inferences about the ability to think strategically of the students enrolled in the first year of the program *Industriell Ekonomi.* The probability for being part of the sample was the same for each student enrolled in the first year of the program *Industriell Ekonomi*, since the information was distributed during a lecture offered to all students from the respective year. Additionally, students not attending that specific lecture were still bearing the opportunity to attend, because all necessary contact information was provided to the whole class and a registration period of three weeks was considered sufficiently long to ensure that everybody who was interested got the possibility to sign up for the study. This sampling method led to a sample size of 15 participants in the control group.

To acquire students for the experimental group, non-probability sampling was used, meaning that the sample was not chosen statistically random (Saunders et al., 2009). The sampling methods used for the experimental group were convenience sampling, and snowball sampling (Easterby-Smith et al., 2015)**.** The application of two different methods is explained as follows. The students desired for the experimental group, the fifth-year students, were conducting their degree projects at the time of acquiring participants for this study. The students did not have lectures at the faculty anymore, and hence, the first attempt to acquire students was by using convenience sampling. A pitch and a presentation, containing all relevant information about the project itself, the CPP, and the contact information needed for signing up for the test, was published in the Facebook group of their year. However, this sample method only motivated one student to participate, which was the reason why the snowball sampling method additionally was applied. One professor, supervising four degree project teams, was contacted

and asked to distribute a preformulated email to his students, with the intention to arouse interest in the students to sign up for the study. The email contained the same information as the presentation used in the first sampling attempt did. The professor's help was useful in terms of accessing the students in a more direct way, and for increasing the projects' legitimacy. In reaction to the professor's email, four additional students signed up, and asked fellow students to participate as well, which led to a final number of nine participants in the experimental group.

To secure representativeness, a sample should bear the same characteristics as the population itself, otherwise it can be claimed distorted (Easterby-Smith et al., 2015). A sample can be distorted, for example, when some individuals have a higher chance to be part of the sample than others, due to excluding groups of people, the method of distributing information or the language used (Easterby-Smith et al., 2015). To avoid excluding or favorizing any individuals, it was made sure that all students got the same information at the same time, nobody who signed up was rejected for any reasons, and a Swedish speaking person was always available in case of comprehension problems regarding the language. The snowball sampling method can be criticized for not reaching out to all students.

In connection with the CPP, all participants provided information about their age and gender, whereby it was possible to examine on the representativeness of the samples with regard to their populations. The sample of the fifth-year students consisted of 44 % females and 56 % males, the total population of 39 % females and 61 % males (Antagningspoäng, 2018b) and hence, the sample is representative for the population in terms of gender. The sample from the first year consisted of 13 % females and 87 % males, the population consisted of 35 % females and 65 % males (Antagningspoäng, 2018b). The sample of the first-year students hence is not perfectly representative for the population in terms of gender. In terms of age, the students starting the program are according to the program leader of *Industriell Ekonomi* between 19-20 years old, and 24-25 years old when they finish the program. Hence, sample one, with the mean age of 21 years, can be said to be representative to the population in terms of age, since the students by the time they took the CPP had completed ¾ of the first year, and should be between 20-21 years old. The mean for sample two is 24.6 years, and thus being representative to the population as well.

Limitations regarding the Sampling

Non-probability sampling does not allow to draw conclusions about the sample's representativeness to its population (Saunders et al., 2009). Hence, it might be that sample two

does not represent the problem in question to its full extent. However, non-probability sampling can be justified as being the most practical sampling method in the exploratory stage of a research project (Saunders et al., 2009), which is applicable for the Strategic Thinking Research Project. It is, however, recommended to use probability sampling techniques in further investigations (Saunders et al., 2009).

Furthermore, the initial intention was to use the same sample method for both the control and the experimental group. However, different sampling methods needed to be applied as a result of having problems accessing the fifth-year students.

The fact that the study itself, as well as all information about it, was provided in English could have led to a biased sample, unconsciously excluding people who were not feeling comfortable about their English language skills. It was seen as necessary, however, to distribute all information in English, since the test itself requires a certain level and confidence with the English language. Additionally, Cognadev UK Ltd., the company providing the CPP, suggests that the participants should be native English speakers or have studied English for at least five years (Cognadev UK Ltd., 2016). The latter was the case for all participating students.

3.5.2 Conduct of the CPP

The participants took the CPP test in a monitored environment at LUSEM, supervised by an accredited CPP practitioner. Two different time periods for taking the test were offered to the participants, each containing three days, comprising two four-hour time slots each. The time blocks were placed in two non-consecutive weeks in April 2018, to decrease the chance of losing participants due to e.g. sickness or holidays. On the test occasion, the accredited CPP practitioner introduced the test to the participants, providing all necessary information about the background of the project, the practicalities regarding the execution of the test, and legalities about the protection of their data, before the participants started the test. The introduction, containing background information about the project and the test, was held in Swedish, to ensure that none of the participants missed out on any important information. The official test taking policies however were read out in English.

All participants used their own computers and headphones for taking the test, wherefore it can be assumed that they were familiar with their devices and no difficulties regarding the handling of the hardware occurred. The usage of headphones in the test was necessary in order to be able

to listen to the instructions of a virtual mentor, who provided guidance to the test takers throughout the first four stories. The instructions were additionally written out in text on the computer screen, which left the decision to the participants whether they preferred to listen or to read instructions by themselves. After the first four stories, no more instructions were given. When the participant has interpreted all eight stories, the test was finished.

Limitations regarding the CPP

The most relevant results would arise if the control group took the CPP one day before starting the program, and respectively if the experimental group, was tested one day after graduating from the program. Due to time restrictions and the academic schedule of the participants however, that way of testing was not possible. Considered as the best possible and feasible alternative, the CPP assessment was conducted using samples who at the time of this study, were currently attending the first respectively the fifth year of the program.

3.5.3 Structure and Execution of the Interview

The interview conducted with Eva Berg, the program leader of *Industriell Ekonomi,* was a semi-structured in-depth interview. The interview was arranged via email and took place in Berg's office on the 18th of May 2018 between 1 pm-2 pm. The intent of the interview was primarily to get a clear understanding of the program's structure, its content and its teaching techniques.

Throughout the interview a topic guide (Appendix C) was used to cover all topics of importance, while leaving room for discussion. The questions were open questions to avoid biasing the interviewee (Saunders et al., 2009). Furthermore, the techniques of laddering down and clarifying probes were used to get practical examples, and to sharpen the responses to avoid misunderstandings and misinterpretations (Easterby-Smith, 2015).

The interview was divided in three parts. First, general questions about the structure and content of the program were asked. Second, questions designed more specifically to the purpose of this study were asked, like e.g. if and how the six core characteristics of strategic thinking are developed via the program. Third, since the interview was conducted after the results of the CPP had been analyzed, it was possible to ask more specific questions related to the results. The interviewee was not given any information about the concept of strategic thinking, and the results of the CPP were disclosed until all other questions were answered, to get unbiased information. The interview was recorded to avoid misunderstandings.

3.6 Data Analysis

The data derived from the CPP includes information about the participant's *Current* and *Potential Levels of Work*, the preferred *Cognitive Styles* and the *Information Processing Competencies*. The statistical evaluation program SPSS (Statistical Package for the Social Sciences) was used for the data analysis. The test that was conducted in SPSS to examine on significant differences between the two samples' ability to think strategically, was the non-parametric Mann-Whitney U Test. The motivation for using a non-parametric test is that non-parametric tests are suitable for small samples, and for comparing samples of different sizes. Additionally, no assumptions need to be made about normal distribution when using a non-parametric test. The independent variable in the Mann-Whitney U Test consisted of the two independent samples of this study (the first and the fifth-year students), whereas the *Levels of Work, Cognitive Styles* and the *Information Processing Sub-Competencies* were tested as the dependent variable. Furthermore, SPSS was used to calculate the Spearman correlation coefficient between the participants' results of the CPP and their age. The Spearman correlation coefficient was used because it is a non-parametric measure that is suitable for testing the correlation between two variables that are not normally distributed.

The information obtained from the interview was summarized by topics and subsequently used for analyzing the differences shown by the CPP with respect to the design of the program *Industriell Ekonomi.*

Limitations regarding the Data Analysis

The intended sample size of 30 students within each sample was not reached. The smaller sample size can affect the precision of the sample negatively (Easterby-Smith et al., 2015). Hence, the rather small sample size in this study can query the representativeness, validity, reliability and generalizability of the study. Moreover, the sample size had an impact on the data analysis method. A larger sample would have enabled the use of a parametric test for the data analysis. By this means, the analysis could have been based on less assumptions, since parametric tests allow for the assumption of normally distributed data (Saunders et al., 2009). Due to the smaller sample size, it was not possible, and a non-parametric data analysis was applied.

3.7 Validity and Reliability of the Collected Data

The data generated by the CPP, is automatically stored on the servers of Cognadev UK Ltd. Before making the data available to the accredited CPP practitioner, mistakes in the processing of the data were eliminated by Cognadev UK Ltd. The quality of the quantitative data in this study relies to some extent on the CPP's validity (that it measures what it is supposed to measure) and reliability (the consistency of the measurement). According to Cognadev UK Ltd. (2016), the CPP tool has, after its development in the 90's, continuously been validated as an effective tool for measuring a person's intellectual functioning through a number of quantitative and qualitative studies (Cognadev UK Ltd., 2016). Regarding the reliability of the CPP, empirically examinations conducted by Cognadev UK Ltd., show that the test is reliable (Cognadev UK Ltd., 2016). Since the CPP is considered both valid and reliable, the quality of the data generated by the CPP can be said to be high. Within this study, it was ensured that none of the participants had taken the CPP before, and therefore the gathered data can be considered valid.

3.8 Validity and Reliability of this Study

Validity refers to "the extent to which measures and research findings provide accurate representation of the things they are supposed to be describing" (Easterby-Smith et al., 2015, p. 343). As stated, the CPP can be considered as a valid and reliable tool to measure how a person deals with unfamiliar situations. However, it implies that a person cannot conduct the CPP twice, as the CPP is designed nowadays, since the requirement of unfamiliarity would not be given anymore. If the CPP provided more than one version, including other scenarios to solve for the test-person, it would be possible to retest people, since the requirement of unfamiliarity would be given again. Within this study, it was ensured that none of the participants had taken the CPP before, and therefore the gathered data can be considered valid.

Regarding the purpose of this study, the validity is partly dependent on how the data was interpreted and analyzed in relation to the core characteristics of strategic thinking. Subsequently, the validity of this study in turn, relies on this study's understanding of what strategic thinking is, as well as on the connection of the core characteristics of strategic thinking

to the CPP. If this study's interpretation of the CPP and strategic thinking however, proofs being invalid, the results from this study can be questioned as well.

The external validity of this study, i.e. the generalizability of the results, might be questionable with respect to other academic programs, even other programs in *Industriell Ekonomi*, since the course contents and teaching techniques might vary. Furthermore, regarding the internal validity, it can be questioned whether academic education is the only thing that distinguishes the two samples from each other.

Reliability deals with the question whether the data collection and the data analysis would lead to similar findings in another study (Easterby-Smith et al., 2015). The reliability for this study can be discussed from different angles. First, an objective interpretation of the data was secured by anonymizing the quantitative and the qualitative data gained from the two samples, and by the fact that the researchers were not engaged in the data collection. The results could not be linked in any manner to particular individuals, which can be considered secured both validity and reliability (Saunders et al., 2009). Second, it is necessary to consider whether the data would have been interpreted in the same way in another study. The interpretation of the data was verified by an accredited CPP practitioner, before it was used for the analysis, which can be considered to ensure the reliability of the data, and in turn of this study.

4 Empirical Findings

In the following chapter, the findings from the quantitative data collected by the CPP will be presented (compare Appendix D). Sample one in the dataset refers to the first-year students and is the control group in this study. Sample two refers to the fifth-year students, who is the experimental group. The findings are structured as follows; In the first subchapter, the findings and observations gained from assessing the quantitative data collected by the CPP will be presented. This includes presenting the score and potential differences between the two samples regarding the current and potential *Levels of Work*, the *Information Processing Competencies* and the *Cognitive Styles*. The second subchapter presents the findings from the interview with the program leader. The raw quantitative data can be found in Appendix E.

4.1 The CPP

To interpret the data received from the CPP, the non-parametric statistical test Mann-Whitney U Test was conducted in SPSS, testing the two samples against the *Levels for Work*, the six *Information Processing Competencies* and the 14 *Cognitive Styles*.

Levels of Work

When comparing the scores for the *Levels of Work* between the two samples at a significance level of 0.05, no differences are shown in the *Current Levels of Work*, but in the *Potential Levels of Work* (compare Table 6). The mean of the *Potential Levels of Work* for sample one is 4.2, with the participants scores ranging from 3-5, whereas the mean of the *Potential Levels of Work* for sample two is 4.9, ranging from 4-5. These scores however, do not give any information about the underlying differences between the two samples. To assess where the differences between the two samples arise from, the data about the participants' *Information Processing Competencies*, as well as their *Cognitive Styles* will be assessed.

	Significance	Mean Sample One	Mean Sample Two
Current Levels of Work	0.238	3.5	3.9
Potential Levels of Work	0.010	4.2	4.9

Table 6: Differences in the Current and Potential Levels of Work between the Samples

Information Processing Competencies

Two sub-competencies within the *Information Processing Competencies* show a significant difference between the two samples, namely *Judgment* (0.048) and *Quick Insight Learning* (0.021). Both are sub-competencies of the information processing competency *Metacognition* and said to facilitate strategic thinking. The mean of *Judgement* for sample one is 63.7, respectively 70 for sample two (on a scale from 0-100). The mean score of the sub-competency *Quick Insight Learning* is 74.7 for sample one, and 81.3 for sample two. Table 7 shows the significance level for each one of the sub-competencies, as well as both samples' average score in each sub-competency.

Processing Competency	Sub-Competency	Significance	Mean Sample One	Mean Sample Two
Memory	Use of Memory	0.084	**74.6**	69.6
	Memory Strategies	0.599	71	**72.4**
Exploration	Pragmatic	0.861	68.2	**69.2**
	Exploration	0.815	69.3	**71.1**
Analysis	Analysis	0.558	58.3	**61.6**
	Rules	0.861	**75.1**	73.1
Structuring / Integration	Categorization	1	73	72.6
	Integration	0.682	71.1	**72.3**
	Complexity	0.073	70.7	**74.3**
Transformation	Logical Reasoning	0.77	68.3	**69.6**
	Verbal Conceptualization	0.519	**64.7**	61.8
Metacognition	Judgement	0.048	63.7	**70**
	Quick Insight Learning	0.021	74.7	**81.3**
	Gradual Improvement Learning	0.682	59.4	**61.4**

Sub-competencies facilitating Strategic Thinking *Significant Differences between the Populations*

Table 7: Empirical Findings in the Information Processing Competencies

Apart from *Judgment* and *Quick Insight Learning*, no other sub-competencies of the information processing competencies show a significant difference between the two samples. Nonetheless, the sub-competency *Complexity*, with a significance level of 0.073, shows an indicative difference between the two samples, sample two having a higher score than sample one. All other sub-competencies that facilitate strategic thinking do not show a significant or

indicative difference between the two samples. Sample two however shows a higher mean in each of the remaining sub-competencies that facilitate strategic thinking, except for the sub-competency *Verbal Conceptualization,* where sample one has a higher mean.

Apart from the sub-competencies that facilitate strategic thinking, an indicative difference can be seen in the sub-competency *Use of Memory* (0.084). The mean of *Use of Memory* for population one is 74.6, compared to a mean of 69.6 in sample two.

Cognitive Styles

When interpreting the data about the participant's *Cognitive Styles,* the ranking number was translated into a score of the same number; e.g. if one participant has the cognitive style *Intuitive* as their most preferred one, hence a ranking number of 14, this cognitive style was given a score of 14 in order to interpret the data. Hence, the higher the score, the more preferred the cognitive style. By using the ranking number as a score, the significance level could be calculated in the same way as for the work environment and the information processing competencies, as well as the mean of each cognitive style for the two samples.

Table 8 shows the significance level for each one of the 14 cognitive styles, as well as both samples' average score in each cognitive style. When comparing the preferred cognitive styles between the two samples, the significance level for neither of the cognitive styles is less than 0.05, indicating that no significant difference in the preference of the cognitive styles was found. In other words, the two samples do not show any significant differences in what cognitive styles they preferred to use when taking the CPP. However, two indicative differences can be seen for the cognitive styles *Structured* (0.084) and *Quick Insight* (0.096), implying that these are the two cognitive styles differing the most regarding to what extent the students of sample one and sample two used these cognitive styles when taking the CPP (note: The cognitive style *Quick Insight* was not allocated to neither of the three categories operational thinking, either or both and strategic thinking by Cognadev. For the purpose of analysis within this study, this style was allocated to the category strategic thinking, after evaluating the description of the style made by Cognadev UK Ltd., 2018).

Cognitive Style	Significance	Mean Sample One	Mean Sample Two
Quick Insight	0.096	10.6	**12.8**
Holistic	0.482	**9.5**	9.1
Logical	0.290	9.2	**10.0**
Integrative	0.815	9.9	**10.0**
Intuitive	0.446	**11.3**	10.1
Analytical	0.238	5.9	**6.0**
Learning	0.155	9.3	**11.0**
Metaphoric	0.446	**5.5**	4.7
Memory	0.138	**10.7**	9.2
Trial-And-Error	0.290	**1.3**	1.0
Reactive	0.726	2.0	**2.1**
Reflective	0.640	6.9	**7.3**
Structured	0.084	**9.8**	7.7
Explorative	0.558	3.1	**3.8**

Cognitive Styles Associated with Strategic Thinking *Cognitive Styles "Either or"* *Cognitive Styles Associated with Operational Thinking*

Table 8: Findings Cognitive Styles

When ranking the preferred *Cognitive Styles* for sample one (compare Table 9), respectively for sample two, based on the mean, it shows that sample one and two have the same eight cognitive styles ranked as their top-eight used styles, but in a slightly different order. Those eight styles are; *Intuitive, Memory, Quick Insight Learning, Integrative, Structured, Holistic, Learning* and *Logical.*

Preferred Cognitive Styles Sample One	Preferred Cognitive Styles Sample Two
Intuitive	Quick Insight
Memory	Learning
Quick Insight	Intuitive
Integrative	Integrative
Structured	Logical
Holistic	Memory
Learning	Holistic
Logical	Structured
Reflective	Reflective
Analytical	Analytical
Metaphoric	Metaphoric
Explorative	Explorative
Reactive	Reactive
Trial and Error	Trial and Error

Facilitating Strategic Thinking | Either/or | Facilitating Operational Thinking

Table 9: Ranking of the Preferred Cognitive Styles of Sample One and Two

As evident from Table 9, five of the eight preferred *Cognitive Styles* for both samples facilitate strategic thinking, two facilitate strategic either/or operational thinking and one facilitates operational thinking (Cognadev UK Ltd., 2018b). The six least used *Cognitive Styles* are ranked in the exact same order for both samples. These six least preferred *Cognitive Styles* in turn, include four styles that are said to facilitate operational thinking and two styles said to facilitate operational and/or strategic thinking (Cognadev UK Ltd., 2018b).

When looking at the top three *Cognitive Styles*, ranked according to the mean of both samples, two out of three are the same for both samples, just arranged differently.

Additionally, a positive correlation has been found between the participants' age and their *Potential Levels of Work* (compare Appendix D).

4.2 Interview

The program *Industriell Ekonomi* is structured as follows. All students study together for the first two and a half years. In this period of time, the students have modules in three different areas; namely economics and business administration, technology and mathematics. The students choose different tracks after the fifth semester, whereby they have different courses

and projects for the rest of the program. Graduating from the program after five years leads to a Master of Science in Engineering, Industrial Engineering and Management (LTH, 2018a).

The development of the core characteristics of strategic thinking can be put in relation to the contents of the program as follows. *Analytical* skills are developed by the application of formulas and frameworks, as well as by analyzing the results of using those formulas and frameworks. This is required as a part of the curriculum for all three areas of the program (economics and business administration, technology and mathematics). The development of a *holistic* mindset is to some extent dependent on the track the students choose. Some specializations, such as supply chain management for example, train the students' ability to see the big picture to a higher probability than other specializations (Berg, 2018). Students who choose the business and innovation track, in contrast, might develop *creativity* to a deeper extent (Berg, 2018). The ability to *reflect* is developed in all the students regardless their specialization, because many courses include self-reflection over one's performance as part of the examination (Berg, 2018). The ability to think in a long-term and *visionary* way requires work experience, which is not included in the program, and is therefore not developed via the program (Berg, 2018). The development of *intuition* neither is explicitly fostered by the program (Berg, 2018).

The key components of the development of strategic thinking are found in the program as follows. Both theoretical and practical knowledge creation is part of the program. Theoretical knowledge is provided mainly through lectures and readings (Berg, 2018). Case studies are further used to let the students make use of their theoretical knowledge in a practical way (Berg, 2018). Theoretical and practical knowledge can also be gained by conducting the degree project in cooperation with a company, which about 98 % of the students in the program do (Berg, 2018). The principle part of the program is to teach the students how to compromise and analyze information, how to coordinate and prioritize tasks, and how to work efficiently in order to cope with several tasks at the same time (Berg, 2018). Hence, the principle part of the program is to supply the students with theoretical and practical knowledge rather than experience.

The key component experience was not particularly found in the structure of the program. Many students are engaged in student unions aside of their studies, which is a potential source of gaining practical leadership experience (Berg, 2018). Furthermore, many students choose to study one or two semesters abroad in the fourth or fifth year of the program. This also develops a certain type of experience, because by living abroad, students get a distant perspective on their

way of doing things (Berg, 2018). By being confronted with new and unfamiliar situations the students gain experience. Interaction is provided in various forms throughout the duration of the program. The students have to e.g. solve case studies in groups and therefore need to interact with other students in order to get the desired results. In addition to the interaction with fellow students of their own program, the students interact with students from other programs, e.g. mechanical engineering, since some courses are offered together with other programs. Furthermore, the students are given the opportunity to interact with senior students of the same program, because the elective courses are offered to students of different years at the same time. Reflection as mentioned above, is practiced throughout the program.

The teaching techniques used throughout the program are lectures, readings, case studies business games and simulations, field trips and seminars. All courses have a certain amount of lectures and readings, and additionally, many courses have case studies and business simulations. The amount of the different teaching techniques used is not specifically defined.

5 Analysis and Discussion

As evident from the findings, a difference in the ability to think strategically exists between the first and the fifth-year students of the program *Industriell Ekonomi*. The purpose of this chapter is to discuss if the higher ability to think strategically of the fifth-year students can be explained in terms of the academic program *Industriell Ekonomi.*

Figure 3 outlines the upcoming discussion about the potential impact of the program *Industriell Ekonomi* on the students' ability to think strategically as measured by the CPP. The figure is to be understood as follows. The left side of the figure represents the program *Industriell Ekonomi*, with its teaching techniques, and the key components of developing strategic thinking (hereafter, key components). It will be discussed if the key components are apparent in the program. If those key components are found to be apparent in the program *Industriell Ekonomi,* it could be said that the program has a good foundation to develop the ability to think strategically in its students, and the program could account for the fifth-year students' higher ability to think strategically.

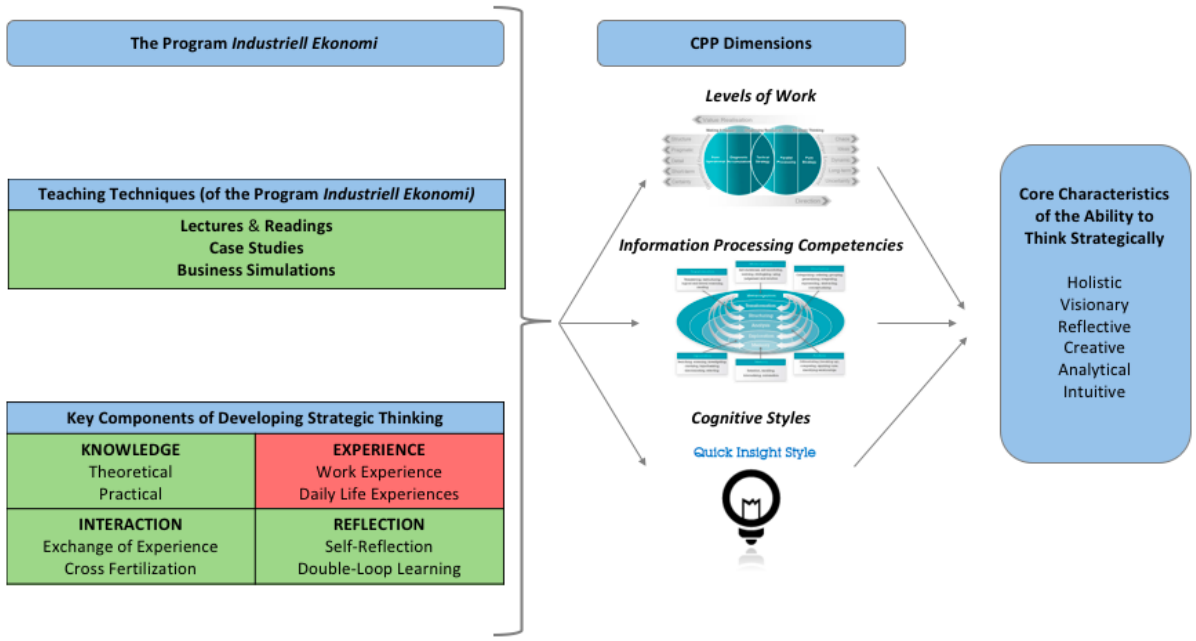

Figure 3: Potential Impact of the Program Industriell Ekonomi on the Ability to Think Strategically

5.1 Potential Impact of the Program on the Ability to Think Strategically

Strategic thinking, in this study expressed by the core characteristics holistic, visionary, reflective, creative, analytical, intuitive (compare Table 1), is useful when dealing with an environment characterized by unfamiliarity and complexity. The increasing complexity and unfamiliarity of the tasks and problems the students are approached with throughout the program *Industriell Ekonomi*, can be assumed to trigger the development of these core characteristics, and subsequently strategic thinking. This in turn would imply that the program had an impact on the development of strategic thinking. Hence, explain the significantly higher scores of the fifth-year students in the *Potential Levels of Work* and the information processing sub-competencies *Judgement* and *Quick Insight Learning,* which facilitate strategic thinking. However, to understand the reasons underlying the higher scores of the fifth-year students, the key components (knowledge, experience, interaction and reflection) will be analyzed in relation to the teaching techniques used in the program. If it appears that the program contains the key components e.g. via the teaching techniques, it can be seen as evidence that the program in fact could be held responsible for the higher level of the ability to think strategically of the fifth-year students.

By means of lectures and readings, the program intends to provide the students with a repertoire of *theoretical knowledge* in the form of tools and frameworks. Theoretical knowledge creation is especially emphasized in the beginning of the program, since it provides the students with assistance for dealing with unfamiliar problems throughout the rest of their education (Berg, 2018). Giving the students the opportunity to build up a repertoire of theoretical knowledge is aligned with the concept of strategic thinking, because a repertoire of concepts and frameworks helps individuals to broaden their view, and improves their ability to develop new ideas (Liedtka, 1998). A broad (holistic) view and new ideas (creativity) in turn can develop the students' ability to think strategically, because according to Liedtka (1998), this enables individuals to solve strategic issues in situations characterized by unfamiliarity, and as well, helps in the development of strategic thinking (Liedtka, 1998).

Theoretical knowledge is mostly gained through formal teaching techniques such as readings and lectures. Those formal teaching techniques are certainly helpful to create and transfer

knowledge (Davies & Easterby-Smith, 1983; Sloan, 2017), but not explicitly helpful in developing strategic thinking (Sloan, 2017). The readings and lectures used in the program *Industriell Ekonomi* can be seen as being effective means to create theoretical knowledge. Although theoretical knowledge on its own is not sufficient to develop strategic thinking it is one step on the way of developing the ability to think strategically.

Case studies, can be said to foster theoretical knowledge as well as practical knowledge, since the participants apply theoretical knowledge in practical situations. Case studies can be particularly beneficial to e.g. give the students a holistic overview of the business landscape (Hsueh et al., 2006), but can also prevent them from the process of reflection, which however is one of the key components. The process of reflection can be inhibited when students get biased in their way of solving the case, when for example trying to get to the solution, they anticipate is the professor's predefined solution (Davies & Easterby-Smith, 1983). This can lead to an inhibition of reflection, because the students might not think about and reflect upon other possible solutions to the case, but instead just conform to an accepted wisdom in order to come to the solution they think the professor expects (Davies & Easterby-Smith, 1983). Cases therefore, can be said to prevent the development of reflection and double-loop learning, which however is useful in the development of strategic thinking.

In sum, the case studies used in the program *Industriell Ekonomi* can be seen as a meaningful way for the students to apply their theoretical knowledge on practical situations. However, the usage of case studies cannot be seen as a justification for the development of strategic thinking, since it not necessarily encourages the students to reflect critically. The lack of reflection in case studies, however, can be considered compensated by other elements in the structure of the program.

In some courses the students have to take on opposing views regarding issues in various contexts (Berg, 2018), which trains their ability to look at and reflect on situations from various points of view. To reflect about one's own experiences, as well as about different situations, develops double-loop learning, which is an essential part of developing strategic thinking (Sloan, 2017).

The key component *reflection* can be found in the program in the following way. Throughout the program *Industriell Ekonomi,* the students receive personal feedback for their performances (Berg, 2018). The feedback helps them to establish an understanding about their strengths and weaknesses, i.e developing their *self-concern*, which is crucial knowledge for an individual to

be able to develop the ability to think strategically (Casey & Goldman, 2010). What Casey and Goldman (2010) define as self-concern, can be said to be similar to the key component reflection. Additionally, disregarding the specialization, self-reflection is part of the examination in many courses. The key component reflection, therefore, can be said to be apparent in the program *Industriell Ekonomi.* That the students develop reflection by means of the program can be said to be reflected in the results of the CPP. Both information processing sub-competencies the fifth year students scored significantly higher in, are sub-competencies of the information processing competency *Metacognition,* which refers to self-awareness, self-monitoring and self-evaluation. The higher scores in *Judgment* and *Quick Insight Learning* can therefore be explained by a higher ability to reflect.

Furthermore, the students are occasionally approached with business simulations (Berg, 2018). Business simulations can develop a systems perspective (Fontaine, 2008), which is similar to what Casey and Goldman (2010) call *factual* knowledge, explained as understanding how different parts are connected to each other (Casey & Goldman, 2010). Furthermore, business simulations are said to develop *procedural* knowledge, which is about learning to write down and test hypothesis (Casey & Goldman, 2010). The abilities to understand how different parts of a situation are connected, and to write down and test hypothesis, are also by Liedtka (1998) stated to be important in strategic thinking, even including both matters in her five attributes defining strategic thinking. Therefore it can be argued that business simulations contribute to the development of strategic thinking by providing the students with factual and procedural knowledge, both part of the key component knowledge.

Additionally to the mix of different teaching techniques, *Industriell Ekonomi* provides its students with a wide range of possibilities to *interact* with other individuals (Berg, 2018). Interaction is as well identified to be one key component in the development of strategic thinking. Disregarding their selected specialization tracks, the students of the program *Industriell Ekonomi* take some courses together with students from other programs. Interaction between individuals from various backgrounds ensures to get different opinions and perspectives on a situation (Davis & Easterby-Smith, 1983; Liedtka, 1998), which in turn helps to create new ideas, to detect new patterns and to foster cross fertilization of each other's opinions (Schilling, 2017). From interaction with individuals of different backgrounds, the students are provided with the possibility to gain an understanding that different views can lead to the creation of new ideas. Casey and Goldman (2010) call this understanding *conceptual* knowledge (Casey & Goldman, 2010), being one of four types of practical knowledge they

refer to as important in the development of strategic thinking. Furthermore, it is argued that collaboration and interaction between junior and senior people fosters strategic thinking (Davies & Easterby-Smith, 1983). Speaking in favor of offering courses to students of different years at the same time, because this enables more junior students to get the possibility of interacting with more senior students. Furthermore, the program offers the students opportunities to interact with alumnis and company representatives right from the beginning, another opportunity for learning from more senior people. In sum, the program seems to offer various possibilities for students to interact with more senior people and/or people from different backgrounds, helpful for them to develop their ability to think strategically.

Furthermore, *experience* was identified as one key component of the development of strategic thinking. When examining on the program *Industriell Ekonomi* however, none of the types of experience that previous research put forward as developing strategic thinking can be detected in the program. The program provides one elective course that includes an internship of half a semester/15 hp. However, the course is not mandatory and therefore, it cannot be said that all students enrolled in the program gain work experience during their studies already. Throughout the program the students need to prioritize and coordinate their workload, possibly extracurricular activities in student unions and their private life. Even if not connected to the program itself, daily life experiences are said to be valuable in the development of strategic thinking as well (Sloan, 2017). Since the amount of both work-experience and daily-life experiences is dependent on how the students themselves structure their time and courses, the key component experience cannot be said being included in the structure of the program *Industriell Ekonomi.*

In sum, it can be said that the program *Industriell Ekonomi* seems to be designed in a good way to develop the ability to think strategically. This is based on the fact that the teaching techniques foster knowledge, interaction and reflection, hence three out of four key components of developing the ability to think strategically. The fourth key component of developing the ability to think strategically, experience, cannot be detected in the structure of the program. However, this can be considered reasonable, since the purpose of the program is to supply the students with a foundation of knowledge preparing them for their future working life, not with working experience itself.

5.2 Other Results

Additionally to the significant results in the information processing sub-competencies *Judgement* and *Quick Insight Learning*, some indicative differences have been found between the two samples' scores of the information processing sub-competencies *Complexity* and *Use of Memory*.

It is reasonable that the first-year students score higher in the information processing sub-competency *Use of Memory*. Their higher score can be explained as follows; in the early semesters of the program, the focus is for the students to generate basic knowledge in the fields of economics and business administration, technology and mathematics (Berg, 2018). Hence, the *Use of Memory* is a beneficial competency to capitalize on when the focus for the students is to understand and memorize theories and concepts. This is mostly done through the use of teaching methods such as readings and lectures. Hence, the aim is for students to build up a repertoire of theoretical knowledge, tools and frameworks, which serves them as a foundation later on in the program, as well as in real-life, when faced with solving complex problems (Berg, 2018).

The increase of complexity throughout the program can, according to Berg (2018), be a possible explanation for the indicatively higher results of the fifth-year students in the information processing sub-competency *Complexity*. In the beginning of the program, the students nearly always have issues with solving tasks that are proportionally easy to solve, while later on in the program, students manage to solve assignments of increased complexity in less time and with less struggle (Berg, 2018). Hence, the indicatively increased ability to deal with complexity as shown by the CPP, possibly results from the program.

The similarities (see Table 9) of the two samples' preferred cognitive styles can be interpreted in different ways. First, that the program does not have an impact on the students' preferred cognitive styles. Second, the students enrolled in the program *Industriell Ekonomi* already have certain cognitive preferences when starting the program. It would further mean that the students gained their preference for certain cognitive styles from another area in life than academic education. To find evidence for those assumptions, however, it would be necessary to compare the two samples to e.g. students from other academic programs and a larger sample would be required in order to ensure representativeness of the findings.

To sum up, the academic program could have had an impact on the fifth years students' ability to think strategically, but might not have been the only influencing factor. One fact for example, that leaves room for speculations about if the program impacts the ability to think strategically in the students, is that the first-year students already showed high preferences to the cognitive styles associated with strategic thinking. Therefore, although it can be claimed that the increase within the information processing sub-competencies and subsequently the higher scores in the *Levels of Work* arose from the impact of the program, the preferences regarding the *Cognitive Styles* do not seem to stem from the academic program *Industriell Ekonomi*. This in turn would imply that other factors could account for the higher ability to think strategically in the fifth-year students.

5.3 Other Potential Determinants of the Increase of Strategic Thinking

Age is one factor that can be considered as possibly impacting the development of the ability to think strategically. This assumption can be said being supported by the positive correlation found between age and the *Potential Levels of Work*, indicating that getting older can have an influence on the development of strategic thinking. It is a reasonable finding, because the older people get, the more time they have to generate knowledge, to accumulate experience and to learn by interaction and reflection. However, since the determinant age does not show significant correlations to any of the *Information Processing Competencies* nor to the *Cognitive Styles,* no conclusions can be drawn that age in fact develops any of the specific cognitive abilities that are facilitating strategic thinking. Another possible explanation for the positive correlation between age and *Potential Levels of Work,* is that getting older per se, without taking into consideration potential generated knowledge, experience etc., can have an impact on the ability to think strategically. However, neither of these assumptions can be proved within the scope of this study.

Another factor that possibly fosters strategic thinking, is spending time abroad, either from working in a foreign country (Dragoni et al., 2014) or traveling (Sloan, 2017). Many students of the program *Industriell Ekonomi* choose to study one or two semesters abroad during the fourth or fifth year of the program (Berg, 2018), which Berg (2018) sees as a valuable

experience for the students in the sense that it distances them to their usual environment and provides them with new perspectives. Getting distance to something oneself is part of can help to see the whole picture as well as its separate parts, which by Senge (1990) is described as having a systems perspective, which is a part of strategic thinking. Hence, it can be assumed that those students studying a part of the program abroad might develop their systems perspective to a higher extent than the students who stay at their home university. The experience from studying abroad can further be said being characterized by informal learning, which strengthens the argumentation made by Sloan (2017) that traveling as a specific form of informal learning, develops the ability to think in new ways, and hence the ability to think strategically.

6 Conclusion

The results of the CPP showed a higher ability to think strategically in the fifth-year students compared to the first-year students of the program *Industriell Ekonomi.* The higher ability to think strategically of the fifth-year students can be a result of the impact of the program, since the program was found to be designed in a way that can facilitate strategic thinking. Other factors that potentially are influential on the development of the ability to think strategically have been disregarded. Drawing from indications from the theoretical background and the findings in this study, factors like age or traveling could be possible determinants as well. The result of the analysis of the program however, allows the assumption, that the program actually had an impact on the development of the students' ability to think strategically. This study accomplished new insights on the topic strategic thinking in general, and particularly in connection to the development of the ability to think strategically via academic education.

6.1 Theoretical Implications

This study fulfilled its purpose of contributing to the aim of project three, to deepen the understanding whether strategic thinking can be developed via academic education. Furthermore, this study has theoretically contributed to a deeper understanding of what strategic thinking is by reviewing and critically discussing previous studies and literature on the topic. Additionally, this study has contributed to the understanding of how the dimensions measured by the CPP (*Levels of Work*, *Information Processing Competencies* and *Cognitive Styles*) are connected to strategic thinking and what insights the results provide about an individual's ability to think strategically. This study furthermore strengthened the assumption that the CPP can be used to measure something that is "in close association with" strategic thinking.

6.2 Practical Implications

One practical implication of this study is that the results may prove valuable for the students who participated in this study. Every participant received a confidential report about their cognitive abilities and preferences and got the opportunity to get more detailed feedback on his/her results of the CPP. A deeper understanding of their cognitive preferences and abilities might prove valuable to the participants in terms of gaining knowledge about the work environment they are best suited for. Additionally, the results might be beneficial for the individuals in the way that once they are aware of their cognitive preferences and abilities, they can, to a certain extent, avoid or use certain cognitive abilities more commonly. Becoming more aware of their ability to think strategically can further help them developing the ability and become better strategic thinkers.

Moreover, some companies pay attention to the results of cognitive tests like the CPP when looking for new employees. Therefore, it could be valuable for the students in their job search when looking for internships or permanent positions after graduating. Furthermore, the results of this study might prove value for the program leader of *Industriell Ekonomi,* since the analysis of the program's impact on the ability to think strategically, can be beneficial for a future potential re-design of the program. Additionally, it can be beneficial for any other educational institution that intends to provide an academic program that aims to educate students to become key decision makers.

6.3 Future Research

Several areas for further research are suggested in order to forward research about strategic thinking. First, it might be interesting to test larger samples of students to compare the results and foster the reliability of this study, and to harmonize the three studies conducted within the scope of project three of The Strategic Thinking Project, to see whether more generalizable conclusions about the impact of academic education on the development of strategic thinking can be seen.

Second, it would be interesting to compare students' ability to think strategically from different academic programs, to see whether academic education itself, or maybe also the subject of study might have an influence on the development of strategic thinking. Third, it could be interesting to compare students' ability to think strategically to peers without an academic background. Fourth, further research on extracurricular activities can be considered interesting, since it cannot be guaranteed that the difference seen in the ability to think strategically in this study in fact arises from the impact of academic education. On this matter it is especially interesting to inquire the topic of traveling and (work) experience abroad, since literature (Dragoni et al., 2011; Dragoni et al., 2014; Sloan, 2017) as well as practice (Berg, 2018), see experience abroad as conducive for the development of strategic thinking.

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Appendix A - Core Concepts by Sandelands and Singh (2017)

Appendix A.1: Definition of the 15 Core Concepts, by Sandelands and Singh (2017).

1. **Analytical** - Demonstrating a logical, reason-based approach
2. **Creative** - Searching for new approaches and envisioning better way of doing things (Bonn, 2005, p. 338)
3. **Conceptual** - Forming ideas or concepts to provide answers to experiences, observations etc.
4. **Context Oriented** - The ability to recognize the environment of operation (e.g. individual, organisational) (Bonn, 2005)
5. **Divergent** - The ability to think in a different manner or ways
6. **Flexible** - Displaying adaptability, able to handle change
7. **Future Oriented** - Being forward thinking
8. **Holistic** - Realisation that a scenario must be viewed as a whole, rather than within separate parts (Kaufman, 1991)
9. **Integrative** - The ability to combine concepts, thoughts, or ideas
10. **Intuitive** - The ability to react instinctively (Olson & Simerson, 2015)
11. **Process Oriented** - Cognitive activities demonstrative of self-awareness, and awareness of the wider environment (Olson & Simerson, 2015)
12. **Reflective** - An ability to draw upon and learn from past experiences
13. **Synthetic** - Refers to the ability to synthesize (blend) ideas, information, or processes
14. **Systematic** - An ability to examine how different concerns are connected, affect, and influence one another (Liedtka, 1998)
15. **Visionary** - Individuals who convey a sense of direction, and provide a focus for all activities in an organisational context (Bonn, 2005, p.339)

Appendix A.2: Authors supporting the Core Concepts (Sandelands & Singh, 2017)

Analytical	Conceptual	Context Oriented	Creativity	Divergent Thinking	Flexibility	Future Oriented	Holistic
Allio (2006)	Andrews (1971)	Bonn (2001), (2005)	Bonn (2001),(2005)	Bonn (2001), (2005)	Fiol & Huff (1992)	Allio (2006)	Bonn (2001), (2005)
Andrews (1971), (1980)	Kim & Mauborne (2005)	Liedtka (1998), (2011)	Graetz (2002)	Chevallier (1974)	Hitt et. al. (2001)	Bonn, (2001), (2005)	Kaufman (1991)
Bourgeois & Eisenhardt (1988)	Nuntamanop et. al. (2013)	Linkow (1999)	Heracleous (1998)	Heracleous (1998)	Nuntamanop et. al. (2013)	Hamel & Prahalad (1994)	Liedtka (1998)
Hussey (2001)	Saloner et. al. (2001)	Olson & Simerson (2015)	Hussey (2001)	Schoemaker et. al. (2013)	Rowe et. al. (1986)	Linkow (1999)	
Nuntamanop et. al. (2013)	Thompson & Strickland (1996)		Liedtka (1998), (2011)		Steptoe-Warre n et. al. (2011)		
Olson & Simerson (2015)			Mintzberg (1994a, b)				
Thompson & Strickland (1996)			Nuntamanop et. al. (2013)				
			Olson & Simerson (2015)				
			Rowe et. al. (1986)				

Intuitive	Integrative	Process Oriented	Reflective	Synthesizing	Systemic	Visionary
Graetz (2002)	Bonn (2001), (2005)	Bonn (2001), (2005)	Argyris (2002)	Bonn (2001), (2005)	Bonn (2001), (2005)	Bonn (2001), (2005)
Liedtka (1998), (2011)	Liedtka (1998)	Hampden-Turner (1993)	Bonn (2001), (2005)	Bowman (2016)	Crawford (2013)	Dragoni et. al. (2011)
Mintzberg (1994a, b)	Kaufman (1991)	Liedtka (1998), (2011)	Bowman (2016)	Hampden-Turner (1993)	Liedtka (1998), (2011)	Liedtka (1998), (2011)
Nuntamanop et. al. (2013)	Mintzberg (1994a, b)	Olson & Simerson (2015)	Frederick (2005)	Liedtka (1998), (2011)	Olson & Simerson (2015)	Mintzberg (1994a, b)
Olson & Simerson (2015)			Schoemaker et. al. (2013)			Nuntamanop et. al. (2013)
						Rowe et. al. (1986)
						Thompson & Strickland (1996)

Appendix B - Cognitive Styles vs. Core Characteristics

Interpretation made between the Cognitive Styles and the Core Characteristics of Strategic Thinking.

Cognitive Style	Summary of the interpretation of the Cognitive Styles as presented by Cognadev (Cognadev, 2016, p. 21-23)	Connection to the Core Characteristics (see Table 1)
Intuitive	- Often relies on previous knowledge and experiences - Largely relies on connections made at a subconscious level - Trust own feelings and instincts - May integrate information to formulate creative and unusual ideas	**Intuitive:** "The judgments and choices made through immediate cognition and without significant reflection"
Holistic	- Tends to see the big picture without losing sight of detail - Views elements in relation to the whole - Synthesizes and integrates separate information structures	**Holistic:** "... an understanding of how different problems and issues are connected with each other, how they influence each other and what effect one solution in one particular area would have on other areas"
Integrative	- Tends to make sense of information as they go along - Likes the challenge of reconciling discrepant, ambiguous and fragmented elements to create a coherent whole - Tends to formulate, verify and falsify hypotheses to eliminate unnecessary information. Has a need to understand and usually learns in the process	**Holistic:** "... an understanding of how different problems and issues are connected with each other, how they influence each other and what effect one solution in one particular area would have on other areas"
Logical	- Disciplined, rigorous thinking, exploiting on analytical thinking but with a less focus on details, compared to analytical thinking - Right side of the brain (Creativity) - Process oriented thinking, as well as having a long-term view	**Creative:** Think outside of the box and search for new and alternate ways of doing things. **Visionary:** Conveying a sense of direction and providing the focus for all activities within the organization
Learning	- Tends to be curious and explorative - Often capitalizes on memory functions - Is self-aware and tends to respond to feedback on the efefctiveness - Seeks novelty and focuses on unfamiliar tasks	**Reflective:** "Dialogue with others and the cyclical process of double-loop learning are necessary to understand and then alter existing mental frames so new strategies can be imagined"
Analytical	- Has a precise, detailed approach - Works systematically and pays attention to rules - Enjoys pulling information apart and subdividing issues - Analyses, compares and categorises various elements	**Analytical:** "A systematic examination and evaluation of data or information, by breaking it into its component parts to uncover their interrelationships. Opposite of synthesis."
Metaphoric	- Tends to view problems abstractly or symbolically - May combine elements of information in new and unusual ways - Often creates mental pictures to represent an idea - Capitalizes on both verbal and visual modes	No clear connection
Memory	- Tends to concentrate well and remembers information - Usually tries hard, concentrates carefully and has high standards - Relies on past experience and a knowledge base - Tends to use memory strategies such as confirmation of hypotheses, external reminders, visualisations and associations	No clear connection

Appendix C – Interview Topic Guide

Topic-Guide for the interview with Eva Berg the program leader of *Industriell Ekonomi* at LTH.

Questions on the Program *Industriell Ekonomi*

- Outline of the overall structure of the program
  - Different tracks / specialization opportunities
- What are the targeted learning outcomes of the program?
  - Is the program aiming for developing some abilities or skills in particular? (e.g. analytical thinking, critical thinking etc.)

Development of Strategic Thinking

- Does the program aim to develop any of the following abilities? And if so, in what way?
  - Intuition
  - Holistic mindset
  - Analytical skills
  - Creativity
  - Reflection
  - Vision/Long-term planning

- What type of knowledge would you say that the students develop (theoretical, practical)?

- What type of experience do the students gain during the program that you believe is useful in their future career/roles?

- In what way are the students interacting with each other? (e.g. Groupworks, discussions, oppositions)

- Who else are students interacting with throughout the program? (Other students, teachers, companies etc.)

- Would you say that the students train their ability to reflect over their own results, experiences, abilities etc.? If so, how?

- Do the students have an opportunity to get personal feedback on their performance to know what in fact was right and wrong?

Teaching Methods

- What teaching techniques are used? (e.g. lectures, readings, cases, business games and simulations, field trips, seminars)
- To what extent are those techniques used?

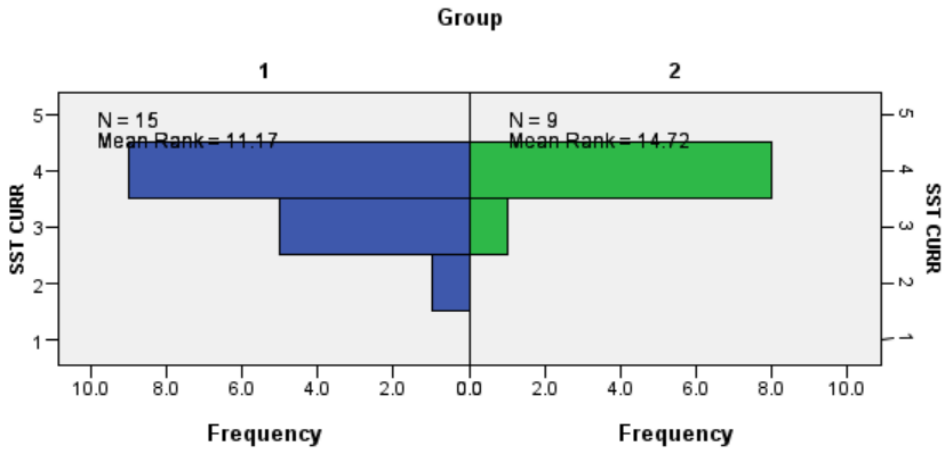
Significant Differences between 1st and 5th year Students

- Which courses / components of the program / teaching methods could account for these differences?
    - Complexity - the preferred level of complexity and the unit of information used
    - Judgement - capitalizing 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
    - Use of Memory - Reliance on memory

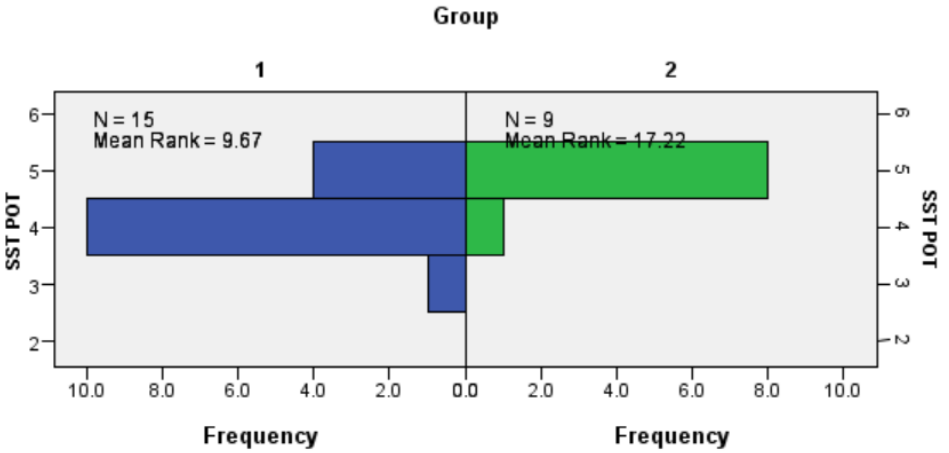
Appendix D – Findings CPP

Levels of Work

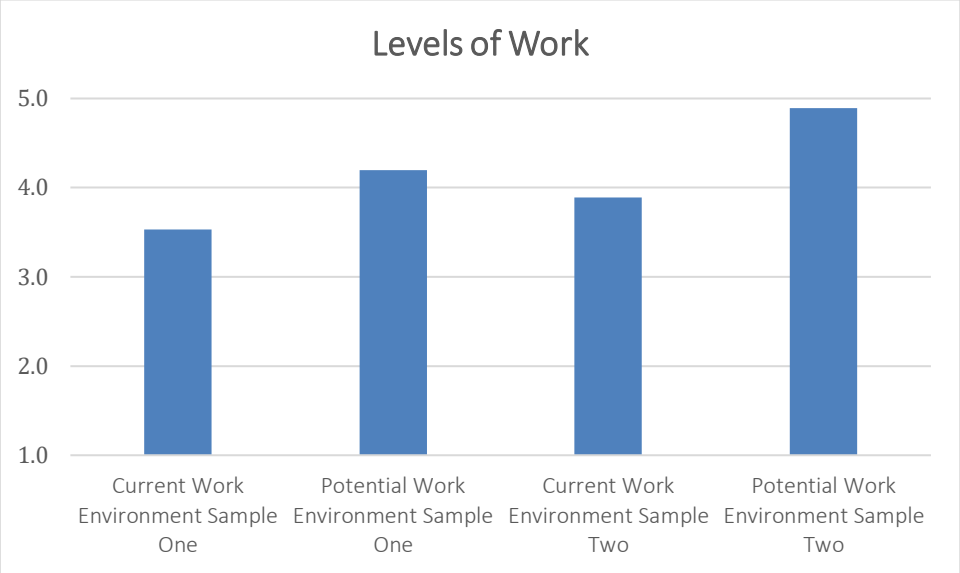
Appendix D.1: No significant difference between the two samples regarding their *Current Levels of Work* as shown by SPSS.



Appendix D.2: Significant difference between the two samples regarding their *Potential Levels of Work* as shown by SPSS.

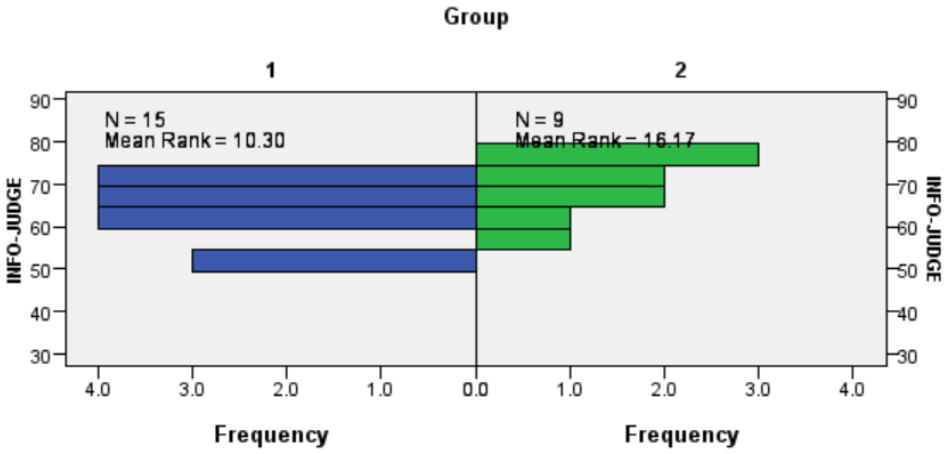


Appendix D.3: Comparison sample one and two regarding their *Current* and *Potential Levels of Work.*

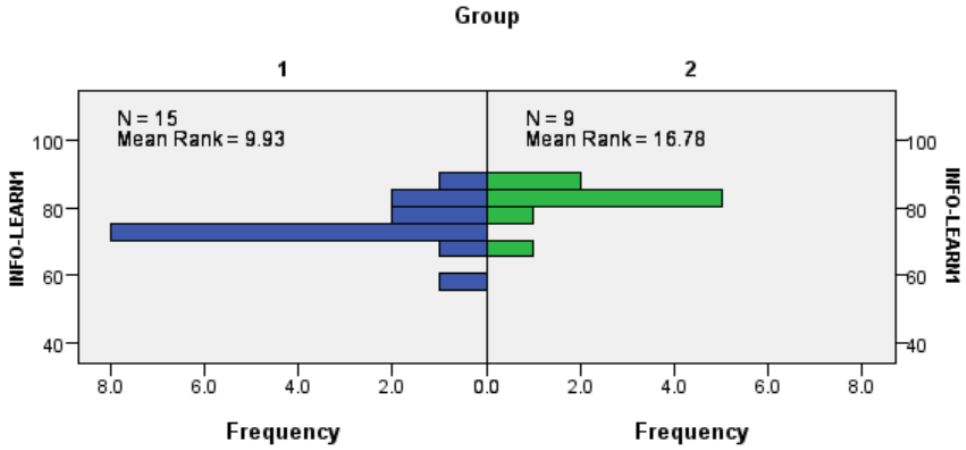


Information Processing Competencies

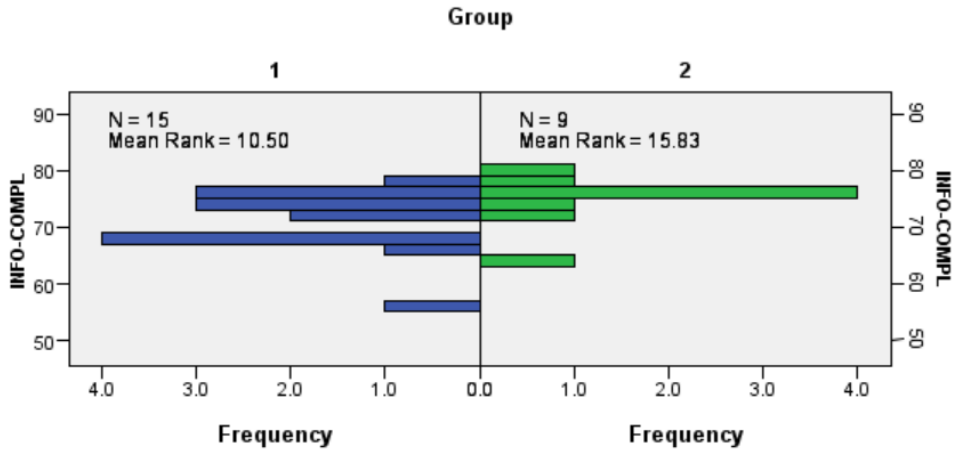
Appendix D.4: Significant difference (0.048) across the two samples in *Judgement*.



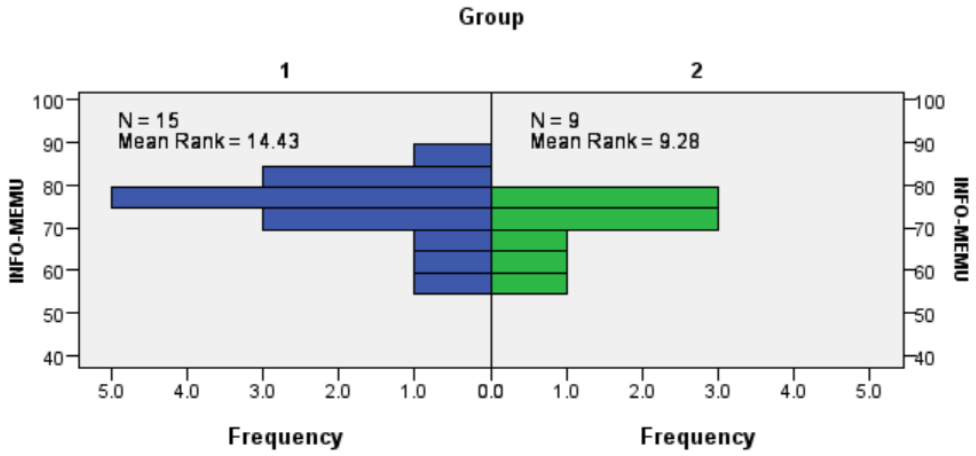
Appendix D.5: Significant difference (0.021) across the two samples in *Quick Insight Learning*.



Appendix D.6: Indicative difference (0.073) across the two samples in *Complexity*.



Appendix D.7: Indicative difference (0.084) across the two samples in *Use of Memory*.



Appendix D.8: Positive correlation between Age and the *Potential Levels of Work*.

Correlations

			Age	SST POT
Spearman's rho	Age	Correlation Coefficient	1.000	.413*
		Sig. (2-tailed)	.	.045
		N	24	24
	SST POT	Correlation Coefficient	.413*	1.000
		Sig. (2-tailed)	.045	.
		N	24	24

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix E – Raw Data CPP

Appendix E.1: Raw data collected by the CPP regarding the Cognitive Styles of the two samples.

			Cognitive Styles												
Facilitating Strategic and/or Operational Thinking			Operational	Strategic	Strategic	Either or	Either or	Strategic	Operational	Operational	Operational	Either or	Strategic	Strategic	Either or	Operational
Group	Age	Gender	Trial and Error	Logical	Holistic	Metaphoric	Analytical	Integrative	Reflective	Structured	Explorative	Learning	Intuitive	Quick Insight	Memory	Reactive
1	20	M	1	8	10	4	7	11	6	9	3	14	13	12	5	2
1	23	M	1	8	10	3	6	9	5	7	4	13	11	14	12	2
1	23	F	1	8	7	3	5	9	6	10	4	12	11	14	13	2
1	23	M	1	8	12	5	3	13	6	11	4	10	14	9	7	2
1	23	M	2	13	10	6	14	9	12	11	3	5	7	8	4	1
1	19	M	1	8	9	6	5	11	4	13	3	7	12	10	14	2
1	20	M	2	13	8	3	5	7	10	11	4	12	9	6	14	1
1	22	M	3	7	10	13	5	9	4	11	1	12	8	6	14	2
1	20	M	1	7	8	10	4	11	5	9	3	6	14	12	13	2
1	21	M	1	8	11	5	4	10	6	7	2	9	13	14	12	3
1	23	M	1	10	11	3	7	13	12	9	4	6	14	8	5	2
1	19	M	1	8	10	6	5	7	4	12	3	9	13	14	11	2
1	19	M	1	10	9	6	4	11	8	5	3	7	12	14	13	2
1	21	F	1	13	7	3	11	8	10	14	4	12	5	6	9	2
1	21	M	2	9	10	7	4	11	5	8	1	6	13	12	14	3
2	25	F	1	11	8	3	6	9	10	7	4	13	5	14	12	2
2	25	M	1	9	8	3	5	10	6	7	4	13	12	14	11	2
2	23	M	1	5	11	6	7	12	4	8	3	10	14	13	9	2
2	24	F	1	11	9	3	8	10	6	7	4	13	5	14	12	2
2	25	M	1	12	9	4	6	7	11	3	8	13	10	14	5	2
2	25	M	1	8	9	5	6	10	4	7	2	13	12	14	11	3
2	24	F	1	13	9	4	6	7	8	5	3	10	12	14	11	2
2	25	F	1	12	8	4	6	14	11	13	3	9	7	10	5	2
2	25	M	1	9	11	10	4	13	6	12	3	5	14	8	7	2

Appendix E.2: Raw data collected by the CPP regarding the Information Processing Competencies and the Levels of Work of the two samples.

			Information Processing Competencies								Levels of Work	
			Structuring/Integration			Transformation			Metacognition			
Group	Age	Gender	Categorization	Integration	Complexity	Logical Reasoning	Verbal Conceptualization	Judgement	Quick Insight Learning	Gradual Improvement Learning	Current	Potential
1	20	M	71	76	74	74	74	70	86	86	4	5
1	23	M	78	73	78	68	55	68	83	83	4	5
1	23	F	79	68	67	59	43	62	75	75	3	4
1	23	M	78	78	68	75	75	52	73	73	4	4
1	23	M	60	67	72	75	69	73	69	69	4	4
1	19	M	75	71	68	69	67	62	73	73	4	4
1	20	M	70	68	73	67	48	64	72	72	3	4
1	22	M	75	60	56	57	75	52	58	58	2	3
1	20	M	75	72	66	67	70	62	73	73	3	4
1	21	M	66	73	76	63	66	67	82	82	4	5
1	23	M	71	76	73	70	57	71	75	75	4	4
1	19	M	79	72	76	70	77	52	76	76	3	4
1	19	M	75	77	75	76	75	71	80	80	4	5
1	21	F	69	68	71	70	53	65	73	73	4	4
1	21	M	66	68	68	64	67	65	72	72	3	4
2	25	F	71	70	76	65	45	74	82	82	4	5
2	25	M	75	75	79	67	48	79	88	88	4	5
2	23	M	73	78	72	72	76	73	82	82	4	5
2	24	F	78	70	75	66	47	77	87	87	4	5
2	25	M	61	70	76	73	67	77	83	83	4	5
2	25	M	78	72	75	67	67	62	82	82	4	5
2	24	F	69	67	78	72	66	65	82	82	4	5
2	25	F	79	77	74	73	64	68	77	77	4	5
2	25	M	69	72	64	71	76	55	69	69	3	4