The Dynamic Development of Cognitive and Socioemotional Traits and Their Effects on School Grades and Risk of Unemployment.

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The Dynamic Development of Cognitive and Socioemotional Traits and Their Effects on School Grades and Risk of Unemployment.

A Test of the Investment Theory

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Abstract

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The purpose of this thesis is to examine the dynamic development of cognitive and socioemotional traits and how these traits influence academic achievement and predict risk of unemployment. Data was retrieved from the Evaluation Through Following-up (ETF) database. The data consists of 9,080 students born in 1972, who answered a questionnaire and completed cognitive ability tests in 3rd and 6th grade. In addition, register-based data was used for students' grades and for various background variables. All analyses were conducted using structural equation modelling (SEM).

The dynamic development of the relationships between cognitive and socioemotional traits between 3rd and 6th grade is driven by cognitive ability factors. Support was found for Cattell's investment hypothesis, which states that fluid cognitive ability (Gf) influences development of crystallized cognitive ability (Gc). No influence of socioemotional traits on either cognitive traits or socioemotional traits was found. The evidence of a Gc reading achievement trait complex was weak. Furthermore, both cognitive and socioemotional traits are related to academic achievement.

In the prediction of unemployment risk, effects of almost all cognitive and socioemotional traits are captured by grades. Gc has both a direct effect on unemployment risk and an indirect effect via grades on unemployment risk. All other effects of socioemotional traits and Gf are related to the risk of unemployment via academic achievement. The strongest determinant of unemployment risk is academic achievement, which has a protective effect on the risk of unemployment.

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Chapter 1. The importance of cognitive and socioemotional traits

For nearly a century, scholars have tried to understand, measure, and explain successfulness in life. In 1973, both Herrnstein and Jensen concluded that school performance and entering the labor market are due to intelligence that is largely inherited and unchangeable (Herrnstein 1973; Jensen, 1973). As a response, Bowles and Gintis (1976) argued that family social class persists across generations largely because of behavioral traits rather than inheritance of cognitive capacities from parent to child. They argued that both cognitive and non-cognitive traits exert an effect on student outcomes and, later, occupational outcomes. They concluded that both teachers and employers rewarded the same non-cognitive traits, such as obediance, creativity, etc. Non-cognitive traits are more vaguely specified as motivational and personality traits, such as hard work, conscientiousness, self-discipline, determination, and the way individuals think and feel about themselves in terms of self-concept, self-esteem, and self-efficacy (Borghans, Meijers, & ter Weel, 2008). This rationale is in line with Edward Webb's (1915) suggestion that abilities are important, but even more important is what we do with those abilities. Cognitive abilities (e.g., "what a person can do") contribute both to understanding and learning, and personality traits (e.g., "what a person will do") facilitate or impede what will be understood and learned (Chamorro-Premuzic & Furnham, 2003). Thus, aptitude tests reflect what a person can do, and non-cognitive traits what a person will do.

Since children spend a lot of time in school, and a great part of the economic activity of numerous countries involves investing money in educational activities, it is valuable to understand how such factors that enable or impede academic achievement are developed and interrelated. Thus, an important question that has returned to the domain of individual differences is how cognitive abilities and socioemotional traits are, or are not, associated with each other (Chamorro-Premuzic, & Furnham, 2005). Even though cognitive abilities and socioemotional traits have existed as constructs since the early 20th century, they have traditionally been analyzed independently. Since the 70s, this controversy has benefited from a variety of studies (Farkas, 2003; Heckman, Sixtrud & Urzua, 2006). Nowadays, both economists and social researchers recognize that both cognitive traits and socioemotional traits, e.g., attitudinal

and emotional traits, influence lifetime outcomes, such as income development, well-being, and academic performance (Saltiel, Sarzosa & Urzúa, 2017; Poropat, 2009). Examples of non-cognitive factors are: motivation, perseverance, self-concept, coping, creativity, anxiety, and social competencies. Within the framework of cognitive and socioemotional traits, research has tried to determine the effects of cognitive traits (measured by test scores) and attitudinal and emotional traits (measured by latent factors based on self-reported locus of control, educational aspirations, anxiety, sociability, self-concept, etc.) on different outcomes later in life. In a later study, Bowles, Gintis and Osborne argued that:

> …measures of cognitive performance are not sufficient indicators of the effectiveness of schools in promoting student labor market success. We need broader indicators of school success, including measures based on the contribution of schooling to the behavioral and personality traits which we have termed incentive enhancing preferences (Bowles, Gintis, & Osborne, 2001, p.158).

It appears that Bowles, Gintis, and Osborne emphasized the importance of academic achievement for labor market outcomes. Educational attainment and avoiding the risk of unemployment benefit individuals and society in various ways (Carnevale, Smith, & Strohl, 2013; Phillippe & Sullivan, 2005). For individuals, higher educational attainment is related to an overall increase in several quality of life indicators, such as employment opportunities, lower risk of unemployment, and job satisfaction.

Nevertheless, there is a plethora of studies from a variety of academic disciplines that have found an association between socioemotional traits and school-related and labor market outcomes (Heckman et al., 2006; Kuncel, Ones, & Sackett, 2010; Poropat, 2009). However, most studies investigating the relationship between cognitive traits and socioemotional traits treat cognition as a unidimensional construct, i.e., they do not distinguish between non-verbal (i.e., Gf) and verbal cognitive traits (i.e., Gc), while other studies only use either Gf or Gc in their investigation of the relationship between cognition and socioemotional traits and other outcomes (e.g., di Fabio & Busoni, 2007). As Moutafi, Furnham & Paltiel (2004) emphasized, it is important to make a distinction between fluid and crystallized intelligence in order to understand *how*

and *why* socioemotional traits are related to intelligence. Thus, using intelligence as a unidimensional construct provides little understanding of the process explaining the relationship between intelligence and socioemotional traits, but also how these constructs are related to distal outcomes, such as academic performance and unemployment. In addition to the difference between fluid and crystallized intelligence, the proposed causal relationship between Gf and Gc has not been extensively investigated in relation to socioemotional traits and how these are related to distal outcomes. Thus, the present thesis aims to take a more in-depth look at the role of Gf, Gc, and socioemotional traits to depict their interrelations and explain scholastic success and the risk of unemployment in a longitudinal sample spanning age 10 to age 40.

The investigation of the dynamic development of both cognitive and socioemotional abilities, and the interplay between these abilities in childhood (i.e., between 3rd and 6th grade), are of particular interest for several reasons. First, much is still not known about how cognitive and socioemotional traits influence each other over time, especially during childhood and early adolescence. Second, a major theme within the field of educational psychology is the stability of socioemotional traits beginning in young adulthood (Mischel & Shoda, 2008) and intelligence that develops early in life. In addition, economists have reported high stability in socioemotional traits over a four-year period for adults (Cobb-Clark & Schurer, 2012). Subsequently, by investigating the dynamic development and how these traits influence one another prior to young adulthood, this thesis will contribute to a greater understanding of these developmental processes that also affect school achievement and other outcomes later in life (Heckman et al., 2006).

In addition, many econometric models tend to neglect to consider school performance (such as grades, etc.) as a mediator when investigating the relationship between individual differences and various outcomes later in life. For example, individual differences measured during school years are directly predicting the risk of unemployment without taking school performance into the equation as a potential mediator, regardless of whether socioemotional traits are measured in grade 6 and academic achievement in grade 9. Hence, it is important to model school-related variables when investigating the relationship between these individual differences and outcomes later in life. By unfolding the complex relationships between cognitive abilities and socioemotional traits, and their influence on various distal outcomes, this thesis will help inform school personnel and policy makers about these complex relationships. This

information may be helpful for teachers in planning appropriate strategies to overcome dips in academic self-concept or perseverance. Therefore, this study has implications for both researchers and practitioners.

In summary, the thesis has the following main aims: The first is to investigate the longitudinal relationships between cognitive and socioemotional traits from 3rd to 6th grade. The second aim is to determine the relative importance of cognitive and socioemotional traits in the prediction of academic achievement in 9th grade, and how effects of student background variables on achievement are mediated via such student traits. The third aim is to determine the impact of cognitive and socioemotional traits and academic achievement on risk of unemployment in adult age.

Chapter 2. Intelligence and academic achievement

2.1 Intelligence

Intelligence could be defined as: "…general ability to reason, plan, solve problems, think abstractly, learn quickly, and learn from experience" (Gottfredson, 2000:81). This definition underlines that intelligence constitutes the ability to solve problems by reasoning (DeYoung, 2011). Theories of intelligence form the foundation of attempts to determine and quantify human ability with extensive implications for learning, academic achievement, occupational performance, and team building, among countless other areas (Rohde & Thompson, 2007; Kaufman, 2009). Intelligence is a theoretical concept that is related to observable behavior (Chamorro-Premuzic & Furnham, 2005) and is evaluated on at least three different levels: psychometric, physiological, and social (Davidson & Kemp, 2011). In this thesis, the psychometric perspective is used, since it encompasses individual differences in achievement in relation to mental ability. The physiological (i.e., biological) perspective studies the brain through advanced technology to assess the associations between mental ability and brain activity. The social perspective focuses on accomplishment on "real-world" tasks to investigate intellectual traits in context (Davidson & Kemp, 2011).

The psychometric perspective tries to capture the structure of the intellect and to quantify the abilities underlying individual differences in knowledge and traits (Chamorro-Premuzic & Furnham, 2005). The name psychometric is related to the statistical approach of psychological tests. Psychometric tests are standardized tests constructed by psychologists to measure cognitive abilities. One main question is how many different cognitive abilities need to be recognized, and another main question is how are these cognitive abilities interrelated?

2.2 Models of the structure of cognitive abilities

Spearman (1904) developed the statistical technique factor analysis in order to explain performance on a large number of tasks in terms of one underlying factor. This idea was based on the observation that performance on different

tasks are positively, but far from perfectly, correlated, and Spearman hypothesized that these intercorrelations were a result of a general ability factor that he called "*g*". Spearman (1904, 1927) concluded that his factor analytic investigations supported the hypothesis of a *g*-factor. However, in the 1930s, this conclusion was challenged by Thurstone (1938), who, on the basis of newly developed forms factor analysis that could separate multiple ability factors, concluded that at least seven primary abilities should be identified. Followers of Thurstone identified many more primary abilities, and around the mid-20th century, an almost overwhelming number of different cognitive abilities had been found.

2.2.1 The Horn and Cattell model

By applying factor analysis to the intercorrelations among primary abilities, Horn and Cattell (1966) identified a small set of second-order factors, which they interpreted to represent broad cognitive abilities. Extending ideas proposed by Cattell (1941), they emphasized the distinction between Gf and Gc. They saw this as a subdivision of Spearman's *g*-factor into two separated, but associated, types of *g*. Gc was defined as the ability to obtain, maintain, arrange, and conceptualize information. Gf, in contrast, was seen to encompass ability to deal with novel information, as effortful and integrated cognitive activities are required. Cattell (1941) suggested that Gf stems from genetic and biological factors, while Gc primarily represents environmental impacts, such as education and socioeconomic status.

The Cattell and Horn model is often referred to as the Gf-Gc model, and it has had a strong influence on many fields of research, such as the field of life-span developmental research. Several researchers have suggested that Gf tends to reach its peak around age 25 and then gradually decline (e.g., Salthouse, 2012). This decline is hypothesized to be due to a decline in the activity of the central nervous system. Gc, on the other hand, is not directly dependent on the effectiveness of the nervous central system (Horn & Blankson, 2005; Moutafi et al., 2004). Thus, it is believed that it can increase during childhood and adulthood, or at least remain stable during adulthood (Horn & Blankson, 2005). In line with these findings, McArdle, Ferrer-Caja, Hamagami and Woodcock (2002) investigated the developmental trajectories of cognitive abilities with

growth curve modeling techniques, and found that Gf peaked at about age 22, while Gc peaked about at age 36.

2.2.2 The Three-Stratum Model and the Cattell-Horn-Carroll model

Carroll (1993) conducted a meta-analysis of studies of the structure of cognitive abilities and extended the Cattell-Horn Gf-Gc model into a hierarchical three-stratum model, which encompasses more than 80 narrow traits at stratum level one, nine broad second-order traits at stratum two, and one general ability (*g*) at the top level, i.e. at stratum level three (for a more extensive review, see Carroll, 1993; Newton, & McGrew, 2010; McGrew, 1997). Gf and Gc are second-order factors within stratum level two.

The Cattell-Horn-Carroll (CHC) model synthesizes the Cattell-Horn Gf-Gc model and the Carroll (1993) three-stratum models of human cognitive abilities (see McGrew, 2005; see also Kaufman, 2009). However, there are three main differences between the Gf-Gc model and the three-stratum theory: (1) the three-stratum theory includes the *g*-factor, but the Gf-Gc theory does not take this factor into account; (2) the three-stratum model does not include any apparent factor for quantitative ability, whereas Gf-Gc theory does; (3) the three-stratum theory merges short- and long-term memory into one general memory factor, whereas in the Gf-Gc theory, these components are separate second-order factors (Davidson & Kemp, 2011).

Keith and Reynolds (2010) concluded, after reviewing 20 years of factor analytic investigations of intelligence from a CHC perspective, that Gc remains somewhat indefinite. It remains elusive, and is defined in terms of a broad Gc, academic achievement, and verbal ability. According to Kan, Keivit, Dolan, and van der Maas (2011), Gc may be defined broadly as achievement in different domains of knowledge and traits in culturally and educationally heterogenous samples, or narrowly as verbal comprehension in culturally and educationally homogeneous samples.

2.3 The Investment Theory

Although the hierarchical taxonomy of human intelligence has received substantial interest among researchers within the intelligence field, Cattell's

(1941, 1987) developmental Investment Theory has not gained similar attention as the structural Gf-Gc theory. Cattell's Investment Theory describes developmental processes of intellectual abilities in which Gf is defined as a general ability that drives the development of knowledge, traits, and other domains. This perspective is represented already in the definitions of Gc and Gf. Cattell (1987) described Gc as: "The term crystallized is meant to imply this freezing in a specific shape of what was once fluid ability" (Cattell, 1987, p. 140). Consequently, crystallized abilities are domain specific, since their representations are "tied to particular areas" (Cattell, 1987, p. 139). In contrast, Gf is assumed to be domain transcending or, in Cattell's words: "has the fluid quality of being directable to almost any problem" (Cattell, 1987, p. 97).

The Investment Theory states that persons with high levels of Gf acquire knowledge at a faster rate than people with lower levels of Gf (Schneider & McGrew, 2012). Therefore, this type of intelligence is not related to a specific cognitive domain, but it is particularly important for "higher" mental processing, such as problem solving, abstract thinking and reasoning, etc., in all domains (Cattell, 1963). Gf was regarded by Cattell (1987) as an ability unrelated to cultural aspects that has a general influence on cognition and learning. Individuals that score high on Gf tests find solutions to problems with very little instruction. In addition, once having identified a satisfactory solution to a problem, they are able to figure out how it might apply to other similar problems. In contrast, persons with low Gf find it more difficult to reach a solution to unfamiliar problems. These persons typically need hands-on, well-guided instruction to solve novel problems, and learn mostly by trial-and-error. Furthermore, they tend to have difficulties seeing how the solution might apply in other situations, i.e., fail to implement the solution in new contexts (Schneider & McGrew, 2013).

The Investment Theory is based on the assumption that Gf influences Gc. Moreover, it suggests a dynamic relationship between these types of intelligence in guiding mental activity and observable behavior. It proposes that Gf is the leading driver of performance in infancy. For example, learning requires relation perceiving, and Gf represents a capacity for perceiving relations. The theory, thus, proposes that Gf influences the acquisition of cultural knowledge and culture-specific traits. In this regard, learning complex tasks through the ability to solve novel problems results in the acquisition of knowledge and traits that become "crystallized." Subsequently, Gf will be reflected in all tasks that are Gc-related (Ackerman, 1996; Schneider & McGrew, 2012), which also explains

why a correlation of unity is frequently found between Gf and *g* (Gustafsson, 1984; Kvist & Gustafsson, 2008).

In this developmental model, time plays an important role as the Investment Theory distinguishes between "prior" and "present day" abilities. Prior, or historical, abilities could represent traits that were learned during the early years of schooling (Ackerman, 1996). Going from childhood to adulthood, the dominance of Gf shifts steadily to Gc. This is reflected in the change of the cognitive activities associated with problem solving. In the initial stages, problem solving involves the application of unspecific rules that appear to be somewhat associated with the problem, while knowledge-based problem solving characterizes the later stages. Thus, the postulation of a lasting influence of Gf on Gc, which results in a time-dependent change of Gc, is a main feature of the Investment Theory.

Cattell (1957, pp. 878-879) pointed at the importance of using specific measures of Gc for different professions and domains of learning in order to avoid unobserved heterogeneity when investigating the Investment Theory. Cattell suggested that different professional groups that were included in the same sample should be given measures that guarantee equivalence, despite the differences between the knowledge bases of the groups. The differences between the knowledge bases of professional groups will increase with age and experience (Cattell, 1987, pp. 143-144). One solution for this problem would be to measure Gc with one test during the time of schooling and a short time afterwards. Such an approach allowed Ackerman (2000) to discern between historical Gf and present Gc.

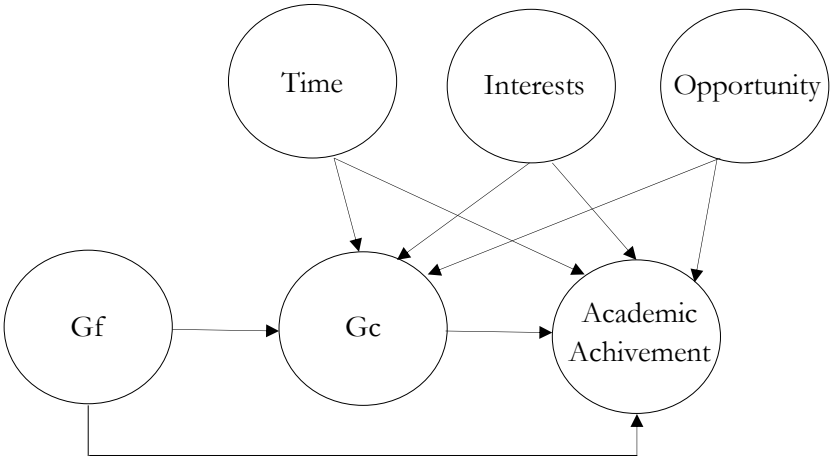

Figure 2.1. Illustration of Cattell's investment model

Cattell (1971) argued that learning is also influenced by other non-general abilities, such as time, interests, effort, and personality traits. All these traits contribute to the investment into the knowledge acquisition process.

2.4 The PPIK Theory

The PPIK (intelligence-as-Process, Personality, Interests, and intelligence-as-Knowledge) Theory is a theoretical framework that depicts the developmental role of Gf on Gc in conjunction with cognitive, affective, and conative trait complexes. The PPIK Theory acknowledges Cattell's (1987) Investment Theory, i.e., that acquired knowledge and expertise is a consequence of the investment of cognitive resources over time, and it may be regarded as an extension of the Investment Theory. The PPIK Theory proposes that Gf, personality traits, interests, and traits form an integrative process that determines the direction and intensity of cognitive investment.

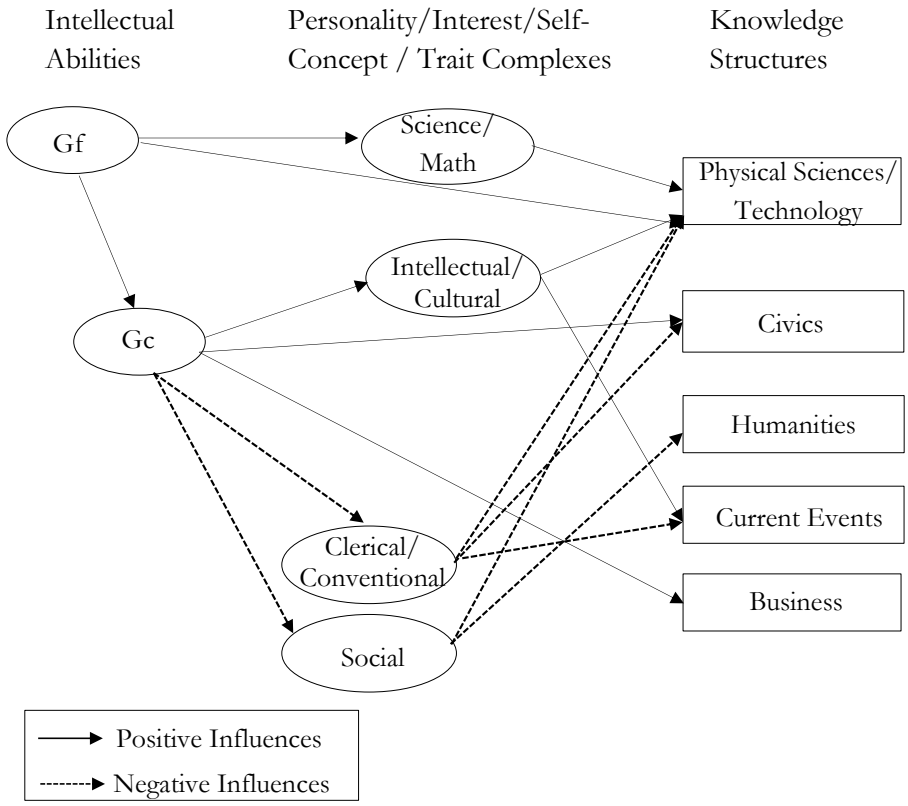

Figure 2.2. Constructs and influences in the PPIK theory (Adopted from Ackerman,1996)

Gf (fluid intelligence) also defined as "intelligence-as-process"; Gc (crystallized intelligence) represents "intelligence-as-knowlegde"; trait complexes (including: personality, interests, self-concept, ability) from Ackerman and Heggestad (1997). Positive and negative influences derived from the theory and supported by prior empirical data (Ackerman, 2000; Ackerman & Rolfhus, 1999; Beier & Ackerman, 2001; Rolfhus & Ackerman, 1999). Adopted from Ackerman (2003).

According to the PPIK Theory, cognitive abilities are the strongest predictors of academic achievement throughout the pre-adult years, since all students are exposed to the same curriculum in school. Subsequently, the child's freedom of choice is limited by the curriculum. However, as people grow older, they attain more freedom to make decisions that are in line with their interests, i.e., people begin to specialize. In this way, the effects of personality and interests will play a more prominent role for performance compared to the pre-adult period (Ackerman & Heggestad, 1997).

2.5 Investigations of the Gf-Gc Theory and the Investment Hypothesis

According to Cattell (1987), Gc is a product of historical Gf, which means that this year's Gc level is caused by last year's Gf level and the Common Learning Investment (such as time, interest, and memory). The Investment Theory is rather uncomplicated, but empirical research has found mixed support for it.

Schmidt and Crano (1974) found in a cross-lagged correlation analysis that Gf was more strongly related to Gc over time than Gc was to Gf. However, this result disappeared when Schmidt and Crano adjusted for differences in reliability in these constructs. They also found that the Investment Hypothesis was only valid for middle-socioeconomic status children, but not for lower-socioeconomic status children. One explanation offered by Schmidt and Crano (1974) for the lack of support for the Investment Hypothesis among lower-socioeconomic status children is that the causal mechanism is present only if certain previous levels of Gc have been reached. Another study by Proctor, Floyd, and Shaver (2005) identified two groups of children with low mathematics achievement: those with specific normative deficits in calculation, and those with specific normative deficits in reasoning. They found that across the CHC factor clusters, children with deficits in calculation did not achieve significantly less than an average-achieving group. Nevertheless, children with deficits in mathematics reasoning scored below average on fluid reasoning and Comprehension-Knowledge (Gc) factor. Thus, this population heterogeneity among low-SES students could have prevented the relationship between Gf and Gc from appearing. A third explanation of the partial support for the Investment Hypothesis could be that the sample is lacking high-SES students. Stankov, Horn, and Roy (1980) concluded that the relationship between Gf and Gc was significantly affected by SES, although the association decreased monotonically with a decrease in SES. If Schmidt and Crano had also included high-SES students, their results might have been different.

McArdle (2001) investigated the relationship between verbal and non-verbal abilities among children measured during the first, second, fourth, and sixth grades. The results showed that non-verbal ability was negatively related to verbal scores, a finding which was opposite to the proposed Investment Hypothesis. A more comprehensive longitudinal study executed by Ferrer and McArdle (2004) did not find any support for the Investment Hypothesis, either. In a cross-lagged model, previous levels of Gf were negatively related to

subsequent levels of Gc (β = -.06). Furthermore, previous levels of Gc were negatively associated with subsequent levels of Gf (β = -.10). However, another finding demonstrated that Gf had a direct effect, and not via Gc, on academic achievement. Ferrer and McArdle (2004) presented a couple of possible explanations of these data to account for the failure to find an explicit relationship from Gf to Gc. First, they argued that motivation and interest could serve as mediators of an association between Gf and Gc. More specifically, high Gf might not result in an increase in Gc, since the accumulation of Gc is a function of motivation and interests. Second, persons with high Gf are not further stimulated, due to low demands of the educational system. Thus, the growth of intelligence is restrained by the schooling system.

Rindermann, Flores-Mendoza, and Mansur-Alves (2010) investigated, using longitudinal data, the effect of Gf on Gc, and vice versa. They found that Gc influenced Gf more strongly than Gf influenced Gc. They used two samples (Brazilian and German) based on participants aged 7 to 15 and 10 to 20, respectively. For the Brazilian sample, they reported a cross-lagged effect between Gf and Gc of .16, and .14 for the German sample. In contrast, they found a cross-lagged effect between Gc and Gf of .19 for the Brazilian sample and .22 for the German sample. In addition, socioeconomic status and education had a larger effect on Gc compared with Gf. Furthermore, Christensen, Batterham, and MacKinnon (2013) did not find any support for the Investment Hypothesis among young adults (20 to 24 years old) as measured at age 19, 23, and 27. They found that Gc increased over the three measurement time points, spanning 8 years, but not as a function of Gf.

However, based on adults (ages 16 to 68), McArdle et al. (2000) reported that Gf followed a general decline. In this study, Gc was measured by vocabulary scores, and the researchers found support for the Investment Hypothesis when examining the relationships through cross-lagged regression analysis. This finding was, according to the authors, "…interesting because the original investment theory was based on development in young children," (p. 72) and concluded that the "results seem to show that the key dynamic propositions of Gf-Gc theory (e.g., the investment of Gf into Gc) is good empirical representation of these data. /…/ we note that the Gf-Gc investment theory was originally stated as a theory of early childhood development (Cattell, 1971) but it is possible that the remnants of these developmental processed remain evident in the adult part of the life span" (p. 72). In addition, they found that Gc did not significantly influence any other construct. McArdle et al. (2000)

suggested that other mechanisms influence Gc after Gf reaches its peak during early adulthood, such as memory, which plays a role in the maintenance of Gc. They found that memory was associated with Gf in the complex network of interrelations among cognitive abilities. This finding has been supported by other studies (Lu, Weber, Spinath, & Shi, 2011).

Schweizer and Koch (2001) revisited Cattell's model. They suggested that learning mediates the relationship between Gf and Gc. More precisely, they suggested that Gf influences learning, which, in turn, facilitates the transfer of knowledge to memory. Subsequently, learning works as a catalyst for the creation of Gc. This hypothesis was tested in two small subsamples of German students (n = 51) among students aged 19 to 23 years and 24 to 30 years (n = 53). The results showed that learning, assessed by associative and complex learning assignments, mediated the relationship between Gf and Gc among students aged 19 to 23, but not in the older subsample.

Valentin Kvist & Gustafsson (2008) examined the Investment Theory by testing Cattell's (1987) hypothesis that a second-order Gf factor would be perfectly correlated with a third-order *g*-factor (cf. Gustafsson, 1984). For the total sample of adult participants, the correlation was only about .80, but within all three homogeneous subsets of participants (Swedish non-immigrants, European immigrants, and non-European immigrants), the correlation between Gf and *g* was unity. This result is explained by the fact that the three groups had had different opportunities to learn the traits measured by the test battery, some tasks being dependent on knowledge of language and culture. When the opportunities to learn were more equalized within the groups, Gf became a common determinant of individual differences in performance in all domains. This study, thus, provides strong support for the Investment Theory.

In addition, the Investment Hypothesis was tested in a study by Thorsén, Gustafsson, and Cliffordson (2014). The aim was to examine the developmental effect of Gf and Gc on the acquisition of knowledge and traits. Three models were tested, and the Gf-Gf model showed the best model fit. Thus, support for the Investment Theory was provided, and the conclusion was that the development of knowledge and traits was influenced by Gf via Gc between 6th and 9th grade.

2.6 Definition and measurement of Gc

When Keith and Reynolds (2010) summarized 20 years of factor analytic investigations on intelligence "from a Cattell–Horn–Carroll (CHC) perspective," they concluded that: "Gc remains an elusive construct, and researchers often talk past each other when discussing Gc, with it being referred to as crystallized intelligence, academic achievement, verbal ability, or comprehension/knowledge, to name a few […] Clarification about the nature of Gc versus verbal ability and achievement would be useful" (p. 643).

Gc is conceptualized in two separate ways, but it is presumed that the same construct is measured (Keith & Reynolds, 2010). Sometimes, Gc is measured in terms of a broad cognitive ability, such as general knowledge, that is supposed to be found within a culture. However, other times, it is conceptualized more narrowly as the form of acquired knowledge that is reflected in verbal tests. This lack of agreement upon the precise nature of Gc emanates from the history of CHC theory. Even though Cattell (1943) argued that verbal ability and Gc are not identical constructs, Carroll (1993) suggested that constructs such as Gc and verbal ability are more-or-less interchangeable. In an attempt to bring clarification to the Gc factor, Kan, Kievit, Dolan, and van der Maas (2011) demonstrated that Gc is identical to verbal ability in a homogenous sample. They suggested that Gc could not represent a psychological capacity in terms of a causal theory of measurement if it was measured by diverse knowledge items. In such a case, the cause (e.g., a latent variable) would not be separated from its effects (i.e., its indicators). Having a construct that represents knowledge itself and simultaneously causes individual differences in the observed variables that measure the same knowledge would be circular to assume. In a sample from the Human Cognitive Abilities project (McGrew, 2009), Kan and colleagues demonstrated that Gc was statistically equivalent to verbal ability. They argued:

> We contend that in culturally and educationally homogeneous samples factors Gc and verbal comprehension merge into one factor. In other words: If the investment hypothesis is true, once differences in culture, language, and education have been taken into account, individual differences in fluid intelligence (the same capacity as general intelligence) and verbal comprehension can account for individual differences in the (purely statistical) variable crystallized intelligence. Sample heterogeneity due to differences in education, introduces variance that is not attributable to

> cognitive factors, and results in the statistical separation of crystallized intelligence from fluid intelligence and verbal comprehension (Kan et al., 2011, p.293). /---/ To study investment theory properly, it is thus important to be aware of the role of sample heterogeneity. Ideally, investment theory should be investigated using a longitudinal design and using same-aged, same-sex, culturally and educationally homogeneous samples (Kan et al., 2011, p.301).

The importance of sample homogeneity has previously been demonstrated by Valentin Kvist and Gustafsson (2008) in relation to the Gf-g distinction. Based on the assumptions of Cattell's Investment Theory, Valentin Kvist and Gustafsson (2008) argued that all learning is driven by historical Gf, especially during the younger years. They showed that once differences in opportunity to learn emerge, Gf and g cease to be statistically indistinguishable. Thus, they proposed that a perfect relationship between Gf and g exists due to the Investment Hypothesis, which requires a culturally homogeneous sample.

Scrutiny of the composition of the test batteries used in the studies presented above shows that some studies use a vocabulary test to measure Gc (e.g., McArdle et al., 2000) or a test which is closer to the laboratory, such as lexical decision tasks or measures of processing speed. Others use a broader set of verbal tests as indicators of a latent or observed Gc variable (Rindermann et al., 2010; Valentin Kvist & Gustafsson, 2008). These test batteries may also include achievement tests (e.g., Rindermann et al., 2010). Thus, there is considerable heterogeneity in the kinds of measures used to capture Gc, which may contribute to the explanation of the contradictory results obtained.

2.7 Using prior knowledge to solve novel problems

Improving students' problem-solving abilities is one of the major challenges in education, since it is considered to be of importance in one's work life (Mayer & Wittrock, 2006). Problem solving refers to a person's ability to activate cognitive processes in order to understand and resolve problem situations in which a method to solve the problem is not immediately available (Shute, Wang, Greiff, Zhao, & Moore, 2016). Hence, solving novel problems requires that the individual approaches them in an unusual way. Persons that use prior knowledge to solve a novel problem, i.e., they try to solve a novel problem the "usual" way, will find it more difficult to discover that the problem needs to be

approached in an atypical manner. This phenomenon is known as *functional fixedness* (Defeyter & German, 2003), or as Brosnan and Hopper described it, the "disinclination to use familiar objects in novel ways" (Brosnan & Hopper 2014, p. 2).

According to Knoblich, Ohlsson, and Raney (2001), when a novel problem occurs, the individual makes an initial conceptual representation of the problem. The representational status of a problem reflects the ease with which it can represent something else. If the individual does not realize that the novel problem needs to be solved in an atypical way, the initial representation will interact with prior knowledge and block alternative ideas of how to solve the problem. Petersen and McNeil (2013) reported that the more a person knows about the problem, the more likely it is that prior knowledge will be used in a typical way to solve the problem, which also has been proposed by Furnham (2008). In addition, Jonassen (2000) suggested that many problem-solving strategies taught in school are based on a "cookbook" type of memorization, which leads to functional fixedness. Such fixedness could have detrimental effects on students' abilities to solve novel problems and on the enhancement of their own knowledge-seeking traits (Jonassen, Marra, & Palmer, 2004). Furthermore, Bergendahl and Magnusson (2015) argued that when persons are relying on existing knowledge when approaching novel situations, it might also prevent them from being innovative (McCaffrey & Krishnamurty, 2015).

Referring to schools' inability to enhance students' Gf, Mayer and Wittrock (2006) argued that schools must educate students to improve their problem-solving abilities by creating tasks for which prior accumulated knowledge is of limited help to solve the problem and in which well-defined goals are depicted. In this way, students will learn to use means-ends analysis to solve a novel problem instead of using prior acquired knowledge and, thus, reducing the risk of functional fixedness. Students need to learn to construct abstract representations of the problem (e.g., causal models or concept maps) in order to minimize the influence of prior accumulated knowledge and build an adequate structure of the novel problem (Greiff, Wüstenberg, Molnár, Fischer, Funke, & Csapó, 2013).

Although Mayer and Wittrock (2006) suggested that schooling has no effect on Gf, several studies have reported the opposite. For example, Stelzl, Merz, Ehlers, and Remer (1995) found significant results of schooling on Gf tests. This finding has been supported by numerous studies (e.g. Artman, Cahan, &

Avni-Babad, 2006; Cliffordson & Gustafsson, 2008; Kyriakides & Luyten, 2009).

It should also be pointed out that various problem-solving tasks require knowledge and previously acquired traits for their solutions. At the very least, numerous problem-solving tasks require reading traits and vocabulary, and in addition, many tasks require domain-specific knowledge to be successfully framed and solved. Thus, while the phenomenon of functional fixedness is of great interest, there also are other relationships between previously acquired knowledge and problem solving.

2.8 School achievement measured with grades

Within most school systems, grades are used as a summative measure of school achievement, and they often constitute an important selection instrument to higher education and the labor market (Heckman et al., 2006). Hence, academic achievement is typically conceptualized in terms of grades or one's highest level of educational attainment. These two measures of achievement are important for both individual and societal development perspectives (Ackerman, Chamorro-Premuzic, & Furnham, 2011).

Grades have been found to be important predictors for numerous outcomes. For example, grades predict school dropout (Bowers, Sprott, & Taff, 2012), admission to college, college achievement, college graduation (Atkinson & Geiser, 2009), and risk of unemployment (Brugiavini, Carraro, & Kovacic, 2015). In Sweden and many other countries, teachers are responsible for grading their students, which raises issues of reliability and equity of grading. Standardized tests, among other sources of information, are often available to ensure that each teacher has information about to what extent the students have reached the knowledge requirements posed for different levels of performance when grading his or her students.

However, there is a large body of evidence that grades not only measure the knowledge and traits stated in the curriculum and other steering documents, but that they also measure many other aspects (e.g., Bowers, 2011; Klapp-Lekholm, 2010). Grades have been found to be influenced by socioemotional traits, such as perseverance, motivation, and cognitive abilities (Furnham & Monsen, 2009). For example, Bowers (2011) reported that grades captured both cognitive and socioemotional components, as he identified two dimensions.

The first component represented knowledge and traits as assessed by standardized achievement tests, and the second dimension represented effort and engagement. Bowers had hypothesized that grades should be considered as a multidimensional construct consisting of both knowledge and socioemotional abilities (Bowers, 2011).

In addition, several studies have reported that teachers tend to take socioemotional traits into consideration when assigning grades (e.g., Brookhart, 1993; Guskey, 2011). Guskey (2011) argued that grades are a confusing mixture of academic and nonacademic aspects, and rarely represent a valid picture of student proficiency. Stanley and Baines (2004) argued that a student's grade may be inflated by extraneous socioemotional aspects, such as being cooperative or persistent. In contrast, when a student's grade is deflated for the opposite reasons, it will lead to an underrepresentation of the student's academic performance. According to Brookhart (1993), the teachers' rationale for taking socioemotional traits, such as perseverance, into account was that they wanted to treat the students fairly and were also concerned with effects of grades.

Another influential factor on subjective assessment of students' performances is the halo effect. As Edward L. Thorndike (1920) wrote regarding halo effects in the Army: "Features with a halo belonging to the individual as a whole appeared in the ratings of officers made by their superiors in the army." (p. 25). The halo effect is a cognitive bias that is mostly unconscious (e.g., Malouff, Emmerton, & Schutte, 2013). A positive halo effect occurs when a previous favorable judgement of a student's performance leads to higher subsequent evaluations. In contrast, a negative halo effect describes how prior pessimistic evaluations of a performance can result in lower subsequent evaluations, even if the grader has ample information to allow for independent judgements of them (Malouff et al., 2013).

In educational settings, Dennis (2007) used correlated uniqueness modeling with raw scores of undergraduate psychology student projects and identified halo effects transmitting from one piece of a student's work to another and from one rating component to another within the same piece of work. In a more recent experimental study, Malouff et al. (2013) investigated the halo effect by assigning 126 psychology faculty members and teaching assistants to grade a student giving a poor oral presentation or the same student giving a good oral presentation. Then, each rater assessed an unrelated piece of written work by the student followed by an assessment of the oral presentation given by the student. The results showed that "graders assigned significantly higher

scores for the written answer following the good oral presentation than for the same written answer following the poorer oral presentation" (Malouff et al., 2013, p. 236), thus, providing evidence for the halo effect and adding support to previous findings (Dennis, 2007).

In sum, the complex classroom environment, where teacher's expectations, values, and external factors affect the grading process, suggests that grades are, at least, sometimes afflicted by construct-irrelevant variances, as proposed by Messick (1989). From an objective and fair assessment perspective, such irrelevant variance is large enough to be worrying to both instructors and students (Klapp Lekholm & Cliffordson, 2009).

2.9 Discussion

Intelligence is usually defined as the ability to solve problems by reasoning. Although several theories of intelligence have been proposed such as "multiple intelligences," "tacit knowledge," "emotional intelligence," or "contextualized intelligence," these theories do not provide developmental explanations for accumulated knowledge. In contrast, the Gf-Gc model is based on two distinct types of abilities, namely Gf and Gc, and the Investment Theory describes developmental processes of intellectual abilities in which Gf is defined as a general ability that drives the development of knowledge and traits in different domains (Gc). High levels of Gf lead to faster knowledge acquisition and, therefore, Gf is reflected in all tasks that involve acquisition of knowledge and traits. Going from childhood to adulthood, the dominance of Gf is assumed to shift steadily to Gc.

Most studies have failed to find support for the Investment Theory (e.g., Christensen et al., 2013; Ferrer & McArdle, 2004; Rindermann et al., 2010; Schmidt & Crano, 1974). However, some studies have provided evidence that supports the Investment Hypothesis. Schweizer and Koch (2001) found that learning, assessed by associative and complex learning assignments, mediated the relationship between Gf and Gc among students aged 19 to 23, but not in the older subsample. In addition, Valentin Kvist and Gustafsson (2008) found support for the Investment Hypothesis by showing that unequal opportunities to learn prevented Gf from coinciding with g.

One possible explanation for the difficulties encountered in finding support for the Investment Hypothesis may be that there are conceptual issues that have not been sufficiently addressed. Kan et al. (2011) observed that Gc has been

conceptualized in two fundamentally diverse ways. One is as a psychological entity, or as an ability and the other is as a statistical entity, which represents a broad range of performances in different domains. Gf, in contrast, has typically only been interpreted as a psychological entity that causally affects acquisition of knowledge and traits, or development of Gc. Thus, it follows from Investment Theory that Gc is rather a product of learning, the nature of which varies depending on the domains in which different persons develop knowledge and traits. According to this view, Gc is a statistical entity that could be better conceptualized as a formative factor, rather than as a reflective factor.

Kan et al. (2011) argued that, depending on the constitution of the test battery, Gc can be interpreted as either exposure to information through education, or as verbal comprehension. In a reanalysis of a previous study, they found Gc and verbal comprehension to be statistically equivalent, and they concluded that the results supported the interpretation of Gc as verbal comprehension.

Kan et al. (2011) interpreted the results as providing partial support for the Investment Theory, in that Gf was found to influence Gc. They also observed that exposure to information through education is another factor, as is verbal comprehension. Thus, they concluded that, "The essence of investment theory – the hypothesis that cognitive processing (including reasoning) is involved in the acquisition of knowledge, traits, and solving strategies – remains plausible" (p. 300). They also observed that, in order to study the Investment Theory properly, it should be investigated using a longitudinal design and using same-aged, same-sex, culturally and educationally homogeneous samples. Only few studies satisfy these requirements.

Chapter 3. Socioemotional traits

Cognitive traits are usually represented by constructs that are based upon standardized intelligence and achievement tests (Messick, 1979). In addition to cognitive traits, the term non-cognitive traits is used to refer to psychological traits that predict important outcomes. However, this term is a misnomer.

The conceptualization of personality traits stems from the variety of human individuality. Persons diverge significantly in how they think, feel, and behave. The conceptualization is also based on the observation that a certain individual often acts consistently over time and across different situations. The research on personality traits focuses on structural differences and similarities among persons, and traits are employed to describe and explain behavior. Hence, personality traits are both internal (attributes of an individual, instead of the situation or context) and causal (affect behavior) (Chamorro-Premuzic & Furnham, 2005).

By applying the definition by McCrae and Costa (2003, p. 25), "dimensions of individual differences in tendencies to show consistent patterns of thoughts, feelings, and actions," this guides us in defining a trait and how it can be recognized when encountered. For example, neuroticism, which is characterized by anxious feelings, could provide information about why some persons respond to a stressful situation by going shopping while others go home and do nothing.

The point of departure for a trait researcher is to determine the behaviors that define a specific trait (DeYoung, 2011). The next step is to assess whether and how traits are related to behavior, and the third step is to construct a satisfactory theory of personality traits (Matthews, Deary & Whiteman, 2009). Such a taxonomy of traits can be developed according to the lexical hypothesis, which uses the dictionary as a comprehensive pool of trait descriptors, i.e., adjectives describing human behavior (Saucier, Hampton & Goldberg, 2000).

3.1 A brief history of the trait perspective

Trait theorists Gordon Allport and Thurstone used adjectives in the English language to describe a person in everyday life. It was assumed that a person's personality could be reflected and depicted with words. This approach is known as the lexical hypothesis. By the use of factor analysis multiple personality factors were identified (Norman, 1963).

Raymond Cattell (1905-1998) continued with the lexical hypothesis, but he also used various sources of data. He gathered information from self-rated questionnaires and from other persons who knew the participants well. When he analyzed this data, he found 16 personality factors. Based on these results, he constructed a widely used personality test called the 16 Personality Factor Questionnaire (16 PF) to capture individual differences in each of these dimensions (Cattell, 1965).

Other researchers argued that there was a smaller number of personality traits than 16. One of those was Hans J. Eysenck. He argued that individual differences could be described by using only bipolar higher-order factors, namely introversion-extraversion and stability-instability. These factors could also form mixtures, e.g., an emotionally unstable introvert is a person who is restless, anxious, and keeps to himself or herself; a stable extrovert is restless and impulsive, but calm (Eysenck, 1967).

Eysenck later proposed a third factor, psychoticism, defined as a person who is aggressive, distant, self-centered, antisocial, and tough-minded. Much of Eysenck's work in this field focused on finding a biological basis for these personality traits by linking them to activity in the human brain (Eysenck, 1967).

Eysenck assumed that biological arousal in the brain was normally distributed. Thus, extreme introverts are chronically over-aroused, and they try to reduce this stimulation in order to reach normal levels. In comparison, extraverts seek physical arousal by increasing their social contacts, whereas introverts avoid arousal and social contacts. Although Eysenck argued that personality was strongly influenced by life experiences, these arousal systems among humans could also be attributed to hereditary factors.

3.2 The Big Five – a short overview

The Big Five personality framework (Norman, 1963; Goldberg, 1981; Digman, 1996; Costa & McCrae, 1992) is the most commonly accepted system used by personality theorists when describing personality traits (Chamorro-Premuzic & Furnham, 2005). One reason is because of the extensive support, both longitudinal and cross-cultural, of the five higher-order personality traits. Like Cattell's 16PF, the Big Five factor model emanated from the lexical hypothesis. As mentioned, the lexical hypothesis is based on the assumption that the critical dimensions of behavior can be identified by the words used in language to depict a person (Chamorro-Premuzic & Furnham, 2005).

The Big Five personality model stems from a re-analysis of Cattell's 16 PF. In 1961, Tupes and Cristal (1961) carried out a couple of investigations using Cattell's scale and identified only five factors. Norman (1963) also found five factors in his studies. In line with Tupes and Cristal, Norman argued that five factors represent a sufficient taxonomy of personality traits. constructed his own measurement instrument by using synonyms from the dictionary. He also identified five factors. McCrae and Costa (1985, 1987) re-investigated the framework and found a striking correspondence with the taxonomy stipulated by Norman (1963) and Goldberg (1981). The five factors of the Big Five model (also known as the popular acronym OCEAN) are Openness to Experience (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N).

Openness to Experience concerns differences in preference for involving oneself in intellectual activities, learning new things, and exploring new ideas (Busato, Prins, Elshout, & Hamaker, 2000). This factor has been the most controversial among trait researchers, and has also been labeled as Creativity, Intellect, or Culture (Goldberg, 1992; Saucier, 1994).

In their description of *Openness to Experience*, Costa and McCrae (1992) included the following six facets: fantasy, aesthetics, feelings, actions, ideas, and values. Openness to fantasy reflects a person who has a vivid imagination and daydreams. Aesthetics refers to a sentiment for art and beauty. Openness to activity refers to individuals who are willing to try new things. Openness to ideas is related to the need for cognition, as the individual enjoys scrutinizing information, solving puzzles, etc. Openness to values refers to the ability and open-mindedness to re-examine one's own values.

Conscientiousness represents the tendency to be responsible, persistent, and goal-oriented (Busato et al., 2000). Conscientious persons are described in terms of being efficient, determined, productive, and hard-working. This factor includes the facets of competence, order, dutifulness, achievement striving, self-discipline and deliberation.

One reason behind the success of conscientious individuals is their capability to organize and be disciplined, which makes them productive in what they do. Such persons tend to also strive for high achievements in most activities, and they are highly self-disciplined. They are also deliberate, i.e., plan in advance and think before doing something (McCrae & Costa, 2003). Hence, Conscientiousness is closely related to the will to achieve (Digman, 1996).

Extraversion depicts differences in the inclination for social interaction and a socially active life (McCrae & Costa, 2003). In contrast, introverts (persons that score low on Extraversion) tend to be reserved, discrete, and tend to have restrained behavioral patterns (Chamorro-Premuzic & Furnham, 2005).

The facets of Extraversion are warmth, gregariousness, assertiveness, activity, excitement-seeking, and positive emotions (McCrae & Costa, 2003). These facets could also be categorized into three interpersonal (warmth, gregariousness, and assertiveness) and three temperamental traits (activity, excitement-seeking, and positive emotions). Warmth describes a friendly style of personal interaction. Gregariousness reflects an outgoing person, and sometimes, the combination of being warm and gregarious is referred to as sociability. The third facet of extraversion, assertiveness, refers to leadership traits, easily taking charge, and freely expressing feelings and thoughts (McCrae & Costa, 2003).

The three facets that McCrae and Costa (2003) labeled temperamental describe individuals that are energetic, forceful, and absorbed by work or other activities.

Agreeableness is also known as sociability, and reflects considerate, compassionate and modest behavior (Chamorro-Premuzic & Furnham, 2005). The six facets are described by McCrae and Costa: trust, straightforwardness, altruism, compliance, modesty, and tender-mindedness (Costa & McCrae, 1992).

Neuroticism can be defined as the propensity to experience negative emotions and thoughts, such as anxiety, distress, depression, and anger (Busato et al., 2000). Individuals who score high in Neuroticism are faced with these emotions more frequently in comparison to typically stable, calm, and relaxed (low Neuroticism) individuals (Chamorro-Premuzic & Furnham, 2005). The facets that constitute Neuroticism are anxiety, angry, hostility, depression, self-consciousness, impulsiveness and vulnerability (McCrae & Costa, 2003).

Anxiety and angry hostility are part of two rudimentary emotional states: fear and anger. Although everybody has such feelings once in a while, the intensity and frequency varies from person to person. Persons that score high in Anxiety also have a tendency to worry; they are prone to think about what might go wrong. Hostile individuals are inclined to be exasperated and may be hard to get along with (McCrae & Costa, 2003).

The facets of depression and self-consciousness include feelings such as unhappiness and embarrassment. Depression, as a trait, is the proclivity to feel

gloomy, heavy-hearted, and lonely. Persons that show a tendency to be depressed also tend to exhibit a lower self-worth. Individuals that score high in self-consciousness are more sensitive to teasing and ridicule, since they often experience feelings of inferiority to others (McCrae & Costa, 2003).

The remaining two of the six facets, specifically impulsiveness and vulnerability, are more found in behavior than in emotional states. Impulsiveness describes the inclination to give in to temptations and become quickly passionate about certain things as a result of a lack of control. Hence, impulsive persons could indulge in activities such as overeating and overspending, overconsuming alcohol, smoking, etc. Vulnerability is characterized by an inadequacy to deal with stress. Subsequently, vulnerable persons are prone to be disoriented in stressful situations and become dependent on others for help (McCrae & Costa, 2003).

3.3 Elaboration of conscientiousness and neuroticism

The measures of socioemotional traits that are utilized in empirical investigations are frequently dictated by data availability. In this case, the ETF (Evaluation Through Follow-up) database does not explicitly include items about the "Big Five" personality traits, but it does contain information about fear, worry, perseverance, procrastination refrainment, and domain-specific and general Academic Self-Concept. Thus, items that measure facets of Conscientiousness (i.e., perseverance and procrastination refrainment) and Neuroticism (i.e., Anxiety) have been identified among the Big Five constructs. Therefore, a further elaboration of the constructs of perseverance and procrastination refrainment and Anxiety is needed.

3.3.1 Anxiety as a construct

Many theorists make a distinction between trait anxiety and state anxiety. Trait anxiety is defined as a personality dimension that is stable over time, whereas state anxiety depends upon the current situation and is not stable over time. Traits are believed to be affected by factors such as heredity and experiences of early childhood. The distinction trait-state anxiety is in line with disposition and occurrence (Eysenck & Van Berkum, 1992; Ladd, 2003).

Anxiety is also a sub-factor of the trait Neuroticism within the Big Five theoretical framework. Anxiety involves a reciprocation of cognitions (attention, perception, reasoning, and memory), subjective emotions, and behavioral inclination of avoidance. Hence, Anxiety may result in underachievement and failure at school (Busato et al., 2000).

According to Sarason (1978, 1984), Anxiety is a reaction to a perceived threat that is triggered by perceived difficulty or a sense of inefficacy to manage the situational demands or threats. However, there is no consistent definition of Anxiety as a construct. As Zeidner wrote:

> The fact that anxiety is such a complex construct, encompassing as it does both worry and self-preoccupation, physical upset, disruptive feelings, and maladaptive behaviors, makes it particularly difficult for researchers to sort out all these components. In fact, there has been wide disagreement about its exact definition as well as its criterial attributes and there is currently no universally accepted definition of anxiety (Zeidner, 2008:424).

Anxiety consists of several distinct emotional, cognitive, and perceptual constructs. The cognitive component involves anxious apprehension (Heller, Nitschke, Etienne, & Miller, 1997), also known as worry (Borkovec, Alcaine, & Behar, 2004), or worrysome thoughts (Eysenck & Calvo, 1992). Anxious persons tend to interpret neutral events negatively or threatfully (Myers, Aarons, Tomlison, & Stein, 2003). Thus, Borkovec and colleagues (2004) suggested that worrying may serve as a negatively reinforced coping strategy, which results in a prolonged focus on a threat in the environment, hence, maintaining the fear response over time by an increase in perceptual sensitivity (Cornwell, Alvarez, Lissek, Kaplan, Ernst, & Grillon, 2011). However, previous studies have shown that Anxiety and threat-related mental mechanisms are malleable by the use of various cognitive strategies such as self-distraction and reappraisal (e.g., Kalisch, Wiech, Herrmann, & Dolan, 2006; King & Schaefer, 2011).

In addition, Anxiety is an expression of internalizing responses that involve feelings (such as discomfort, fear, and worry), overt behaviors (e.g., avoidance, social withdrawal, or isolation), and physiological responses (e.g., nausea, sweating). High levels of Anxiety tend to reflect negative affect. Anxiety in children has been found to relatively stable (Whitcomb & Merrel, 2013). Since internalizing problems such as Anxiety is an inner-directed process, it has been

linked to low self-concept with negative self-affirming thought processes. However, the directionality of this association is less known. For example, does poor self-concept cause Anxiety? Or, do Anxiety and Self-Concept covary in some kind of symbiotic relationship? (Whitcomb & Merrel, 2013).

In academic settings, Anxiety could increase due to high demands imposed by many parents onto their children. Anxious persons tend to be apprehensive, fearful, prone to worry, tense, and nervous. One central cognitive attribute of Anxiety is hyper-alertness. High trait-anxious persons do not only tend to pay attention to threating stimuli over nonthreatening stimuli, but they also show an increased general distractibility (Eysenck, 2014). They use a broad attentional window when they scan the environment prior to the detection of a threat, and a narrow attentional window after the threat has been identified. According to Eysenck (2014), the more a high trait-anxious individual is exposed to stressful events, the more likely that he or she will perceive the environment as threatening. Such accumulation of stressful stimuli could increase the chance that they will develop some sort of anxiety disorder.

Although fear and worry are part of Anxiety, worry is differentiated from fear (e.g., Zlomke & Jeter, 2014). In a school context, feelings of fear could be attributed to fear of negative evaluations (Weeks, Norton, & Heimberg, 2009), or as a result of when a teacher tries to motivate the student to increase effort before an upcoming high-stakes test. Fear could also be related to bullying or fear of the unknown and intolerance of uncertainty (Carleton, 2012). For example, Barlow's (2002) definition of fear and worry is that fear is directed to a present or imminent threat, whereas worry may be related to a more distant threat.

Several studies report that fear and worry are two different phenomena. In the Anxiety literature, a distinction is made between *facilitating* and *debilitating fear*. Facilitating fear results in increased task-related activities when being faced with situations perceived as threatening, whereas debilitating anxiety leads to task-irrelevant (avoidant) behaviors in the same situation (Zeidner, 2008).

In primary school settings, Bekdemir (2010) concluded that most Anxiety is caused by teachers who make the students feel uncomfortable and afraid to answer questions in class. Teachers usually address questions to the students as a pedagogical tool to check whether they are comprehending the material. In general, it is the same persons who answer the questions, since many students are afraid to respond even though they might know the answer (Strasser, 2010). Prior investigations (e.g., Hamouda, 2013; Mustaphaa, Nik Abd Rahman, &

Yunus, 2010) have showed that students experience higher levels of Anxiety when students are called upon to answer a question personally, compared to when they are given the choice to answer voluntarily. Thus, how teachers use questions affects the degree of Anxiety among their students. In addition, students might be afraid or feel uncomfortable answering questions in class if the teacher pushes the students to respond quickly, i.e., gives little or no wait time to respond (Tsui, 1996).

Shy students tend to be afraid or feel uncomfortable to raise their hand, even if they know the answer. Such students perceive that there might be a chance of making a fool of themselves if they provide an incorrect answer to the question, especially in primary school when the school situation is relatively new to the children. As a result, many students feel uncomfortable speaking in class (Mustaphaa, Nik Abd Rahman, & Yunus, 2010; Tsui, 1996).

Anxiety in terms of the fear of someone could also be related to perceived social penalties of scholastic performance (e.g., being teased for studying a lot), or that academic performance is confounded with the social class of a particular neighborhood (Duffield, Allan, Turner, & Morris, 2000). In an interview study, one girl said:

> "Some people say if you come from [area] and you get good marks …. or speak differently then you're a snob - when I first came to this school I was scared of a lot of people…. now I just ignore them - say shut up…. it's not my friends that do it, just people I don't like" (Duffield et al., 2000, p.268).

Brady and Bowd (2005) argue that anxious children carry their anxiety and feelings of unsecurity to higher grades and to college.

Teachers who set high demands on students to perform can induce fear. Therefore, teachers sometimes use fear appeals as a motivational approach in order to elicit a greater effort among the students to avoid failure on examinations (e.g., Ruiter, Kessels, Peters, & Kok, 2014; Putwain, Nicholson, Nakhla, Reece, Porter, & Liversidge, 2016). Fear appeals are more frequently used by the teacher when an examination is approaching in order for the student to be thoroughly prepared and avoid the negative consequences of performing poorly. The components of fear appeals are stressing the timing of the tests (test reminders) or the negative consequences of not being adequately prepared (consequence reminders). Investigations have provided evidence that English

secondary school teachers use both types of reminders in relation to important exams (Putwain & Roberts, 2012; Putwain & Symes, 2014).

Previous studies have reported that the effect of fear appeals on examination performance vary with how the individuals interpret those appeals. When the students interpret the message as a "threat," then it is negatively related to examination scores and positively associated with Anxiety (Putwain & Symes, 2011). Only recently have studies investigated how fear appeals that are perceived as a challenge are correlated with Academic Self-Concept (Sahranavard, 2015), Academic Self-Efficacy (Putwain, Remedios, & Symes, 2015), and Task Engagement (Putwain, et al., 2016). For example, in a study based on 1,433 students, Putwain et al. (2015) demonstrated that, when students perceived fear appeals as a challenge, exam scores and Academic Self-Efficacy were higher. In another study, Symes, Putwain, and Remedios (2015) found a positive correlation between academic buoyancy (i.e., a student's ability to overcome setbacks) and fear appeals perceived as a challenge. Academic buoyancy has been found to be highly correlated with perseverance (Martin, Ginns, Brackett, Malmberg, & Hall, 2013). In this sense, test performance could be positively correlated with fear, academic self-efficacy, and perseverance.

The Extended-Parallel Process Model (Popova, 2012) posits that the probability that fear appeals will be successful to elicit effort and positive emotions are due to the likelihood and severity of a negative outcome. In addition, it depends on the student's beliefs that he or she can perform the alternative course of action (i.e., Self-Efficacy). Research (e.g., Peters, Ruiter, & Kok, 2013) has provided evidence that fear appeals are effective when individuals perceive a "threat" as high, and assess that the negative outcome is likely and severe and when self-efficacy is high.

School children also have a tendency of displaying school-related fears because of their developmental stage. Children are less able to distinguish reality from the imaginary, and their ability to express and cope with their fears is limited. Young children are also found to have both more frequent and intense fears than adults (Reuterskiöld, 2009). In addition, the novel demands of learning new academic and interpersonal traits in school place many young children in a challenging position. Subsequently, the new learning environment likely triggers various arousing emotions such as excitement, anxiety, and fear (Muris, Merckelbach, de Jong, & Ollendick, 2002). Self-reported school-related fears concern failure, criticism, and disappointment factors (e.g., failing a test and, thus, believing that the teacher or parents will criticize the child)

(Reuterskiöld, 2009). Emotions play an influential role in goal attainment, since they determine one's behavior (Goleman & Senge, 2015).

Although anxiety has also been interpreted in terms of poor self-concept (Kröner & Biermann, 2007), the definitional characteristics of trait fear and anxiety remain controversial. While some researchers conceptualize the terms as largely or entirely interchangeable (e.g., Beck & Emery, 2005; Gino, Brooks, & Schweitzer, 2012), others define trait fear and anxiety as different (e.g., Barlow, 2002). In this thesis, Anxiety is operationalized in line with the research of Beck and Emery (2005) and Gino et al. (2012) who argued that worry and fear are highly related. Although Barlow (2002) disagreed that fear and worry are similar entities, he argued that fear is directed towards a present or imminent threat, whereas worry may be related to a more distant threat. Such a definition assumes that both worry and fear are based on the presence of a threat, but differs on how distant the threat is perceived to be. This definition describes the same phenomenon (i.e., presence of fear), but differs in intensity. Therefore, worry and fear will be used as measures of Anxiety in this thesis.

Since studies (e.g., Sahranavard, 2015; Putwain, et al., 2016) have found that fear is positively related to Academic Self-Concept and Task Engagement in a reading and writing context, this thesis will test the presence of such a trait complex – see a more elaborative description of this construct in section 3.5.

3.3.2 Conscientiousness as perseverance and procrastination refrainment

A number of studies have pointed at the importance of Conscientiousness for later outcomes in life, such as academic performance (Valiente, Lemery-Chalfant, Swanson & Reiser, 2008), educational attainment (Poropat, 2009).

MacCann, Duckworth and Roberts (2009) identified eight facets of Conscientiousness: industriousness, perfectionism, tidiness, procrastination refrainment, control, cautiousness, task planning, and perseverance.

Industriousness is characterized by items such as "I put a lot of time and effort into my work," "I do more than what's expected of me."

Perfectionism describes the drive of being meticulous and goal-oriented. Examples of items that are used to assess perfectionism are: "I detect mistakes," and "I go straight for the goal."

Tidiness depicts a will to have things structured and in order. Items such as "I like to organize things." and "I love order and regularity."

Procrastination refrainment refers to the ability to start working right away and staying focused on the task at hand. This component is assessed by reverse-coded items such as: "I am easily distracted," and "I put off unpleasant tasks."

Control describes the drive of staying on track by refraining from acting impulsively. Examples of items of this construct are: "I act without planning," and "I make rash decisions."

Caution refers to the ability to be considerate. Examples of items describing this dimension are: "I behave properly," and "I choose my words with care."

Task planning is characterized by items such as, "I do things according to a plan," and "I stick with what I decide to do," and refers to a person who follows a plan or routine in order to accomplish tasks.

Finally, perseverance depicts a will to take responsibility and persist under demanding conditions. Examples of reverse-coded items that are used to assess perseverance are: "I give up easily," and "I am easily discouraged."

Among the eight facets identified by MacCann et al. (2009), Procrastination refrainment was mostly correlated with the Big Five trait of Conscientiousness ($r = .72$) followed by task planning ($r = .70$), perseverance ($r = .64$), and industriousness ($r = .68$). In relation to the Big Five trait Neuroticism, perseverance shows the highest association ($r = -.55$), followed by procrastination refrainment ($r = -.29$).

Both procrastination refrainment and Perseverance were weakly related to GPA, with $r = .06$ and $r = .12$, respectively.

However, MacCann et al. (2009) found that different facets of Conscientiousness predicted diverse outcomes. For instance, perfectionism was the strongest determinant of the SSAT (a standardized test used for students seeking to enroll in an independent school), whereas tidiness was significantly negatively associated with the SSAT. Industriousness was a strong predictor of academic outcomes. For example, industriousness showed a negative correlation of -.92 with class absence. One important finding was that Perseverance was "… better considered a facet crossed between Neuroticism and Conscientiousness" (MacCann et al., 2009, p. 455).

In this thesis, items measuring Conscientiousness stem from two facets, namely perseverance & procrastination refrainment and perseverance. Since perseverance & procrastination refrainment is strongly correlated with

perseverance and, for simplicity, the latent variable used in the empirical analyses in this thesis is called perseverance.

3.4 Other traits - some criticism of the Big Five and other perspectives on personality traits

Although there is a broad consensus about the validity of the five-factor model, some researchers have expressed a couple of objections against the Big Five. Although four traits (Neuroticism, Extraversion, Agreeableness, and Conscientiousness) are highly replicable across cultures and languages, there is still uncertainty about the content, labeling, and replicability of the factor Openness to Experience. In order to resolve these differences, it has been suggested that traits should be universally found across cultures and in different languages (Matthews, Deary, & Whiteman, 2009).

There is also an ongoing debate whether five factors are enough to provide a comprehensive description of personality. Several studies have found six replicable factors (Lee & Goldberg, 2004; Ashton & Lee, 2008). In addition, Almagor, Tellegen, and Waller (1995) found seven factors instead of five. The additional two factors consisted of positive and negative evaluations. However, Costa and McCrae (1995) demonstrated that these dimensions, self-appraisal and social evaluation, were associated with the five factors, but did not represent core personality traits.

However, critics of the five-factor model also suggest that it is not an exhaustive model of personality. For example, Marsh (2008) argues that academic self-concept is an important factor of personality. In addition, narcissism is a personality trait that is not covered by the Big Five model. Since previous studies have found no significant relationship between narcissism, academic entitlement and GPA (e.g., Greenberger, Lessard, Chen, & Farruggia, 2008), this construct will not be further elaborated in this thesis.

3.4.1 Academic self-concept

Self-concept is a critical construct in the social sciences. This construct is a strong mediating factor in predicting various psychological and behavioral outcomes (Shavelson, Hubner, & Stanton, 1976; Marsh, 2008). Longitudinal studies have found that Academic Self-Concept is highly reciprocally related to achievement – each being both a cause and an effect of the other (e.g., Marsh,

Trautwein, Lüdtke, Köller, & Baumert, 2005), a phenomenon known as the *Reciprocal Effects Model* (REM). Positive feelings and thinking about oneself tend to give raise to positive cognitions on choice, planning, and goals. In addition, Marsh and Martin (2011) argued:

> Self-concept enhancement is seen as a central goal of education and an important vehicle for addressing social inequities experienced by disadvantaged groups (see Marsh & Craven, 2006). In their model of effective schools, Brookover and Lezotte (1979) emphasized that maximizing academic self-concept (ASC), self-reliance, and academic achievement should be the major outcome goals of schooling. Recognizing this role of self-concept, the Organisation for Economic Co-operation and Development (OECD) noted that self-concepts are 'closely tied to students' economic success and long-term health and wellbeing' (OECD, 2003, p.9) and play a critical part in students' interest in and satisfaction at school, underpin their academic achievement, and constitute a very influential platform for pathways beyond school (p.62).

Shavelson et al. (1976) defined self-concept as an individual's view of the self that is formed through attributions of one's own actions and affected by interactions with significant others and experiences with one's environment. In the Academic Self-Concept literature, a distinction is made between unidimensional and multidimensional models of self-concept. The unidimensional model measures self-concept by a single score composed of multiple items. For example, a typical item could be: "On the whole, I feel positive about myself." Thus, domain-specific evaluations and the complexities of general self-concept are neglected. The multidimensional model was developed by Shavelson et al. (1976). They defined self-concept as the individual's view of oneself that is formed by prior experiences and interpretations of one's environment. Hence, self-concept is a hypothetical component that could predict an individual's choices and behavior.

The Shavelson model suggested that children's general self-concept was based on two main constructs: Academic and Non-Academic Self-Concepts. Academic Self-Concept represents how respondents see themselves in school settings, and in relation to school subjects such as English, Science, and Mathematics. The Non-Academic Self-Concept was portioned into Social, Emotional, and Physical Self-Concepts. These subdivisions emphasize the multidimensionality of self-concept. A large amount of research has found

support for the multidimensionality of self-concept (see reviews by Byrne, 1996; Marsh & Craven, 2006).

In order to understand self-concept, the role of frames of reference needs to be explored. The frame of reference, or criteria of comparison that individuals use to evaluate themselves, can lead to various levels of self-concepts. In this regard, Marsh's (2008) two theoretical models of frame of reference effects, namely the Big-Fish-Little-Pond Effect (BFLPE) and the Internal/External Frame of Reference (I/E) Model, are interesting. A key component of both models is the process of social comparison.

The way a person perceives her- or himself is due to a process of social comparison. According to the Social Comparison Theory, a person's self-concept is formed by the ways in which he or she perceives or comprehends significant others in the environment. Festinger (1954) proposed that individuals tend to assess and appraise their opinions, beliefs, and abilities against an established standard. In the absence of definite and explicit objective criteria, people usually identify and compare with others in the environment as the basis for forming subjective estimates of their personal ability levels and self-worth. Festinger (1954) maintained that individuals need to compare themselves to others in order to define themselves. In this way, individuals use others in their immediate environment as the basis for forming comparative subjective judgments of self-worth (Festinger, 1954). The perceived similarity between two individuals increases the likelihood of them comparing their capabilities with one another. People usually select similar others as a basis of social comparison when faced with a choice between relatively similar and dissimilar people.

Attending a school with excellent students could lead to lower Academic Self-Concept for bright students when they compare themselves to more able classmates. This phenomenon is called a negative BFLPE. A positive BFLPE is present when students develop higher Academic Self-Concept when they compare themselves with less proficient students. This frame of reference model was based on the Social Comparison Theory (Marsh, 1984, 2005). In this model, Marsh suggested that students first compared their abilities with abilities of their classmates, and then used information from significant others when forming their own self-concept. According to the BFLPE, Academic Self-Concept is positively enhanced by higher achievements, but negatively affected by high class-average performance (i.e., the same student will report a lower Academic Self-Concept when class average score is high).

In an educational context, Marsh and Parker (1984) demonstrated that large negative BFLPEs could occur for Academic Self-Concept. Thus, participating in gifted and talented programs could lead to lowered Academic Self-Concept, i.e., negative BLFPE.

Educationally disadvantaged students show higher Academic Self-Concept in special education classes compared to regular mainstreamed classes.

Marsh and Hau (2003) found also support for the BFLPE in a comprehensive cross-cultural study in 26 countries.

Research investigating the original Shavelson et al. (1976) model resulted in contradictory findings. According to this model, components of Academic Self-Concept should be correlated with each other and explained by a higher order variable. Early research found that verbal and math components were almost unrelated (e.g., Marsh, 1996). In addition, this almost-zero correlation was found across various measures of verbal and math self-concepts. Hence, in order to explain this lack of association between verbal and math self-concepts, Marsh and colleagues (Marsh & Yeung, 1998; Marsh and Craven, 1997) developed the Internal/External Frame of Reference (I/E) Model. This model suggests that Academic Self-Concept in a certain school subject is developed by an external (social comparison) reference and an internal (ipsative-like) reference. Thus, students compare their capabilities in a certain field with the abilities of other students in the same domain. Subsequently, when path-analytic models were used, domain-specific traits were found to be positively correlated with Academic Self-Concepts in the corresponding field (e.g., language achievement will be positively related to language self-concept). In addition, students tend to think of themselves as either good at "math" or "verbal / language" people, but not as both (Marsh & Hau, 2003). For example, in path-analytic models, language achievement is negatively related to math self-concept when the effect of math achievement on math self-concept is controlled for.

Several studies have found that children's beliefs of their academic abilities attenuate as they proceed through school. During the first school years, children generally are under the impression that effort is a vital attribute. As the years go by, students' self-concepts of ability and competence tend to weaken as social comparisons are formulated and feedback from others is internalized. Children's sense of self-worth begins to depend on whether they perform better or worse than other students (Marsh, 1990; Wigfield & Eccles, 1990).

Individual differences in social comparison processes have been linked to various personality traits. For example, individuals who score high on anxiety

are more sensitive to external information about their abilities and performances (Jonkmann, Becker, Marsh, Lüdtke, & Trautwein, 2012), and Gibbons and Buunk (1999) found that anxious persons showed a higher tendency to search for social comparison information regarding their capabilities and opinions. In addition, individuals that score high on items that measure Openness to Experience score low on items that measure social comparison orientation. Hence, Gibbons and Buunk (1999) proposed that openness could buffer against negative effects of high achieving environments on self-concept formation. Furthermore, Cunningham and Glenn (2004) reported that children with low self-concept developed internalized negative labels, such as "slow" or "not good at school." Dagnan and Waring (2004) suggested that core negative beliefs about the self were associated with the degree with which people felt differently (i.e., were aware of not performing well at school), and suggested that this could be a result of the group internalizing that stems from negative social comparisons.

Marsh (1990) proposed a distinction between a unidimensional and a multidimensional perspective of self-concept. The unidimensional perspective emphasizes global self-esteem, whereas the multidimensional perspective incorporates a hierarchical model of self-concept. According to Marsh and O'Mara (2008), the multidimensional perspective provides a more useful understanding of the complexity of the self in different contexts, or when relating self-concept to other emotional traits or constructs. For example, Marsh et al. (2006) used three Academic Self-Concept scales (reading, math, and general school) in their conceptualization of the construct. Although the unidimensional perspective of self-concept is prevalent in personality research, there is clear support of multidimensional aspects of self-concept, personality, and academic outcomes.

3.4.3 The relationship between academic self-concept and self-efficacy

Within the field of educational psychology, studies often either include measurements of self-concept or self-efficacy. Prior research has described the similarities and differences between self-efficacy and Academic Self-Concept (e.g., Bong and Skaalvik, 2003; Pajares & Schunk, 2001; Pietsch, Walker, & Chapman, 2003). Both constructs are based on self-beliefs that share a common core when the individual's self-perceptions of competence (Lee, 2009) are

measured. Furthermore, both types of self-beliefs are hierarchical, which means that they can be measured at either general or domain-specific levels (Bandura, 1986; Marsh, 1990). Research has indicated that domain-specific items of self-efficacy and self-concept are more strongly related to criterion variables than domain general variables of the same measure (Pajares & Schunk, 2001). The relationship between general self-beliefs and performance has been found to be weak (e.g. Marsh & O'Mara, 2008). However, despite these similarities, there are some important theoretical and empirical distinctions between self-efficacy and self-concept.

One major difference is that self-efficacy focuses on descriptions of competence, whereas self-concept represents evaluations of competence (Marsh, Dowson, Pietsch, & Walker, 2004). Hence, self-efficacy captures judgements of capabilities by asking the individual how successful he or she will be in completing a certain task (Ferla, Valcke, & Cai, 2009), whereas self-concept is evaluative and relates to perceptions about whether a person's behavior matches self-set criteria of worth and competence (e.g., "I am good at physics"). This distinction between description and evaluation is important to understanding the difference between these two constructs (Marsh et al., 2004).

With the exception of novel situations, students make their judgements about the likelihood of success on a task on the basis of prior experience (Bong & Skaalvik, 2003). Subsequently, if students were asked about their experience in drawing, a self-efficacy item, such as, "I would be able to draw a nice dog," would not require either normative or internal comparisons (Marsh et al., 2004). Therefore, the negative relationship between performance in one school subject and self-beliefs in another school subject has been found to be weaker for self-efficacy compared to self-concept (Marsh & Craven, 1997). The attenuating effect in this negative relationship could be attributed to the assumption that frames of reference are less relevant as far as self-efficacy is concerned (Marsh et al., 2004). This finding has crucial consequences not only when performance is used to predict self-belief constructs, but also when self-belief variables are used to determine outcomes like course choice, choice to continue studying (attainment), etc.

In summary, academic self-efficacy is a related construct to academic self-concept. It is a narrower construct than self-concept in the sense that self-efficacy is operationalized as confidence in performing a certain task at a given specific time. Academic Self-Concept beliefs rely considerably on social comparative information and solicit judgements from significant others (Bong

& Skaalvik, 2003). In contrast, self-efficacy items reflect goal-referenced appraisals (e.g., specific performance standards) during which students are not asked to contrast their abilities to those of others (Pajares, 1996; Bong & Skaalvik, 2003).

However, self-efficacy is a construct that is more frequently used than Academic Self-Concept together with socioemotional traits and in their predictions of various outcomes, such as academic achievement and labor market outcomes. Although there are dissimilarities between self-efficacy and self-concept, a description of the relationship between self-efficacy and various personality traits could provide hypothetical evidence of how Academic Self-Concept should be related to these traits and various outcomes. Nevertheless, we should keep the differences between these two constructs in mind.

3.5 Trait complexes – Gc reading achievement trait complex

Although cognitive and socioemotional traits are traditionally conceptualized as orthogonal constructs, such as Gc, Conscientiousness, Academic Self-Concept, and Anxiety, it is likely that these constructs are related to other aspects of a student's life (Ackerman, Chamorro-Premuzic, & Furnham, 2011). For example, socioemotional traits could be associated with the student's behavior in the classroom, outside of the classroom, school-related activities such as reading for pleasure, or to "knowledge accumulated over lifetime of school and non-school investment of time and effort" (Ackerman et al., 2011, p. 29). Thus, unlike Gf (which is associated with academic performance via learning or reasoning) socioemotional trait items can overlap and form enlarged trait and ability constructs. Such constructs are also known as trait complexes. Trait complexes are mixtures of abilities, self-concept, interests, and personality trait items.

However, in educational settings, the idea of trait complexes is not new. In 1915, Webb identified an overlapping construct (defined as W) consisting of different personality traits. In a similar vein, Alexander (1935) found a general intelligence factor (g) and two overlapping factors that were related to school grades. The first, and strongest, factor was defined as X, which was similar to Webb's factor W. This factor captured an "interest" or "school readiness" ability, which he also called the "will to succeed." The second factor identified by Alexander was only weakly correlated with school grades. This factor

consists of mathematics, number tests, English, and "Shop Work" (p. 128). The first factor (X factor) could be viewed as a school performance-relevant construct.

There are several different types of trait predictors of individual differences within the domain of accumulated knowledge, i.e., Gc (Ackerman, 2003). For example, cognitive abilities, affect (personality), and conation (motivation and interests) are related to accumulated knowledge. Snow (1963) proposed that various items of latent personality constructs, "aptitude complexes", could overlap with accumulated knowledge and subsequently provide more nuanced explanations for patterns of individual differences in the field of acquired knowledge. In line with this rationale, Cronbach and Snow (1977), suggested that aptitudes were not only restricted to including cognitive abilities, but could also involve any trait construct or item(s). According to Ackerman (2003), the aptitude complex orientation proposed by Snow (1963) could be useful in discovering possible profiles of traits that constitute a phenomenon such as acquired knowledge or expertise. These might be viewed as performance-relevant personality items that are associated with high reading achievement.

Cattell (1971) argued that Gc is more prone to be involved with personality traits than Gf. As such, factors other than biologically inherent aspects have a larger impact on Gc than on fluid abilities. Cattell (1971) argued that Gf was primarily biologically based and was, therefore, less influenced by environmental interventions than Gc, which was more affected by environmental factors.

As previously mentioned in section 2.4.1, Ackerman and Heggestad (1997) identified four trait complexes: (1) Social Trait Complex, (2) Clerical/Conventional Trait Complex, (3) Science/Math Trait Complex, and (4) Intellectual/Cultural Trait Complex. For this thesis, the fourth trait complex that is related to Gc is of interest. The Intellectual/Cultural Trait complex consists of traditional educational measures of intelligence (Gc) and Openness to Experience. It refers to intellectual activities such as reading for pleasure and visiting various cultural events. This trait complex is related to Reading and Writing Self-Concepts and general knowledge. Furthermore, Kanfer and Ackerman (2005) argued: "Some personality traits tend to be more-or-less associated with particular domains of Gc knowledge and skill, and with vocational interests. The communality of various ability and non-ability traits has suggested the existence of a small set of *trait complexes*, that is, groups of traits that are themselves correlated" (p. 343).

Furnham (2008) argued that the personality trait facet of Conscientiousness, such as hard work, is highly related to Gc test scores. Prior research (e.g., Bråten, Ferguson, Anmarkrud, & Stromso, 2013; Hughes, Lou, Kwok, & Loyd, 2008) has also reported that perseverance and effort in overcoming setbacks and difficulties are correlated with reading achievement. It is believed that reading comprehension assessments that are based on complex tasks include a motivational dimension. More precisely, Guthrie and Wigfield (2005) argued:

> "Our rationale is that motivational constructs, such as intrinsic motivation to read, self-efficacy for reading tasks, and interest in text, are all known to increase students' effort, concentration, and perseverance in reading tasks. Thus, if a reading assessment has a high level of complexity, students' sustained effort, avoidance of distractions, and commitment to completing tasks successfully, are likely to contribute to successful performance. In contrast, in a simpler reading comprehension task, which may consist of a short passage, a brief selected response to a few items in a relatively short amount of time would be less likely to be influenced by motivational attributes" (p.201).

Such a motivational dimension has also been linked to characteristics of a growth mindset, such as seeing failures as opportunities to learn, perseverance, and attention. In a more recent study, DiMenichi and Richmond (2015) reported that reflecting on past failures was positively related to grit (a closely related construct to perseverance) and sustained attention. Those who scored highest on the grit scale reported the least amount of mind-wandering tendencies and made fewer errors. Thus, based on 141 participants (mean age = 20.74), they found that those who reflected on past failures were more persistent, attentive, and made fewer errors on the writing assignment than individuals who reflected on past failures to a lower extent. These findings were in line with previous research, e.g., Ramirez and Beilock (2011), who reported a similar pattern in which students in a high-pressure testing situation also showed a positive association between reflection on past failures and achievement. Perhaps students who reflect on past failures may force themselves to judge the amount of effort needed to succeed rather than focusing on the final result (DiMenichi & Richmond, 2015), or it could be interpreted in terms of a growth mindset (Dweck, 2015). Another explanation could be attributed to the task characteristics for which demanding tasks require perseverance and attention to be accomplished per se, or that participants who

thought about failures may have felt that they were in a disadvantaged situation and, therefore, had to invest more effort in the assignments (DiMenichi & Richmond, 2015).

Goleman and Senge (2015) argue that attentive ability, i.e., ability to stay focused on a task, is crucial to success. Goleman and Senge suggested that attention and effort is connected and becomes increasingly more and more important as tasks increase in difficulty. Concentrated attention requires effort to sustain, i.e., deliberate cognitive effort. One characteristic of attention fatigue or lower levels of attention is lowered effectiveness, regardless of whether it is a reading task or a work-related task that requires cognitive effort (Goleman & Senge, 2015). When tasks are relatively easy for students, the requirement of attentive resources are not as pronounced as they are when reading tasks that are more complex. As students progress in primary school, the content also becomes more complex, abstract, and demanding. For example, occasions when words are learned by directly experiencing them are reduced as children progress through the grades. Instead, new concepts are learned through vicarious experiences. In addition, students in grade 5 are subjected to more tests than students in grade 1 and are, therefore, provided with more feedback about their performances from both teachers and peers (e.g., Cole et al., 2001). The increased levels of social comparison processes as children progress through school imply that their self-concept is apt to decline, as they were disposed to overestimating their previous levels of self-concept (Pajares & Schunk, 2001).

Although fear and worry are part of Anxiety, worry is distinguished from fear (e.g., Zlomke & Jeter, 2014). Sahranavard (2015) found that Academic Self-Concept and feelings of fear were positively related to reading achievement, whereas worry loaded on different dimensions.

Thus, it seems that Academic Self-Concept items, fear, and perseverance are related to reading achievement. More precisely, a construct that includes reading achievement, domain-specific self-concept items regarding reading and writing, fear, and perseverance emerges.

However, several researchers have suggested that as children progress through school, their self-concept tends to decline, as they had been inclined to overestimating their previous levels of self-concept (Pajares & Schunk, 2001). In addition, as students advance, the content also becomes more complex, abstract, and demanding, which requires that the students are able to stay focused on the tasks (Goleman & Senge, 2015). This implies that Academic

Self-Concept, perseverance, fear, and Academic Self-Concept items could be related to reading achievement tests in early years of primary school, while the ability to concentrate, fear, and perseverance are associated with reading achievement at the end of primary school (i.e., when children are 12 years old).

Although Gc could consist of several different components, as there are various domains of knowledge (Ackerman, 2003; Cattell, 1957), Gc is usually assessed by writing and reading tests, i.e., measurements of verbal ability (Carroll, 1993; Kan et al., 2011). The main reasons for only incorporating verbal ability is that the construct focuses on knowledge that can be assumed to be found in a considerable proportion of the population. In addition, Kan et al. (2011) found that Gc was statistically equivalent to verbal ability in a homogeneous sample. More specialized knowledge, such as music or athletics, is usually assessed in achievement, since it is not a common part of an individual's intellectual repertoire (Ackerman, 2003).

3.6 Development, stability and change in personality traits

For a long time, personality was thought to develop in childhood and adolescence, and then be fully developed by the age of 30 (Costa & McCrae, 1994). More recent studies have argued that personality traits are malleable in midlife and old age, as well (Branje, Van Lieshout, & Gerris, 2007). Nevertheless, it is necessary to differentiate between various forms of trait consistency in order to draw conclusions about the coherence of traits (Roberts & DelVecchio, 2000). One widely used distinction of trait consistency is between mean-level consistency and rank-order consistency. Mean-level consistency refers to whether trait dimensions increase or decrease over time, and is mostly analyzed by using various forms of growth curve models or correlates of difference scores in order to reflect generalizable patterns of personality developments. Rank-order consistency focuses on the relative location of an individual within a group, mostly analyzed by test-retest correlations (Roberts, Walton, & Viechtbauer, 2006). This does not rule out that there are other types of changes than intra-individual and mean-level changes.

Roberts et al. (2006) found in a meta-analysis of 92 longitudinal studies that mean-level changes in Conscientiousness, social dominance (a facet of Extraversion), and emotional stability increased significantly as people grow

older. They also found that social vitality (another facet of Extraversion) and Openness to Experience increase in adolescence, and then both decrease as individuals grow older. Costa and McCrae (1994) believed that personality trait development is mostly related to genetic aspects rather than to environmental factors. The genetic predisposition directs the growth of a certain personality trait in a specific direction. According to Roberts, Walton, and Viechtbauer (2006), the evidence to support such beliefs is sparse. A couple of longitudinal studies based on twins have indicated that genetic influence on personality traits is more important in childhood rather than adulthood (Plomin & Nesselroade, 1990; Kogan, 1990).

3.7 Discussion

The Big Five personality framework is the system most frequently used by personality theorists when describing personality traits. The five factors of the Big Five model (also known by the popular acronym OCEAN) are Openness to Experience (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N). Openness to Experience refers to differences in preference for involving oneself in intellectual activities, learning new things, and exploring novel ideas. Conscientiousness represents the tendency to be responsible, hard-working, persistent, and goal-oriented. Extraversion depicts differences in the inclination for social interaction and a socially active life. Agreeableness is also known as sociability, and reflects considerate, compassionate, and modest behavior. Finally, Neuroticism can be defined as the propensity to experience negative emotions and thoughts, such as anxiety, distress, depression, and anger.

Although worry and fear belong to the same construct (i.e., anxiety), research has indicated that they have divergent predictive abilities. Sometimes teachers use fear appeals as a motivational approach in order to elicit increased effort among the students to avoid failure on examinations and function as "test reminders." Prior investigations have reported that the effect of fear appeals on examination performance vary with how the individuals interpret those appeals. Subsequent test scores will be negatively affected by appeals perceived as a threat, and positively if appeals are perceived as a challenge. However, fear is a complex phenomenon. School children also have a tendency to exhibit school-related fears because of their developmental stage. In addition, the new school environment with novel demands of learning new academic and interpersonal

traits in school, which places many young children in a challenging position and may trigger emotions such as fears, worry, or excitement.

MacCann et al. (2009) identified eight facets of Conscientiousness, of which *procrastination refrainment* and *perseverance* are of particular relevance for this thesis. *Procrastination refrainment* refers to the ability to start working right away, stay concentrated on the task at hand, and work with less interesting tasks, whereas *perseverance* depicts a will to take responsibility and persist under demanding conditions, i.e., not give up easily in the face of difficulty.

The Big Five framework is not exhaustive and does not cover all personality traits, such as Narcissism and Academic Self-Concept. Self-concept has an important effect on both individual's choices and behavior. A central concept in academic self-concept is the process of social comparison. In the absence of definite and explicit objective criteria, people usually identify and compare with others in the environment as the basis for forming subjective estimates of their personal ability levels and self-worth. As a consequence, attending a school with excellent students could lead to lower Academic Self-Concept for bright students when they compare themselves to more able classmates. This phenomenon is called the negative Big-Fish-Little-Pond Effect (BFLPE). The social comparison process is also used to explain the almost zero correlation between measures of verbal and math self-concepts, according to the Internal/External Frame of Reference (I/E) Model. Hence, students compare their capabilities in a certain field with the abilities of other students in the same domain (e.g., language achievement will be positively related to language self-concept). In addition, students tend to think of themselves as either good at "math" or "verbal / language" people, but not as both. In the conceptualization, Marsh et al. (2006) proposed three measures of academic self-concept (reading, math, and general school).

However, self-concept is a less frequently used construct compared to self-efficacy. Self-efficacy is conceptualized as confidence in performing a certain task at a specific time (i.e., description of competence), whereas Academic Self-Concept is a broader construct and is evaluative of competence and relates to perceptions about how good someone is in a subject. Despite this dissimilarity, self-efficacy and self-concept are related. Therefore, studies that have examined the relationship between self-efficacy and facets of the Big Five model, academic achievement, unemployment, or earnings, could provide hypothetical information about how Academic Self-Concept could be related to these trait facets and outcomes.

Research has provided evidence of the existence of trait complexes (e.g., Ackerman & Heggestad, 1997; Bier & Ackerman, 2001; Snow, 1963). In high-stakes reading achievement tests, prior investigations (Hughes et al., 2008; Sahranavard, 2015; Putwain et al., 2015; Putwain et al., 2016) have suggested that fear, verbal self-concept, and perseverance are highly related. For example, Sahranavard (2015) reported that fear and worry are different phenomena in regard to high-stakes reading achievement tests; fear is positively related with Academic Self-Concept items, whereas worry is loaded on different dimensions.

Constructs such as Openness to Experience, Agreeableness, Extraversion, and the influence of teachers in enhancing various facets of socioemotional traits are omitted variables in this thesis. Instead, this thesis focuses on socioemotional traits such as Anxiety, Perseverance, and Academic Self-Concept.

Chapter 4. Interrelations among socioemotional traits, intelligence and achievement

4.1 Relationships between Neuroticism, Conscientiousness and Academic self-concept

There is a variety of responses to stressful situations. For example, individuals can adopt a more problem-focused strategy in order to resolve difficulties, or adopt a more emotion-focused strategy, focusing internally due to the negative effects of Anxiety and worrying about their abilities associated with a demanding situation. The negative relationship between emotion-focused coping with perseverance and achievement suggests that individuals who score high on task persistence and effort, and proactive problem solving seldom become self-diagnostic, anxious, or worrisome in the face of any difficulties. However, Anxiety could also be related to both confidence in abilities and fears that effort will not result in higher levels of achievement and, therefore, an internalization of failure will occur. By withdrawing effort, students with low faith in their abilities avoid the negative effects of poor achievement in terms of damage of self-worth. Thus, students that employ self-protective strategies respond with low levels of effort, and ability attributions become less salient causes of poor achievement. Such students fear negative evaluations, since they could be perceived as lack of ability in school situations.

Prior research has found that Anxiety is negatively related to Conscientiousness and Academic Self-concept (Zeidner, 2008), and it also has been found that Neuroticism is negatively related to all other Big Five factors (Graziano & Ward, 1992) For example, Biesanz and West (2004) reported a negative correlation of -.19 between Neuroticism and Conscientiousness, as measured by self-reported questionnaire items. A similar correlation (-.17) was also identified by De Young (2006) based on self-reported items. However, Deater-Deckard et al. (2011) argued that, when a situation is perceived as beyond the control of the individual, persistence may lead to increased Anxiety.

Graziano and Ward (1992) found among 91 students (11 to 14 years old) that academic self-concept was significantly correlated with all Big Five factors. In particular, a strong positive correlation was found between academic self-concept and Conscientiousness ($r = .69$), and a negative relationship was found between Academic self-concept and Neuroticism ($r = -.33$). In addition, Erdle,

Gosling, and Potter (2009) and Robins, Fraley, Roberts, and Trzesniewski (2001) found that Neuroticism was most significantly correlated with self-concept, with a negative correlation of about .48 in both cases.

Self-concept in its positive form (self-affirmation) is highly associated with emotional stability. In contrast, lower levels of self-concept are related to higher levels of anxiety, which reflects an individual's affective and physiological responses when thinking about or working on a task (Bandura, 1997; 2003; Lee, 2009). Hence, Anxiety has been found to be related to low self-esteem, locus of control, and self-evaluations (Furnham & Cheng, 2016; Judge, Erez, Bono, and Thoresen, 2003; Zawawi and Hamaideh, 2009). When students hold negative thoughts and fears about their abilities (e.g., feeling nervous in various school situations), their Academic Self-Concept can decrease (Zajacova, Lynch, & Espenshade, 2005). Strong self-efficacy beliefs have been found to minimize other individual difference factors, such as Anxiety (e.g., Hopko, Hunt, & Armento, 2005).

Several possible explanations have been proposed for the negative correlation between anxiety and self-concept. Firstly, children who find a certain school subject (e.g., mathematics or language subject) anxiety-producing may have a tendency to avoid such negative feelings by refraining from the practice needed to achieve mastery in that particular subject. Secondly, students who struggle with a subject tend to perceive this subject as less enjoyable compared to those who are able to master it. Thirdly, anxious thoughts tend to occupy working memory resources, thus, leaving fewer cognitive resources for anxious students to solve problems, which, in turn, increase negative effects on performance. In this way, anxious feelings are fed into self-concept (e.g., "I am not good at reading") (Morony, Kleitman, Lee, & Stankov, 2013). In addition, Griggs, Rimm-Kaufman, Merritt, and Patton (2013) suggested that prior achievement is negatively related to Anxiety, because higher scholastic achievement leads to lower levels of Anxiety.

4.2 Relationships between socioemotional traits and intelligence

4.2.1 Cognitive abilities and Neuroticism

Neuroticism has been found to correlate negatively with intelligence, mostly due to the sub-facet Anxiety, which has an impairing effect on intellectual functioning (Zeidner & Matthews, 2000). More specifically, Chamorro-Premuzic, Moutafi, and Furnham (2005) reported a weak negative correlation of -.08 between the sub-facet Anxiety and Gf.

Findings from cross-sectional studies show negative relationships between neuroticism and attention-demanding cognitive tasks that measure Gf, such as episodic memory, numeric and abstract reasoning, and tasks of perceptual speed (e.g., Chamorro-Premuzic, Furnham, & Petrides, 2006; Graham and Lachman, 2012; Moutafi, Furnham, & Paltiel, 2005). In addition, Wilson, Bennett, Mendes de Leon, Bienias, Morris, and Evans (2005) reported that Neuroticism is a risk factor for cognitive decline among healthy individuals, i.e., in the absence of dementia. Those with high scores in Neuroticism declined an average of 30% faster than those low in Neuroticism.

Revelle and Condon (2015) argued that executive functioning and attention are related. They suggested that highly anxious individuals who perform less well spend too much time on off-task thoughts and not enough time on the task at hand, i.e., they are less able to concentrate while accomplishing tasks. Previous studies have reported that individuals high in Neuroticism more frequently report intrusive thoughts, i.e., worry and rumination (e.g., Nezlek, 2005; Suls & Martin, 2005) and distress (Robinson & Tamir, 2005). Intrusive thoughts are hypothesized to cause "mental noise" in persons with high Neuroticism, resulting in less efficient cognitive processing (Robinson & Tamir, 2005). Eysenck and colleagues (1992, 2007) have provided support for this hypothesis, reporting that individuals who score high on Neuroticism show longer response times on tasks due to attentional interruptions. Stawski and colleagues (2006) also suggested that intrusive thoughts deplete mental resources by acting as a dual-task load, which, in turn, impairs performance in attention-demanding assignments. In line with this reasoning studies have demonstrated a negative association between intrusive thoughts and working memory capacity (Kane, Brown, McVay, Silvia, Myin-Germeys, & Kwapil,

2007) and that intrusive thoughts increase the risk of making mistakes (McVay, Kane, & Kwapil, 2009).

Anxiety that stems from avoiding failure has been found to contribute to depletion and reduced performance on noncreative tasks, such as arithmetic tasks and speaking a foreign language (Ganushchak & Schiller, 2009).

Neuroticism and performance on crystallized items are not robustly associated (Costa, Fozard, McCrae, & Bosse, 1976). Hence, studies examining the association between Neuroticism and Gc have reported conflicting results. Pearson (1993) found a positive relationship among older women diagnosed with depression and anxiety. John, Caspi, Robins, Moffitt and Stouthamer-Loeber (1994) found no significant relationship between Neuroticism and verbal ability assessed by standardized verbal tests. However, Cattell and Scheier (1961) reported that verbal ability is negatively related to Anxiety.

4.2.2 Cognitive abilities and Conscientiousness

Research on the relationship between Conscientiousness and intelligence has reported mixed results. A meta-analytic study by Ackerman and Heggestad (1997) found the correlation between Conscientiousness and intelligence to be non-significant. This finding has also been supported by Austin et al. (2002). However, Baker and Bichsel (2006) reported a moderate positive relationship between processing ability and Conscientiousness ($\beta = 0.35$) among older adults. Previous studies have suggested that tests that assess processing ability require attentional capacity (e.g., Baker & Bichsel, 2006; Woodcock, McGrew, & Mather, 2001). In addition, low distractibility is one of the components of Conscientiousness (MacCann et al., 2009). As a result, individuals who perform well on tests that measure processing speed also score high on Conscientiousness items (Baker & Bichsel, 2006). Previous success in solving problems increases the knowledge that the person will be likely to solve problems in the future. Therefore, children who score high on numerical tests also invest more time in such tasks, since they know that the likelihood of being successful is high (Park & Brannon, 2013). In line with this rationale, Opdenakker and Van Damme (2005) found that numerical cognitive ability was positively related to mathematical performance and effort.

Nevertheless, over the last decade, several studies have found a negative relationship between intelligence and Conscientiousness (Demetriou, Kyriakides, & Avraamidou , 2003; Moutafi, Furnham, & Crump, 2003; Moutafi,

Furnham, & Paltiel, 2004, 2005). It has been proposed that there is a causal relationship between intelligence and Conscientiousness, in that relatively less intelligent persons compensate by becoming more conscientious. However, Moutafi et al. (2003) suggested that some of the more intelligent individuals rely on their cognitive abilities when they accomplish various tasks.

More concretely, Moutafi et al. (2004) stated:

> In a competitive academic environment filled with highly (fluid) intelligent people, the (comparatively) less intelligent may be able to 'keep up' by working harder. Their Conscientiousness pays off better on 'continuous assessment' examined courses than those which are more likely to test understanding and thinking (gf) rather than knowledge per se (gc). This suggestion views C as being adaptive, i.e. hard work, persistence, dutifulness and deliberation develop to compensate for quick-wittedness (p. 1015).

Prior investigations have demonstrated that underachievers had a more external locus of control, were more indecisive about trying hard, and reported that they felt anxiety (Robinson & Clinkenbeard, 2008). External locus of control is characterized by attributing success to luck or task ease, rather than to effort. In addition, high-ability students tend to accomplish schoolwork easily with little effort, especially in the primary grades (Rimm, 2008). Thus, not having to be persistent in executing school-related tasks is also related to the curriculum: "Curriculum materials that are too easy or too difficult do not build internal locus of control or a sense of self-efficacy in students. They do not contribute to experiences where children find success by making strong efforts. Instead, for gifted students, they learn that they can be successful without effort" (Rimm, 2008, p. 144). Prior research (e.g., Reis, Westberg, Kulikovich, & Purcell, 1998) has reported that a majority of gifted elementary school pupils were already familiar with about half of what they were planning to learn before they entered school for the year. Such tasks tend to be perceived as not meaningful and "boring" for many of the gifted students. Furthermore, intelligence is often defined by students, parents, and teachers, as how quickly and easily they learn difficult material. In early grades, gifted students complete their tasks successfully and without effort. Thus, they do not experience that effort is needed to be successful in school (Rimm, 2008).

Early research (e.g., Weiner, 1986) proposed that effort could work as a compensatory factor for low levels of ability when the student perceives the

demands as controllable. Thus, Muenks, Miele, and Wigfield (2016, p. 439) concluded: "In this sense, the less capable the individual is, the harder she has to work to succeed."

Research has also indicated that students may, at times, perceive effort to be positively linked to ability, and believe that his or her ability becomes higher the more effort is exerted (e.g., Blackwell, Trzesniewski, & Dweck, 2007). In order to understand the different sources of effort, Muenks et al. (2016) distinguished between task-elicited effort and self-initiated effort. Task-elicited effort is defined as effort initiated by the demands of the task (especially if the task is perceived as difficult), whereas self-initiated effort is prompted by the student as a consequence of her or his own motivation (e.g., the desire to master the material). When students perceive that effort is related to a subjectively difficult task, they might think that they have a low level of ability. In contrast, when self-initiated effort is exerted by a student's own motivation and, thus, strive to go beyond the basic demands that are associated with the task, he or she might perceive that abilities have increased due to the extra effort that has been exerted.

A large body of investigations has shown that a "growth mindset" (Dweck, 2007), which refers to the belief that intelligence is malleable and can be developed through hard work and learning, is positively related to perseverance, achievement, and educational attainment (Chen & Pajares, 2010; Dweck, 2012). Students with a growth mindset are not concerned with sustaining a self-image of being intelligent. Instead, they invest a lot of time and effort in learning new things. Thus, they are prone to pursuing and continuing more challenging tasks and persisting with them.

Students with a growth mindset are hypothesized to respond to setbacks with renewed effort and better focus (Ravenscroft, Waymire, & West, 2012). In an investigation of this hypothesis, Dupeyrat and Marine (2005) reported that goals that were related to growth mindset predicted subsequent performance and effort, but not attentiveness.

In contrast, students with a "fixed mindset" are preoccupied with appearing and looking smart, since they believe that every person is born with a set amount of intelligence (Blackwell et.al., 2007). Such students tend to choose less challenging tasks in order to prove their intelligence. Choosing more challenging tasks requires more effort, and according to this mindset, effort is a sign of lack of intelligence. Thus, exerting effort makes them feel incompetent.

In addition, when persons with a "fixed mindset" make mistakes, they try to hide them rather than correcting and learning from them.

Dweck (2007) reported that praising students for being intelligent could inhibit learning and decrease motivation, while students praised for investing time and effort continue to improve. When students are praised for their effort, teachers and significant others encourage students to ascribe their academic performance to intrinsic factors.

Furthermore, praising individuals for intelligence increases the likelihood of inflating their results, i.e., saying that one has a higher score than is the case, compared to effort-praised students. Dweck (2007) found that almost 40% of the students with a fixed mindset overstate their results when asked to report them anonymously, compared to only 10% of the students with a growth mindset.

Research has reported conflicting results concerning the relationship between Conscientiousness and verbal ability, measured as standardized verbal tests. John et al. (1994) found a significant correlation between Conscientiousness and standardized test scores of $r = .22$. In addition, based on a longitudinal study with 102 Swedish children, Lamb, Chuang, Wessels, Broberg, and Hwang (2002) reported that Conscientiousness predicted verbal abilities.

4.2.3 Cognitive abilities and Academic Self-Concept

Self-concept has been found to be related to problem-solving traits (Bos & Vaughn, 1998; Pianta & Walsh, 1996). Pianta & Walsh (1996) demonstrated that students with low self-concept also had low educational aspirations, poor planning skills, generated fewer functional alternative solutions to problems, tended to emphasize short-term goals rather than long-term goals, and identified fewer consequences. Several studies, designed as interventions, have aimed to enhance various aspects of students' multidimensional self-concepts (e.g., Lockhart & Hay, 1995; Marsh & Richard, 1988). For example, Lockhart & Hay (1995) used a school-based program called ABLE (Attribution, Behavior, Life Skills Education), to improve students' self-concepts. This program focused on fostering students to use strategies associated with problem solving and reflection. As problem-solving abilities increased, so did the participants' self-concept. Indeed, Beier & Ackerman (2001) found a positive correlation of .33 between Gf and Academic Self-Concept. A similar

correlation was found in another study by Kanfer, Wolf, Kantrowitz and Ackerman (2010), whereas the relationship between Academic Self-Concept and verbal ability was non-significant. However, Beier & Ackerman (2001) found an almost zero correlation of .03 between Gc and Academic Self-Concept. Schipolowski, Wilhelm, and Schroeders (2014) reported that self-concept in writing (i.e., domain-specific self-concept) was positively correlated with verbal ability (r = .37) and, to a lesser degree, also to *g* (r = .25).

In addition, a meta-analysis of 69 studies (Möller, Pohlmann, Möller, & Marsh, 2009) showed that paths from reading achievement to reading self-concept were positive, r = .49. In a later investigation, Möller, Retelsdorf, Köller, and Marsh (2011) found evidence for both REM and I/EM, even when controlling for prior achievement and academic self-concepts. Based on a three-wave longitudinal design from grade 5 to grade 8 (N = 1,508), evidence was found for REM, indicating that grades and Academic Self-Concept had a positive impact on subsequent grades and Academic Self-Concept within domains, but negative effects across domains.

4.3 Prediction of academic achievement from cognitive abilities

Several studies within the field of educational psychology have demonstrated that intelligence plays a key role for learning and academic achievement. For example, Lynn and Vanhanen (2012) reported high correlations ranging from .50 to .70 between intelligence and academic achievement at the national level. In another study, based on 70,000 children, Deary, Strand, Smith, and Fernandes (2007) identified a strong relationship (r = .81) between intelligence at age 11 and academic performance in 25 school subjects at the age of 16. Although there is a strong predictive ability of intelligence on academic performance, approximately 50% variance in academic achievement is unaccounted for by general cognitive abilities alone (Rohde & Thompson, 2007). Fergusson, Horwood, and Ridder (2005) reported that increasing IQ in an intervention was related to higher levels of academic success, i.e., both increased attainment of post-school qualifications and higher levels of university degree attainment.

Gf has been found to be highly correlated with working memory capacity (Kyllonen & Christal, 1990), and positive associations between students' scores

on working memory tests and their academic achievement have also been reported (e.g., Gathercole, Pickering, Knight, & Stegmann, 2004).

Thorsen (2014) found a stronger effect for Gc (verbal ability) than Gf on academic performance.

4.4 The effects of socioemotional traits on academic performance

There is agreement that positive emotions, such as the enjoyment of learning, are positively correlated with effort and persistence (Ainley, Corrigan, & Richardson, 2005; Pekrun, Frenzel, Goetz, & Perry, 2007), and that negative emotions, such as worry and fear, are negatively related with effort (Pekrun, Goetz, Daniels, Stupnisky, & Pe, 2010). In addition, Daniels, Stupnisky, Pekrun, Hanyes, Perry, and Newall (2009) demonstrated that mastery orientation was negatively associated with negative affect (e.g., worry and fear), which, in turn, was related to lower academic performance.

4.4.1 Anxiety and academic achievement

The effects of trait anxiety on academic achievement have been less researched (Mellanby & Zimdars, 2011). Previous studies of the relationship between anxiety and academic performance have reported mixed results. Chamorro-Premuzic and Furnham (2003) found that a one standard deviation increases in anxiety decreased exam grades by 0.34 standard deviations among 70 university students. In a randomized controlled study, Keogh, Bond, and Flaxman (2006) investigated the effect of an anxiety-reducing intervention with a focus on cognitive-behavioral stress management among children. They reported a significant effect, as those in the treatment group experienced lower levels of anxiety and higher grades. This effect was believed to be mediated through more available resources of working memory when anxiety levels are reduced (Owens, Stevenson, Norgate, & Hadwin, 2008).

In addition, Eysenck and Eysenck (1985) have proposed that more successful students experience higher levels of motivational anxiety than less successful peers. Hence, Anxiety is a positive determinant of Academic achievement among successful students, whereas it is a negative determinant in less talented students.

In contrast, McEwan and Goldenberg (1999) found a positive association (r = .35) between high trait anxiety and academic achievement. In addition, the positive relationship between trait anxiety and academic performance could be driven by gender, with girls being more prone to being anxious and outperforming boys regarding academic performance (Mellanby & Zimdars, 2011). Furthermore, Mellanby and Zimdars (2011) found a positive relationship between trait anxiety and academic performance among women, but not among men.

4.4.2 Conscientiousness and academic achievement

Conscientiousness is identified to be the most robust determinant of academic performance across education, with an average correlation of 0.20 (Noftle & Robins, 2007; Poropat, 2009; Richardson & Abraham, 2009). This finding is also valid among younger children. For example, Lamb, Chuang Wessels, Broberg, and Hwang (2002) found, in a sample of Swedish children 2 to 15 years of age, that Conscientiousness was positively related to academic performance. In addition, meta-analytic findings suggest that Conscientiousness is the strongest determinant among the Big Five factors of academic course grades from elementary school through college (Poropat, 2009).

Noftle and Robins (2007) investigated the relationship between the Big Five constructs of personality and college GPA and SAT scores (math and verbal) among students at the University of California at Berkeley. They reported that two subcomponents of Conscientiousness (perfectionism and organization) were significantly related to verbal SAT scores (0.12 and 0.14, respectively). As a construct, Conscientiousness was positively associated with college GPA (β = 0.24), after controlling for SAT scores, gender, and other personality dimensions. The authors hypothesized that the positive association between higher levels of Conscientiousness and higher GPA could be explained by increased effort and higher perception of academic ability.

Research also indicates that ability to concentrate and practice self-control are important determinants of academic performance. For example, Duckworth, Quinn, and Tsukayama (2012) reported that self-control is positively related to grades and other measures of academic achievement.

4.4.3 Academic Self-Concept and achievement

Self-efficacy has consistently been shown to be a significant predictor of school achievement (Chamorro-Premuzic, Harlaar, Greven, & Plomin, 2010; Richardson & Abraham, 2009). However, studies focusing on the self-concept to achievement relationship have suggested that an Academic Self-Concept construct can include both a competence and affect components, which have differential relationships with the outcome variables. Several studies (e.g., Arens et al., 2011; Marsh et al., 2013) have demonstrated that the competence aspect is highly correlated with academic performance, whereas the affect component has been found to be more related to behavioral indicators such as persistence (Arens & Hasselhorn, 2015; Pinxten, Marsh, De Fraine, Van Den Noortgate, Van Damme, 2014).

Findings from previous studies (e.g., Marsh & Craven, 2006; Marsh & Martin, 2011) have suggested that the relationship between Academic Self-Concept and achievement is mutually reinforcing, which is formulated in the Reciprocal Effects Model (REM; Marsh & Craven, 2006). The REM takes into account both the assumptions of the skill-development model, which states that achievement impacts self-concept, and the assumptions of the Self-Enhancement Model, which states that self-concept impacts upon achievement (Caslyn & Kenny, 1977). As such, the REM suggests that self-concept is both an outcome and an antecedent of performance. Several investigations have found evidence for the REM across a number of educational systems and cultures (Germany: Marsh & Köller, 2004; Möller, Retelsdorf, Köller, & Marsh, 2011; Niepel, Brunner, & Preckel, 2014; Hong Kong: Marsh, Hau, & Kong, 2002; Taiwan: Chen, Yeh, Hwang, & Lin, 2013).

4.4.4 Joint effects of socioemotional and cognitive traits on academic achievement

In a large meta-analysis (aggregated sample size n = 70,926) of personality, intelligence, and academic performance relationships, Poropat (2009) found that Conscientiousness and Emotional Stability (the opposite of Neuroticism) were positively related to academic achievement. Conscientiousness was associated with a corrected correlation of .22 and Emotional Stability of .02. In addition, Poropat reported that intelligence was positively associated with academic achievement with a corrected correlation of .25.

Evidence based on US longitudinal data indicates that the self-discipline construct accounted for more than twice as much variance as IQ in final grades (Duckworth & Seligman, 2005). More precisely, the standardized regression coefficient from self-discipline to final GPA was .65, whereas IQ showed a regression coefficient of .25. In addition, Borghans et al. (2008) investigated the importance of socioemotional and cognitive traits for college grades and years of education. Although significant effects were found for socioemotional traits, cognitive traits remained the single most important factor of success.

4.5 Discussion

Previous research shows that Neuroticism is negatively related to cognitive processing, verbal ability, Academic Self-Concept, and Conscientiousness in cross-sectional studies. The correlation between Neuroticism and Conscientiousness varies between -.17 to -.38, In addition, the relationship between Neuroticism and Academic Self-Concept is estimated to be around -.30.

Conscientiousness is found to be positively related to Gc, while some studies (e.g., Moutafi et al., 2003) show that Conscientiousness is negatively associated with Gf, while other investigations find no significant relationship.

A strong positive relationship is found between Academic Self-Concept and Conscientiousness, with a range (Pearson's *r*) from .40 to .69.

Meta-analytic studies (e.g., Poropat, 2009) report that Conscientiousness and Neuroticism are significantly related to academic achievement, with a corrected correlation of .22 and -.02, respectively. Intelligence influences GPA positively with a corrected correlation of .25.

Studies investigating the association between Neuroticism and Gc have reported conflicting results. While some studies (e.g., Pearson, 1993) found a positive correlation, others found no significant association (e.g., John et al., 1994), while other investigations (e.g., Moutafi et al., 2004) reported a negative relationship.

Previous studies (e.g., Busato et al., 2000; Gustafsson & Undheim, 1996) have demonstrated a link between intelligence and academic achievement, with approximately 50% of the variation being attributed to intelligence (Gustafsson & Undheim, 1996). In a cross-lagged study, Watkins, Lei, and Canivez (2007) found that intelligence drives academic performance, but not vice versa, thus, providing evidence that intelligence causes academic achievement.

In addition, Conscientiousness and Neuroticism have been identified as the strongest determinants of scholastic success. Conscientiousness is positively related to academic performance, whereas Neuroticism is negatively associated with academic achievement (Poropat, 2009; Poropat, 2011). However, Rosander (2012) found that Anxiety is positively (although very weakly) related to academic achievement.

Although most investigations have demonstrated that personality traits add incremental variance to Gf in predicting academic performance, expressed in terms of GPA (Di Fabio & Busoni, 2007; Furnham & Chamorro-Premuzic, 2004; Lounsbury et al., 2003), few studies have included a measure of Gc to investigate the validity of the Gf-Gc-model with respect to personality traits. The few studies that have investigated the effect of the Investment Hypothesis have found that the Gf-Gc-model is capable of predicting academic achievement (Frank, Decker, & Garruto, 2016; Thorsén, Gustafsson, & Cliffordsson, 2014). In addition, an ongoing discussion concerns the importance of intelligence and socioemotional traits in their prediction of academic performance. In this regard, some studies (e.g., Moreira et al., 2012; Spengler, Lüdtke, Martin, & Brunner, 2013) have reported that personality predicts academic performance to a higher extent than does intelligence, or almost at the same extent (Poropat, 2009). However, while researchers have conducted much research onthe impact of intelligence and socioemotional traits on academic achievement less is known about the dynamic relationship between intelligence and socioemotional traits. There is, therefore, a need for investigations of the longitudinal relationships in the development of cognitive and socioemotional traits over the school years.

Chapter 5. Socioemotional traits, cognitive abilities and academic achievement as determinants of unemployment

5.1 Unemployment and employment

Before moving on to the discussion of literature on unemployment, cognitive abilities, and socioemotional traits, a very brief introduction of the Swedish labor market would be beneficial to readers.

5.1.1 The Swedish unemployment rate between 1980 and 2009

During the 1980s, the Swedish unemployment rate was low by international standards. Whereas the unemployment rate in Western Europe reached double-digit figures, it hovered around 2% on average in Sweden. When the Swedish real estate bubble burst in the early 1990s in conjunction with a fall in the level of GDP, the unemployment rate climbed to 10% and remained at around 8% over the period 1993-97 (Holmlund, 2009). During this period, the number of undergraduate students increased, and the Swedish government initiated an educational drive for low-educated adults (Kunskapslyftet), which involved about 2% of the working-age population (Holmlund, 2009). Nevertheless, the labor market recovered in 1997, and by 2002, the unemployment rate had fallen to 4%, followed by an increase during 2003-2004, when it approached 6%. During the cyclical upturn, the unemployment rate fell over the period 2005-07, followed by a rise due to the global recession in 2008 (Holmlund, 2009).

Until 2007, the official definition of an unemployed person in Sweden was a person who was without paid work, but was searching for a job position and might take one without any reservation. However, in October 2007, the official definition was aligned with EU regulations, and the term unemployed included individuals who were studying full-time, but who were simultaneously also looking for a job (SCB, 2014). This definition is also in line with the definition of unemployment under the ILO (International Labor Organization) guidance, which involves a person above a certain age that is a) without paid work, b) available for work, and c) actively seeking a job position (ILO, 2012). A more specific term that is used to describe individuals that are registered at The Swedish Public Employment Office is "open unemployed."

5.1.2 Theoretical framework – the link between education and unemployment

Human capital theory posits that economic development trends can be explained by high-density patterns of highly educated people living in an area (Storper & Scott, 2009) that is associated with low unemployment (Wolf-Powers, 2013). For example, research has linked educational attainment to employment and economic prosperity, which has resulted in an increase of policies aiming to produce high-skilled jobs via entrepreneurship (e.g., Gottlieb and Fogarty, 2003). Previous research has identified a relationship between skilled entrepreneurial areas with production of new ideas and educational attainment (e.g., Glaeser, Ponzetto, & Tobio, 2011). In line with this finding, several economic development agencies track the proportion of residents holding bachelor's degrees as a key indicator of adaptation to a "knowledge economy" (Moretti, 2012). Moretti (2004) reported that businesses with highly educated (i.e., college degree) employees are associated with higher levels of productivity compared to businesses with less educated employees.

The unemployed population is a heterogeneous group that includes new entrants, individuals who have lost their jobs, and employed people who are simultaneously searching for another job (Boswell, Zimmerman, & Swider, 2012).

Although the unemployment rate is a strong indicator that reflects changes in the business cycle (Startiene & Remeikiene, 2009), which could be considered as structural reasons, there are other factors that drive unemployment. This is in contrast to the Human Capital Theory, which is hypothesized to be the point of departure for job competition, matching theories, and other labor market segmentation theories (Thurow, 1979).

Sørensen and Kalleberg (1981) argued that unemployment occurs when the supply of applicants exceeds the number of vacant job positions. The job seekers are ranked by the employers according to the job position demands. In a situation where the employers lack information about the applicants' true productivity, they generally use educational achievement as an indicator of future job performance. Hence, educational attainment influences the individual's relative position in the labor queue. Nevertheless, in recession times, the low-educated and those with poorer academic achievement will find it harder to enter the labor market, since they are at the bottom of this labor queue (Kline, 2015).

Thus, several studies have focused on the link between unemployment, income inequality, and education (e.g., Tarvid, 2012; Theodossiou & Zangelidis, 2009), i.e., unemployment due to lack of qualifications. Lack of qualifications also involves one's amount of previous work experience. Klein (2015) reported that worsening macroeconomic conditions contributed to widening the unemployment gap between low-educated and high-educated individuals. This finding was in line with previous research that has demonstrated that academic achievement mitigates the risk of being excluded from the labor market, i.e., highly educated persons show a lower risk of unemployment than less educated individuals (Gesthuizen, Solga and Kunster, 2010). Therefore, grades and prior work experience are sources of information that employers can use to discriminate between applicants (van de Werfhorst, 2014).

5.2 The predictive ability of socioemotional and cognitive traits, and academic achievement on unemployment / employment

The process of searching for a job is mostly self-regulated in the sense that persons need to manage their emotions and thoughts (Kanfer, Wanberg, & Kantrowitz, 2001). Since new labor market entrants have no or little job experience, other factors, such as socioemotional traits, become important (Turban, Stevens, & Lee, 2009).

It is believed that individuals with positive emotions possess more personal resources to use in the job searching process. By being more optimistic, conscientious, and extraverted, the person is more likely to be perceived as likeable during the interview (Turban et al., 2009). Thus, personality traits have been found to influence recruiters' assessments of applicant employability. For example, Turban et al. (2009) reported a positive relationship between Conscientiousness and job offers.

However, one important question that arises when examining the effects of personality traits on employment is: How accurate are the recruiters in their assessments of an applicant's personality based on his or her resume information? Barrick, Stewart, and Piotrowski (2002) found an average reliability estimate of .13 between recruiters' judgements of applicants resume information and personality tests administered to the applicants. In a similar vein, Cole, Feild, Giles, and Harris (2009) reported that recruiters were not able to make valid judgements of applicants' Conscientiousness and Openness to

Experience. However, they were more accurate in predicting extraverted applicants. These findings might suggest that persons who are high on Conscientiousness or Openness to experience do not emphasize such traits strongly enough in the application letter, whereas extraverted persons tend to stress their sociability in their applications.

In addition, over the last decades, a plethora of studies have demonstrated a link between general intelligence and employee performance (see Schmidt & Hunter, 2004 for overview). These empirical findings have highlighted intelligence as "the most important trait or construct in all of psychology, and the most 'successful' trait in applied psychology" (Schmidt & Hunter, 2000, p. 4). Subsequently, HR professionals use intelligence tests as a selection tool when recruiting employees, since intelligence is highly associated with job performance. In addition, using intelligence tests in the screening process among applicants has been advocated by scholars. For example, Schmidt and Hunter (2000, p. 3) stated: "Intelligence is the major determinant of job performance, and therefore hiring people based on intelligence leads to marked improvements in job performance – improvements that have high economic value to the firm," or as title of study by Ree et al. (1994) states, "Predicting job performance: Not much more than g" (Ree, Earles, & Teachout, 1994). McDaniel and Banks (2010) emphasized the importance of general cognitive abilities as a predictor of job performance, since applicants that score high on *g* show a better, subsequent job performance compared to lower-scoring applicants. It is believed that individuals who score higher on general intelligence or Gf tests learn job-related knowledge faster, which leads to higher job performance (Ree, Carretta, & Teachout, 1995).

Prior research on the effects of cognitive ability (without distinguishing between Gf and Gc) on unemployment report mixed results. Most studies investigating the relationships between cognitive abilities and labor market outcomes do not separate between verbal and non-verbal abilities. For example, Fergusson, John Horwood, and Ridder (2005) used a longitudinal data set containing 1,265 children born in 1977 in New Zealand. They found a positive effect of childhood intelligence on later educational attainment in terms of gaining a university degree, and negative on years of unemployment at 18 to 25 years of age. In contrast, Lindqvist and Vestman (2011) reported that cognitive abilities did not have any significant effects on unemployment events, while socioemotional traits reduced the duration of unemployment (once being unemployed).

Kuncel, Ones, and Sackett (2010) argued that both Gf and Gc are important in work life. Although both cognitive abilities are needed, Jaques and Stamp (1990) argued that problem-solving ability is more important than knowing key facts to deal with the complexities of work life. Therefore, many job positions require the ability to utilize new information effectively to solve unfamiliar problems, i.e., Gf.

However, Byington and Felps (2010) argued that there at least two main streams in the hiring process that are important for employment, namely education and intelligence. There is a strong relationship between IQ and schooling. Thus, they argued that organizations may ultimately be choosing job candidates on IQ when selecting educational credentials, since schooling reflects cognitive abilities. This might explain why employers often use education as a proxy for intelligence, since both concepts are related and the employers lack information about intelligence. For example, Ceci (1991, p. 705) reported, "Correlations between the highest grade in school completed and full-scale IQ are often very large, frequently in excess of .8." Subsequently, it is believed that job applicants with higher IQ scores will have better employment opportunities. According to Byington and Felps (2010), this implies that the labor market has arranged that individuals with a higher level of intelligence are provided with more opportunities to work and develop job-related competencies.

Prior studies have shown that both education and socioemotional abilities play a key role in finding and keeping a job. Modern workplaces tend to require skills in problem solving and the ability to communicate effectively (Borghans, L., Green, F., & Mayhew, 2001). Kuhn and Weiberger (2005) concluded that the five most highly-valued traits by employers were: *communication skills*, *motivation/initiative*, *teamwork skills*, *leadership skills*, and *academic achievement/GPA*. Furthermore, employers also valued interpersonal skills, work ethic, and analytical/problem-solving abilities. Similar findings were also reported by Casner-Lotto and Barrington (2006). In addition, acquired knowledge in writing, science, history, and geography was less valued among employers (Casner-Lotto & Barrington, 2006). In line with this, Garcia concluded: "Few occupations rely heavily on basic academic knowledge developed in school settings" (Garcia, 2016, p. 37). However, Garcia has not investigated the relationship between communicative abilities and academic knowledge. One might suspect that communicative abilities are positively related to academic knowledge.

In an investigation based on a composite variable consisting of traits such as willingness to assume responsibility, independence, outgoing character, persistence, emotional stability and power of initiative, Nilsson (2015) concluded that individuals with low socioemotional abilities were more likely to suffer from unemployment compared with persons with medium and high socioemotional traits. In line with this, Uysal and Pohlmeier (2011) found that Conscientiousness had a positive effect on finding a job. A closely related construct to Conscientiousness is internal locus of control, the latter frequently being used by economists. Gallo, Endrass, Bradley, Hell, and Kasl (2003) demonstrated that locus of control was related with a higher likelihood of reemployment once being unemployed. Furthermore, Uysal and Pohlmeier (2011) found that neuroticism was not significantly related with cumulative unemployment. However, a one standard deviation increase in Extraversion was related with a 3-5-month reduction in cumulative unemployment, whereas a one standard deviation increase in Openness to Experience was associated with a 4-5-month increase in cumulative unemployment.

Viinikainen and Kokko (2012) used longitudinal data to address the effects of personality traits on unemployment probability and unemployment spells. Information about personality traits were collected at ages 8, 33, 42 and 50, and unemployment information at ages 15 and 50. They found that Neuroticism was positively associated with unemployment spells, whereas Agreeableness was negatively correlated. Conscientiousness was not a significant predictor of unemployment.

In a Swedish study, Lundin and Hemmingsson (2013) followed 49,321 men from the military enlistment from age 18 up until age 50. They found a positive association between cognitive abilities and adaptability to school, and that cognitive abilities were negatively related to unemployment.

Although several studies have found a relationship between socioemotional traits and finding a job, level of education has also been reported to influence a person's employability. Thus, there is a relationship between the level of education and the likelihood of finding a job. In 2010, Statistics Sweden (2010) reported that 86% of the individuals with higher education had a job, compared to 62% among those with a low level of education. This relationship is consistent across most OECD countries (OECD, 2012).

5.3 Discussion

Prior research (e.g., Fergusson, Horwood, & Riedler, 2005; Lindqvist & Vestman, 2011; Nilsson, 2015) on the effects of socioemotional traits and intelligence on unemployment has reported mixed results. One explanation might be that these studies have only used socioemotional traits or intelligence, and not both, in the prediction of unemployment. In some cases, educational level has been used together with socioemotional traits as predictors of unemployment. Another explanation might be attributed to the conceptionalization of socioemotional traits. For example, most Swedish studies (e.g., Lindqvist & Vestman, 2011) investigating the effects of socioemotional traits and cognitive abilities on labor market outcomes have been based on military enlistment data. A person's socioemotional traits were assessed, on a scale ranging from 1 to 9, by a certified psychologist during a 25 minutes long interview. Hence, socioemotional traits are treated as an observed composite variable. However, the conceptualization of socioemotional traits in terms of a single composite variable based on psychologists' judgements is afflicted by two problems. First, a composite observed variable conceals the effects of different socioemotional traits on labor market outcomes. For example, the effect from Conscientiousness on unemployment can not be separated from the effect from Anxiety, when all these constructs are combined into a single variable. Second, the reliability of the psychologists' judgements has not been investigated or discussed in these studies. In addition, the use of military enlistment data with only men conceals gender effects regarding academic achievement (see section 6.5 for further discussion).

Furthermore, when cognitive ability is included in the prediction of labor market outcomes, it is operationalized in terms of a composite of inductive, spatial, and vocabulary ability. Consequently, most studies investigating the associations between cognitive abilty and labor market outcomes do not distinguish between Gf and Gc. Although both Gf and Gc are important in work life, some researchers (e.g., Garcia, 2016; Jaques and Stamp, 1990) emphasize the importance of Gf and downplay the role of Gc.

In summary, by taking Gf, Gc, socioemotional traits, as well as academic achievement into account in the prediction of a person's employability the problems with mixed results mentioned above could be reduced.

Chapter 6. Effects of background variables

Research has identified several crucial factors that affect socioemotional traits, intelligence, academic achievement, unemployment, and earnings. Personality traits have been related to a wide range of adaptive behaviors in school settings that affect academic performance, as such behaviors differ between boys and girls (Duckworth et al., 2015; Steinmayr & Spinath, 2008). As Bowles, Gintis, and Osborne (2001) stated: "Similarly, traits may count differently for men and women, or for different ethnic or language groups" (p. 158), it is important to take such factors affecting personality traits, schooling, and labor market outcomes into account. In addition to gender and ethnicity, family income and parental educational levels have been found to be highly related to a child's schooling, educational attainment, and job opportunities (Duncan, et al., 2007; Knudsen, Heckman, Cameron, & Shonkoff, 2006). Another factor that is associated with schooling and well-being is living in a two-parent vs. single-parent family (Leventhal & Brooks-Gunn, 2000).

The background variables focused upon here are: parental socioeconomic status, parental educational expectations for the child, whether parents live together, gender, and ethnicity.

6.1 Socioeconomic status

Socioeconomic status (SES) could be defined broadly as parental income, wealth, education, occupation, and family structure. Such factors are independently related to a child's well-being and schooling. Socioeconomic status is sometimes measured as an index variable consisting of three components – household income, parent occupation, and parent education. It has also been measured just with one or two of these components (Sirin, 2005). However, most research reports that parent education has the strongest influence among the three components of the SES construct (Cheadle 2008; Downer and Pianta, 2006).

One aspect of the SES construct is human capital, which measures personal attributes that are requested in an economic market. Parents' formal education is one of many indicators of human capital. Fulfillment of higher education is influenced by both cognitive and socioemotional traits, such as planfulness, orderliness, and efficiency (Dunifon, Duncan, & Brooks-Gunn, 2004). In addition, several studies have reported that more educated parents spend more

time with their children (e.g., Guryan, Hurst, & Kearney, 2008; Ramey & Ramey, 2010). For example, from a human capital investment perspective, parents with a college degree and who have a child less than 5 years old spend 7.6 hours per week on educational and recreational activities with their child, compared to 5.6 hours for parents without a college degree (Aiyagari, Greenwood, & Seshadri, 2002). Furthermore, the same number of minutes spent by more educated parents on educational content can be even more efficient with respect to development of knowledge and skills, compared to parents who are less educated (Yum, 2014).

Occupation is another component of SES that is associated with educational attainment and income. Occupation is further related to parental time allocation, particularly for low-income families, as it generates a conflict between the availability of parents to take part in child-rearing versus time spent earning money (Aiyagari, Greenwood, & Seshadri, 2002).

Relationships have been identified between SES and cognitive test scores, beginning at 2 to 3 years of age and being maintained through childhood (Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998; McLoyd, 1998). Several studies have demonstrated that the correlations are attenuated, but do not disappear, when parental cognitive traits and educations are controlled for (e.g., Duncan, Yeung, Brooks-Gunn, & Smith, 1998; Lubienski & Crane, 2010). It is becoming evident that socioeconomic status works as a proxy for other variables that are more likely to have a direct effect on children's cognitive and academic development (Zadeh, Farnia, & Ungerleider, 2010), such as the quality of the home learning environment (Mol & Bus, 2011), children's physical health and well-being (Rothstein, 2010), and motivations and attitudes towards reading (Cunningham 2008; Petscher, 2010). More educated mothers have been found to spend more time on shared reading than less educated mothers (Curenton & Justice, 2008). This active parental involvement in reading and writing together with the child has been identified as a strong determinant of both the child's emerging reading skills and reading interest (Yeo, Ong, & Ng, 2014). Although low income has been reported to have a small, significant association with cognitive development in some studies (Blanden & Gregg, 2004), especially if it is lasting (Dickerson & Popli, 2016), it is rarely the strongest factor.

Several studies have reported that high-SES students perform better on non-verbal achievement tests (e.g., Feinstein, 2000). Feinstein (2000) hypothesized that one reason for this gap could be related to the fact that reading problems are more easily observed by low-SES parents, as such parents will then focus

more on developing the child's verbal ability than numeric ability. However, this hypothesis has not been empirically supported. Another explanation could be that job positions that low-SES parents have do not require higher levels of numeric skills and, therefore, they are not able to help their children in solving mathematical problems. In addition, previous studies have reported that low-SES parents behave differently than high-SES parents. For example, low-SES parents are more prone to be hostile, controlling, and punitive in their parenting and less responsive to their children compared to high-SES parents (Bornstein, Hahn, Suwalsky, & Haynes, 2003).

Correlations between family SES and cognitive outcomes are generally stronger than those found between family SES and children's health. In addition, lower parental education and living in a single-parent home are related to behavioral problems. Linver, Brooks-Gunn, and Kohen (2002) reported that family structure had a stronger influence on behavior problems than academic performance, while parental education influenced achievement to a considerable extent, compared to behavioral problems.

Another aspect of SES is neighborhood socioeconomic status, as shared values have an impact on its residents. Neighborhood SES is highly associated with income. Although neighborhood-level effects have been found to be much smaller than family-level effects, many investigations have reported negative relationships between neighborhood disadvantage and children's cognitive outcomes (e.g., Leventhal & Brooks-Gunn 2000; Schaefer-McDaniel et al., 2009). In contrast, Kingston, Yen-Huang, Calzada, Dawson-McClure, and Brotman (2013) reported that increased parent involvement in education was related to lower rates of behavior problems among children of single parents and among children from neighborhoods with higher levels of childcare burden. However, parent involvement did not show any moderating effect on the relationship between socioeconomic risk and cognitive-academic components of school readiness skills.

Neighborhoods shape opportunities for experiences of control, predictability, and safety. Dupéré, Leventhal and Vitaro (2012) found that neighborhood conditions were associated with adolescents' self-efficacy and, in turn, their internalization problems (i.e., depression/anxiety symptoms).

Interestingly, Gary Marks (2017) argues that the effect of socioeconomic background on academic achievement is moderate, and has only a weak impact on adults' occupation once taking prior achievement and cognitive ability into account. For example, Marks (2017) reports that the SES effect on academic

achievement drops from around 0.3 to around 0.1 once controlling for prior achievement and cognitive ability. Marks (2017) concludes that cognitive ability and prior achievement are much stronger indicators of educational attainment and future occupation than SES.

However, one objection to Mark's conclusions about SES and its effect on distal outcomes such as academic achievement and future employment is that SES is not treated as a multifaceted variable that affects cognitive ability. Although Marks examines SES in terms of a compound variable, i.e., a combination of parent's highest education and occupation, the analysis does treat SES as an exogenous variable that affects cognitive ability. In this way, Marks misses the indirect effects of SES on distal outcomes. In addition, the analysis also misses to reveal what SES reflects, i.e., what SES is strongly related to. For example, SES is found to be related to educational expectations. Burgess and Umaña-Aponte (2011) reported that individuals with low-SES who have friends from high-SES families have significantly higher educational expectations and aspirations compared to peers with the same background, but with friends from disadvantaged families. This finding was also supported by Kiuru et al. (2012).

6.2 Parental investments and academic achievement

Higher incomes enable families to purchase stimulating learning materials and other extracurricular activities, which are an investment in their children.

From a human capital perspective, children in low-income families tend to be less successful in school due to limited access to resources (Currie, 2009). Thus, the provision of learning experiences in the home is more limited among low-SES families. Such learning experiences have been reported to be highly associated with child cognitive outcomes (e.g., Heckman, 2006). High-SES parents read more to their children, which develops their children's verbal skills compared to low-SES children (Whitehurst & Lonigan, 1998). Furthermore, help and support supplied by mothers during a problem-solving task have contributed to an increased enthusiasm and persistence towards such types of assignments (Spiker, Ferguson, & Brooks-Gunn, 1993). Linver and colleagues (2002) demonstrated that supplying a stimulating home environment (including book reading) mediates the relationship between income and children's cognitive outcomes (Linver, Brooks-Gunn, & Kohen, 2002). Thus, parents

with fewer economic resources also have less access to other types of resources, such as books, quality child care, and extracurricular activities. Consequently, high-SES families are better equipped to provide a more stimulating home environment than low-SES parents (Farkas, 2003).

6.3 Parental educational expectations and schooling

Parental educational expectations could be defined as realistic predictions that parents have regarding a child's future academic outcomes, such as highest educational attainment (Yamamoto & Holloway, 2010). Several studies have demonstrated that students whose parents have high educational expectations are more motivated and engaged at school, earn higher grades, score higher on achievement tests, and attain more education (Benner & Mistry, 2007; Jeynes, 2007). Other studies have found that students who experience elevated expectations from their parents perceive themselves as more competent and score higher in class and on achievement tests (Bouchey & Harter, 2005; Gniewosz & Noack, 2012). Parents' educational expectations also are tied to young people's academic success. Students with higher educational expectations are prone to be more academically motivated and engaged at school. They also perform better on achievement tests and are, therefore, more likely to succeed at school (Beal & Crockett, 2010; Domina, Conley, & Farkas, 2011). Yamamoto and Holloway (2010) suggested that parents' actual expectations benefit student's academic performance primarily through their academic support.

Although parents' and students' own educational expectations could be at the same level, discrepancies may occur for other students and influence achievement through inducing academic stress and anxiety (de Anda et al., 2000). Such normative school-related stressors can take their toll on the mental health of young people (Carter, Garber, Ciesla, & Cole, 2006).

6.4 Ethnicity

Parents who communicate values about hard work and the importance of a good education to their children have been identified as one of the most influential factors in explaining higher achievements among children of immigrants (second-generation) compared to their third-generation

counterparts. Fuligni and Fuligni (2007) identified higher parental educational expectations as the main driver of their children's higher academic performance. Much of the parental encouragement and support for achievement is focused on overcoming setbacks, since educational opportunities are perceived to be much better in the new country than those available in their home country. Many immigrant youths feel that doing well in school is something that they owe their parents (Feliciano & Lanuza, 2015).

The interplay between SES and the immigrant experience can be complex. With high-SES students (i.e., high parental education and occupation level), parental expectations for youth achievement are likely to be higher than for low-SES students (Kroneberg, 2008). However, this is not always the case. Various researchers have found that some immigrant groups were achieving higher than expected, given their socioeconomic background. This could be explained by high achievement norms among immigrants, even among low-SES families (Zhou & Kim, 2006).

6.5 Gender

General statistics in the field of education indicate that girls outperform boys at various stages in the school system, i.e., they attain higher grades and reach tertiary education at higher numbers (Duckworth et al., 2015; Voyer & Voyer, 2014). This finding persists after controlling for students' socioeconomic backgrounds (Matthews, Morrison, & Ponitz, 2009).

In addition to personality, intellectual abilities have been identified as one of the most powerful predictors of academic achievement (Steinmayr & Spinath, 2008). However, no significant relationship has been found between gender and intelligence (e.g., Pezzuti & Orsini, 2016; Zell, Krizan, & Teeter, 2015), even though various investigations have demonstrated gender differences in numerous domains, such as females scoring higher on verbal tests and males scoring higher on visuospatial tests (Voyer & Voyer, 2014). Hence, placing focus beyond the effects of cognitive abilities may be an efficient approach to investigate why girls generally perform better than boys in school, since both genders have similar overall intelligence levels (Voyer & Voyer, 2014). Therefore, the role of personality traits in the process of academic achievement has been increasingly considered.

Gender differences in personality traits among youths are well documented (e.g., Costa, Terracciano, & McCrae, 2001; Vecchione, Alessandri, Barbaranelli,

& Caprara, 2012). Some studies have found gender differences for Agreeableness, Neuroticism, and Conscientiousness in late adolescence. Girls tend to show lower levels of Agreeableness and Conscientiousness and higher levels of Neuroticism compared to boys (e.g., Soto, John, Gosling, & Potter, 2011; Vecchione, Alessandri, Barbaranelli, & Caprara, 2012). However, Duckworth, et al. (2015) demonstrated that self-control contributes to explaining the gender differences in academic achievement, and not school motivation. This finding is in line with previous studies indicating that girls spend more time and effort on school-related work in middle school (e.g., participating in class, completing homework) than do boys (Willingham, Pollack, & Lewis, 2002).

Another interesting line of research is wage expectations, i.e., expected returns to higher education among men and women. When students are asked to estimate their future earnings at 45 to 50 years of age, the average expected wages are 23% higher for men than for women (Chevalier, Gibbons, Thorpe, Snell, & Hoskins, 2009). This expected gender pay gap is also consistent with the observed gender pay gap that has been reported in several European countries (Brunello, Lucifora, & Winter-Ebmer, 2004). In addition, low-SES undergraduate students underestimate their post-graduate earnings by 18%, in comparison to high-SES students (Chevalier et al., 2009).

6.6 The relationships between background variables and unemployment

6.6.1 SES and unemployment

SES has been found to be related with risk of unemployment. Geay, McNally, and Telhaj (2012) suggested that SES per definition implies that high-SES persons are highly educated and have a strong position on the labor market. Thus, high-SES parents have a social network that is more strongly attached to the labor market compared to low-SES parents, who have a much weaker position on the labor market. Individuals from less advantaged families have a much lower chance of finding a job through his or her social network (Archer & Francis, 2007). One contributing reason might be the residential segregation, as children from more privileged backgrounds spend time together. Bauer, Chytilová, and Pertold-Gebicka (2014) suggested that children embrace similar perceptions of the world as their friends, parents, and neighbors, and act

according to these perceptions. This rationale might explain why low-SES adolescents experience increasing doubts that their efforts will be rewarded and lead to high achievement and better job opportunities (Schoon, 2008). In a similar vein, the Review of Australian Higher Education (The Bradley Review) argued that a low-SES background remained one of the strongest obstacles to accessing higher education and, thus, increases the risk of unemployment (Davis, 2008). It is believed that low-SES students lack family support for higher education (Schoon, 2008; Tinto & Engstrom, 2008). Thus, SES is an important confounder in the relationship between academic achievement and unemployment, since SES predicts both factors.

In Sweden, there is a difference in employment between individuals with higher levels of education and lower levels of education. As measured in 2010, among those with lower levels of education, i.e., lower and upper secondary school, 62% were employed, whereas 86% among highly educated persons were employed (Statistics Sweden, 2012).

6.6.2 Educational expectations and unemployment

Empirical investigations have found that the levels of parents' educational expectations are significant determinants of both educational achievement and future success in the job market, as a result of higher GPA (Rothon, Arephin, Klineberg, Cattell, & Stansfeld, 2011; Schoon & Parsons, 2002). As previously described, educational expectations are strongly related to SES. Thus, it is believed that educational expectations are reflected in students' motivation to attain parents' social status (Stocké, 2007). High-SES parents who have high educational expectations also have a larger labor market and relevant social network, compared to low-SES parents.

6.6.3 Single-parent households and unemployment

Single parents are more prone to report stress while they are raising their children, compared to households with both parents living together (Spijkers, Jansen, & Reijneveld, 2012). Gillham, Tanner, Cheyne, Freeman, Rooney, and Lambie (1998) found that single parenting was associated with child neglect, and that the parent felt a lack of social support in the child-rearing process (Offer, 2012). Chetty and Hendren (2015) found a reversed traditional gender gap in unemployment rates for children being raised in poor households. Girls in poor families are more likely to find a job compared to boys, particularly

when raised by a single parent. This finding has been supported by Bertrand and Pan (2013) and Figlio, Karbownik, Roth, and Wasserman (2016). Being a single parent is sometimes more difficult when it comes to child rearing and being supportive of the child's school work, compared to a household in which both parents live together. This may influence the chances of finding a job in the future (Chetty & Hendren, 2015; Goldin, Katz, & Kuziemko, 2006).

6.6.4 Ethnicity and unemployment

A growing body of research indicates that immigrants have a higher risk of experiencing unemployment, living in poverty, and suffering from being highly overqualified for the job currently held (e.g., Li 2004; Nakhaie, 2006; Oreopoulos & Dechief, 2011). Li (2004) emphasized the diminishing return to minorities' education as explanations of the higher risk of unemployment, which may be due to discrimination (Oreopoulos and Dechief, 2011).

In addition, ethnicity is associated with residential segregation, which contributes to a reactive segmentation of the labor market (Warman, 2007). Living in an area with individuals with similar limited quantities of assets and resources leads to a lower likelihood of finding a job through personal contacts. Thus, the embedded resources in the social networks among segregated immigrants lower the likelihood that someone they know could "put in a good word" in favor of the job-seeking person (Li, 2004; Warman, 2007). Thus, employment opportunities are dependent on the degree of the ethnic homogeneity of friendship networks. Strong ethnic homogeneity makes it more difficult to find a job through relatives and post-immigration friends.

Another consequence of residential and ethnic segregation is that second-generation immigrants also become part of this ethnic homogeneity (Beaman, 2011), since these children also go to the same school (i.e., most often the school that is closest to their homes) and spend time together outside of the school (Nadler, 2016). Subsequently, residential segregation contributes also to the second-generation immigrants having a lower likelihood of finding a job through personal contacts.

6.6.5 Gender and unemployment

Within the OECD, some countries show similar unemployment rates between males and females, while in other OECD countries, women experience

unemployment to a higher degree (especially in Mediterranean countries) than men (Azmat, Güell, & Manning, 2006).

The human capital theory postulates higher unemployment rates for women, since they have less accumulated human capital due to child rearing and the structure of the labor market. In a more competitive labor market, having lower levels of human capital contributes to fewer incentives for employers to hire such a person (Blau & Kahn, 2003). In addition, another mechanism could be discrimination against women (Algan & Cahuc, 2003).

In addition, the academic study programs at college have a sorting mechanism in which women choose certain fields of studies and men choose other fields. For example, women are more likely than men to choose humanities, teaching, arts, social sciences, and clerical programs, whereas men are more prone to choosing economics and business, engineering, and natural sciences (Katz-Gerro & Yaish, 2003). Several studies have reported that humanities and arts do not provide students with appropriate skills that are needed on the labor market. Thus, individuals that pursue such academic tracks have a lower chance of finding a job after graduation compared to students who pursue engineering (Carnevale & Cheah, 2015; Nunez & Livanos, 2010).

Chapter 7. Aims and Research Questions

As was described in the Introductory chapter the overall aim of this thesis is to investigate the development and impact of cognitive and socioemotional student traits longitudinally from age 10 to 40. Three main aims have been formulated: (1) to unfold the longitudinal relationships between cognitive and socioemotional traits from 3rd to 6th grade; (2) to determine the importance of cognitive and socioemotional traits in the prediction of academic achievement in 9th grade, and how effects of student background variables on achievement are mediated via such student traits; and (3) to determine the impact of cognitive and socioemotional traits and academic achievement on risk of unemployment in adult age.

In previous chapters, research pertinent to these aims has been reviewed, and a large set of established findings have been identified, along with several unresolved issues that require further investigation. These issues will be the starting point for the more specific research questions that will be investigated in the empirical studies.

7.1 The development of cognitive and socioemotional traits between 3rd and 6th grade

As been previously described in the theoretical chapters, unfolding the dynamic relationships between cognitive and socioemotional constructs incorporates at least five themes or issues: (1) the Investment Hypothesis, (2) the Mental Fixedness Hypothesis, (3) the Compensation Hypothesis and the association between cognitive abilities and perseverance & procrastination refrainment, (4) the relationship between cognitive abilities and Academic Self-Concept, and finally (5) the relationship between cognitive abilities and Anxiety. Within each of these areas of research, mixed results have been reported.

In addition, elaborating the relationships among the constructs involves the investigation of an eventual Gc trait complex, as hypothesized in previous research. These studies suggest that personality trait items overlap with and load on the Gc construct.

7.1.1 The Investment Hypothesis

The first issue concerns the Investment Hypothesis, which suggests a causal relationship between prior levels of Gf and subsequent levels of Gc. Although the Investment Hypothesis is straightforward, and has a relatively strong theoretical foundation, only a few studies have found compelling evidence in favor of this hypothesis (see section 2.5). The studies that provide the strongest support have tested Cattell's (1987) hypothesis that Gf is perfectly correlated with a higher-order g-factor, and many studies have found support for this hypothesis. However, several studies have tested the Investment Hypothesis by using cross-lagged path models, and these have generally failed to support the hypothesis. One reason for this may be that methodological challenges have prevented this. Kan et al. (2011) observed that a proper test of the Investment Hypothesis would require a longitudinal design with a homogeneous sample, and as was observed in the review of the studies of the Investment Hypothesis, this requirement has not always been satisfied (see section 2.5). However, the design of the current study should satisfy the requirements proposed by Kan et al. (2011).

7.1.2 The Functional Fixedness Hypothesis

McArdle (2001) found a negative relationship between previous levels of Gc on subsequent levels of Gf. This result not only runs counter to the Investment Hypothesis, but it also requires an explanation of its own. One possible explanation of this phenomenon is that schools foster students to approach problems by relying on Gc rather than on Gf. In the classroom, in many cases, teachers use questions that require the students to retrieve the answer from memory as a tool to determine whether the student has learned the topic. Such a practice that focuses on Gc may lower Gf (Berglund, 2008) and increase the propensity of functional fixedness (Brosnan & Hopper, 2014; Defeyter & German, 2003).

7.1.3 The Relation between Gf and Conscientiousness

Another puzzling result is a negative longitudinal relationship from Gf to Conscientiousness that has been found in several studies (Demetriou, Kyriakides, & Avraamidou, 2003; Chamorro-Premuzic & Arteche, 2008; Chamorro-Premuzic, Furnham, & Ackerman, 2006). In order to explain this result, Chamorro-Premuzic and Furnham (2005) developed the Compensation

Hypothesis. According to this hypothesis, individuals with lower intellectual capabilities compensate this deficit with higher levels of Conscientiousness. Furthermore, persons with higher level of cognitive abilities do not become more conscientious over time, since their cognitive abilities are sufficient for the execution of everyday cognitive tasks.

Another set of hypotheses are derived from causal relationships between intellectual abilities and personality traits. Cattell (1987) hypothesized that personality traits could influence different domains of intellectual abilities. An extension of this hypothesis is Ackerman's PPIK-theory, in which Intelligence-as-process, personality, and interests affect accumulated knowledge. Although intelligence-as-process is critical to the acquisition and retention of new knowledge, personality and interest play a vital role in the development of Gc. In line with this rationale, some researchers have proposed that Conscientiousness is positively related to cognitive abilities. It is hypothesized that conscientious persons are more motivated to learn, and they also take high-stakes tests more seriously than individuals who score lower on Conscientiousness items (e.g., Borghans, Duckworth, Heckman & ter Weel, 2008). Thus, from this line of reasoning, one might expect a positive relationship between Conscientiousness and cognitive abilities.

7.1.4 The Relation between Academic Self-concept and Achievement

The fourth issue concerns the relationship between Academic Self-Concept and achievement or traits. This association has been described with a starting point in three alternative models. According to the first model (the Self-Enhancement Model), Academic Self-Concept influences achievement. The second model (the Skill-Development Model) proposes that prior levels of achievement influence subsequent levels of Academic Self-Concept. According to the third model (the Reciprocal Model), there is a reciprocal relationship between achievement and Academic Self-Concept, in which these constructs influencing each other simultaneously.

Several previous studies have found positive correlations between cognitive abilities and achievement on the one hand, and Academic Self-Concept on the other (see 4.4.3), but correlations do not allow us to distinguish between the alternative models. However, Taube (1998) demonstrated in a longitudinal study that Gc had a larger impact on subsequent levels of Academic Self-

Concept compared to the effect of previous levels of Academic Self-Concept on subsequent levels of Gc.

7.1.5 The Relation between Anxiety and Cognitive Abilities

The review of relations between Anxiety and performance on cognitive tests has showed that many studies have found negative relations (see section 4.2.1). However, previous research has also demonstrated that it is important to distinguish between trait and state anxiety, although they correlate relatively strongly ($r \approx .5$; Ackerman & Heggestad, 1997). However, Keccedil (2013) argued that individuals that score high on trait anxiety (i.e., are generally anxious) might not be automatically anxious in test-taking situations. Depending on their personal histories and prior achievements, they might not feel more anxious than individuals who score low on trait anxiety items when taking a high-stakes test (Szafranski, Barrera, & Norton, 2012). Nevertheless, this assumption has not been tested empirically. Thus, the causal relationship between trait anxiety and cognitive abilities has not been fully tested from a longitudinal perspective together with other personality traits and cognitive ability constructs (i.e., Gf and Gc).

7.1.6 A Trait Complex for Gc

Previous research has shown that cognitive and socioemotional traits tend to go together in what has been called trait complexes (see section 3.5). The review of the literature provided some indications that the broad construct Gc also reflects traits such as Academic Self-Concept, perseverance, fear, and the ability to concentrate, and that the relative importance of these traits tends to vary with age. Therefore, whether such a trait complex can be identified for Gc will be investigated.

In addition to the conflicting results mentioned previously, research has hypothesized the existence of a verbal trait complex. In high-stakes verbal achievement tests at younger ages (i.e., ≤10 years of age), it is suggested that verbal self-concept, fear (e.g., Sahranavard, 2015), and perseverance are highly related to reading achievement (e.g., Putwain et al., 2015; Putwain et al., 2016). However, due to developmental processes and social comparison processes, children become more accurate in assessing their self-concept. As a consequence, self-beliefs become attenuated. Furthermore, researchers (e.g.,

Posner & Rothbart, 2007) have suggested that the ability to stay focused and persevere becomes more and more important as assignments increase in difficulty. Thus, a dynamic Gc trait complex emerges. Achievement on Gc-related tests in later grades (e.g., in 6th grade) will lead to an attenuating effect on verbal and reading self-concept items, whereas the ability to stay focused, perseverance, and fear become increasingly important. At younger ages (e.g., in 3rd grade), achievement on Gc tests is associated with verbal and reading self-concept, fear, and perseverance.

7.1.7 Research Questions for Aim 1

In summary, the following five research questions will be investigated in analyses of longitudinal relationships between 3rd and 6th grade:

RQ 1.1: Is there a positive effect of Gf measured in 3rd grade on Gc measured in 6th grade, as is expected from the Investment Hypothesis?

RQ 1.2: Is there a negative relationship between Gc in 3rd grade and Gf in 6th grade, as is expected from the Functional Fixedness Hypothesis?

RQ 1.3: Is there a negative relationship from Gf in 3rd grade to conscientiousness in 6th grade, as is expected from the Compensation Hypothesis?

RQ 1.4: Is there a positive relationship from cognitive traits in 3rd grade to Academic Self-Concept in 6th grade, as is expected from the Skill-Development Model; or, is there a positive relationship from Academic Self-Concept in 3rd grade to cognitive traits in 6th grade, as is expected from the Self-Enhancement Model?

RQ 1.5: Are there negative relationships between Anxiety in 3rd grade and cognitive abilities in 6th grade?

RQ 1.6: Can trait complexes for Gc be identified that involve reading skills and socioemotional traits in 3rd and 6th grade?

As is described in Chapters 8 and 9, information is available in both 3rd and 6th grade to allow specification and estimation of a cross-lagged model with latent variables. This also involves specification of models for measuring the latent variables, which involves theoretical, conceptual, and methodological issues, as well.

7.2 Cognitive and Socioemotional Traits in the Prediction of Academic Achievement in 9th Grade

The second main aim is to investigate the relationships between cognitive abilities and socioemotional traits on the one hand and academic achievement measured with grades in 9th grade on the other. The investigation also involves student background variables in order to determine to what extent the effects of these variables are mediated via cognitive abilities and socioemotional variables.

As is shown in the review of the literature in Chapter 2, cognitive abilities have been found to be the strongest determinant of academic performance, accounting for approximately 50% of the variation. In the search for other factors contributing unique variance to academic performance, the focus has shifted to socioemotional traits. Among various socioemotional traits, Conscientiousness and Neuroticism have been identified as the strongest determinants of scholastic success. Conscientiousness is positively related to academic performance, whereas Neuroticism is negatively associated with academic achievement (Poropat, 2009; 2011).

Although several studies have found that personality traits add incremental variance to Gf in predicting academic performance, few studies have included measures of Gc in order to investigate the validity of the Gf-Gc-model with respect to personality traits. There is also an ongoing discussion concerning the relative importance of cognitive abilities and socioemotional traits in their prediction of academic performance, with some studies even reporting that personality predicts academic performance to a higher extent than cognitive abilities (see 4.4.4).

Children's social background, referred to as socioeconomic status (SES) has been identified as another important determinant of academic achievement. However, it is not clear through which mechanisms SES influences achievement. The research reviewed in Chapter 6 has suggested that educational expectations and demands on children to perform well in school partly mediate the effect of parental education. However, several other mechanisms have been proposed, such as the effects of upbringing on motivation, school engagement, and personality. Thus, educational expectations affect students' socioemotional behaviors.

Given that correlations have also been established between SES and cognitive abilities, it may also be expected that the SES effect on achievement is partly mediated via abilities (see section 6.1).

Family composition, in terms of the presence of two parents or a single parent, is another factor that has been identified as important for student academic achievement.

Gender and ethnicity are two other influential variables that affect academic achievement. As was shown in the research review in Section 6.5, girls outperform boys at different stages in the school system, i.e., attain higher grades, and reach tertiary education at higher numbers. While there are relationships between gender and socioemotional variables, it seems the larger amounts of time and effort spent by girls on school-related work can account for part of the gender difference in performance.

In conclusion, prior research has not only found that grades are influenced by cognitive and socioemotional factors, but also by gender, SES, parents' educational expectations, living with both parents, and ethnicity. However, little is yet known about how strongly the varied factors influence outcomes, or through which mechanisms this happens.

The following research questions will be focused upon in relation to this aim:

RQ 2.1: What is the relative importance of cognitive and socioemotional traits in the prediction of academic achievement in 9th grade?

RQ 2.2: What are the direct and indirect effects of the student background variables of SES, gender, parents' educational expectations, both parents living together, and ethnicity on achievement in 9th grade, and how are the effects mediated via cognitive and socioemotional traits?

7.3 The impact of cognitive and socioemotional traits and academic achievement on risk for unemployment

The review of the literature on factors influencing the risk of unemployment (Section 5.2) showed that academic achievement, intelligence, and socioemotional traits have been found to influence the risk. One determinant of the likelihood of attaining a job is the outcome of the job application, and the job interview contributes to a positive outcome. For example, a person who

is perceived as conscientious and optimistic during the job interview increases the likelihood of being offered the job.

However, factors influencing job performance also are important determinants of risk of unemployment. While some research has strongly suggested the importance of general cognitive abilities, other research has suggested problem-solving skills and the ability to communicate effectively to be more important. Yet, other studies have shown that socioemotional traits can reduce the duration of unemployment, once being unemployed. In addition, research has reported mixed results regarding the effect of Conscientiousness on the event of unemployment. Some studies have reported a negative association, whereas other studies have not found any significant relationship between Conscientiousness and unemployment.

While previous research has identified relationships between cognitive abilities, socioemotional traits, and school achievement, it is not clear if the effects of socioemotional and cognitive traits are indirectly related to labor market outcomes via school achievement, or if they are directly related to the outcomes over and above the relationships that are mediated via academic achievement. This issue will be investigated empirically, as well.

The following research questions will be focused upon when investigating this aim:

RQ 3.1: What is the relative impact of cognitive and socioemotional traits and academic achievement on the risk of unemployment?

RQ 3.2: To what extent is the impact of cognitive and socioemotional traits on the risk of unemployment mediated via academic achievement in 9th grade?

7.4 The Empirical Approach

The research questions specified above will be investigated empirically with longitudinal ETF data. In this database, information is available that allows the identification of the cognitive and socioemotional traits in both 3rd and 6th grade, academic achievement in 9th grade, and labor market outcomes at around age 40. This information is used in three empirical studies, which are presented in Chapters 9 to 11. Study 1 (Chapter 9) specifies two cognitive abilities (Gf and Gc) and three socioemotional factors (Anxiety, Perseverance, and Academic Self-Concept) at 3rd and 6th grade, and investigates cross-lagged relations among these variables. Study 2 (Chapter 10) combines the model for 6th grade in Study

1 with information about academic achievement in 9th grade and information about background variables, and investigates direct and indirect relationships among the variables. Study 3 (Chapter 11) extends the model in Study 2 with information about unemployment, and investigates risk of unemployment as a function of cognitive abilities, socioemotional traits, and academic achievement.

Chapter 8. Method

8.1 Participants and sampling

The empirical studies are based on a nationally representative longitudinal survey of persons mainly born in 1972. This is one age cohort included in the cohort-sequential longitudinal database known as Evaluation Through Follow-up (ETF; UGU in Swedish). The ETF database, which is developed and maintained at the University of Gothenburg, includes 10 cohorts, each of which includes approximately 9000 students. The 1972 cohort data is based on a sample of students in a total of 437 classes in the 3rd grade during the year 1981-82, which was followed up in the 6th grade of compulsory schooling during the school year 1984-85. The students were 9-10 years old in 3rd grade and 12-13 years old in 6th grade.

The dataset includes information about tests of cognitive abilities, the student's own perception of his/her study ambitions, self-concept, perseverance, social environment and home environment, etc. In addition, this information has been complemented with register data from Statistics Sweden (SCB), which provides information about socioeconomic status and migration status of the students and their parents. From the registers, individual-level data on educational achievement (i.e., grades) and employment status has also been added. The employment data have been collected yearly and span the period between 1991 (age 19) and 2009 (age 37).

One advantage of longitudinal data of this character is that it makes it possible to deal with potential endogeneity problems that are associated with attempts to determine causal relationships between knowledge and traits on the one hand, and labor market outcomes such as unemployment on the other hand. Problems of selection bias, for example, may be dealt with by using data on the cognitive and socioemotional traits that were collected at a young age.

The sample was drawn according to a stratified cluster design that ensures national representability, which was developed by Statistics Sweden. The stratification was implemented according to municipalities, within which school-classes were sampled. This was done in 3rd grade, so the students were, in many cases, spread across different classrooms when the 6th grade survey was conducted, and even more so as the students progressed to 9th grade (Emanuelsson, 1984).

Thus, even though the data has a hierarchical structure, the nestedness in the classrooms is successively eroded. Furthermore, at the time when the sample was drawn, the amount of regional and school differences was much smaller than is the case today. Thus, the intra-class correlation for school differences in achievement in grade 9 was only around .03. Therefore, the analyses in this thesis have been conducted without the use of multilevel modeling techniques, or the "complex" option that is available in the Mplus program (Muthén & Muthén, 1998-2016) to correct the standard errors for cluster effects.

8.2 Variables and constructs

Most analyses in this thesis are based on latent variable models. This technique reduces a large number of fallible items and measures to a limited set of unobserved, latent variables that are freed from errors of measurement. Given that many of the questionnaire items are dichotomous with a Yes/No response, they have very poor measurement properties when analyzed with traditional techniques assuming a continuous scale. This problem has been solved by treating them as categorical variables and using the WSLMV estimator in Mplus, as is elaborated in Section 8.3.3.

8.2.1 A brief description of grading systems in Sweden

In Sweden, a norm-referenced system was introduced in 1949, and the grading system was changed in 1962 to include a grading scale ranging from 1-5 in compulsory schooling (SOU 1961:30; Lgr62). This grading system set grade 3 as the mean value, and the different grades were to be given according to fixed percentages (i.e., 1, 6, 24, 38, 24, 6, and 1%). Thus, a student's performance was related to the average achievement among all students within that school year who were studying in the same course. Although standardized tests were introduced in 1943-44 to assist teachers in their grading process and to establish comparability and equity (Ljung, 2000), the norm-referenced system attracted substantial criticism. The criticism has concerned how it was used at a class level within schools (Wikström, 2005). In 1994, the norm-referenced grading system was replaced by a criterion-referenced system. Hence, the grades used in this thesis stem from a norm-referenced system, as these were measured in 1988.

8.2.2 Academic Achievement as a construct

Academic achievement in 9th grade was based on the grades in Swedish, English, and mathematics from the final year of compulsory schooling, i.e., the year the students turn 16. Students born in 1972 were graded on a 1-5 scale (the higher the grade, the better the performance), according to a norm-referenced grading system that was based on the assumption that achievement has a normal distribution at the population level.

In the grading of these three subjects, teachers had access to standardized national achievement tests that provided information about the level of performance of the class and the individual students. These norm-referenced grades had good comparability across students and classes. Thus, a canonical correlation analysis on the 1972 cohort data shows that the grades in Swedish, English, and mathematics provide a good reflection of the national test performance, with a canonical correlation of .88.

During 7th to 9th grade, students could choose between general and advanced courses in mathematics and English. This means that the grades in these two subjects are not equivalent. However, previous analyses (Reuterberg, 1994) have shown that a correction factor of 1 should be added to take the difference between general and advanced courses into account. Therefore, the scale for grades in English and mathematics ranges from 1.0 to 6.0.

Table 8.1. Descriptive statistics of core subjects in 9th grade

	Abbrev.	Mean	Std.	Min	Max	N (%)	Missing (N)
9th Grade							
Mathematics	(GMA)	3.79	1.11	1	6	8680 (96)	400
Swedish	(GSW)	3.20	0.89	1	5	8601 (95)	479
English	(GEN)	3.90	1.07	1	6	8662 (95)	418
Cronbach's alpha = .85							

Note: All three grades were strongly correlated with each other (GMA vs GSW = .66, GMA vs GEN = .63, GSW vs GEN = .73). Cronbach's alpha for this construct was .85.

8.2.3 Fluid Intelligence (Gf)

Gf is involved in problem-solving situations such as scientific, mathematical, and technical tasks. Gf is typically measured by tests of reasoning (e.g. matrices

or series tasks, mathematical problem solving) and spatial visualization (see Figure 8.1).

In 3rd grade, a spatial ability test and a mathematical ability test were used as indicators of Gf:

Mathematical ability test: The test includes 15 items that require the students to master addition, subtraction, multiplication, division, problem-solving tasks, and familiarity with mathematical terminology. An example item is: 10+5-8-7. The test was developed by Bengt-Olov Ljung (Ek & Pettersson, 1983).

Spatial ability test: The test includes 30 items that require the students to choose one of the four figures that corresponds to the flat piece of metal when it is folded. An example item is shown in figure 8.1.

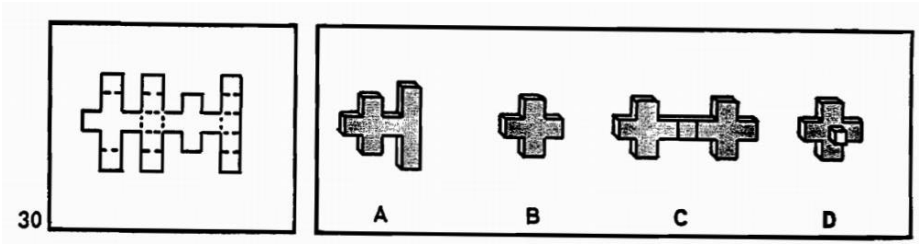

Figure 8.1 Shows item 30 in spatial ability test given in 3rd grade.

According to Härnqvist (SOU 1960:13) the spatial test items were modelled on "Three-Dimensional Space" in the General Aptitute Test Battery by Dvorak (1956).

In 6th grade, an inductive reasoning test, a spatial ability test, and a mathematical ability test were used as indicators of Gf.

Inductive reasoning test: The test includes 40 items that require the students to finalize a number series consisting of six given numbers with two more numbers. According to Härnqvist (SOU 1960:13), the items in the inductive test were inspired by the "Abstract Reasoning subtest" in Differential Aptitute Tests described by Bennett, Seashore & Wesman (1952).

An example item is:

3	6	12	24	48	96	___	___
2	3	5	8	12	17	___	___

Figure 8.2 Example of inductive test item in 6th grade.
Cited from Svensson, A (1984). Förändringar i testresultat under en 20-årsperiod [Changes over a 20-year period in test scores], p.90

Mathematical ability test: The test includes 18 items that require the students to master addition, subtraction, multiplication, division, problem-solving tasks, and familiarity with mathematical terminology. The same mathematical ability test was given as in 3rd grade, but three tasks were added (Reuterberg, 1989). An example item is: 4 x 308 =. The test was developed by Bengt-Olov Ljung (Reuterberg, 1989).

Spatial ability test: The test includes 40 items that requires the students to identify, among four alternatives, the three-dimensional object that is formed when the flat piece of metal is folded by the bending lines. An example item is:

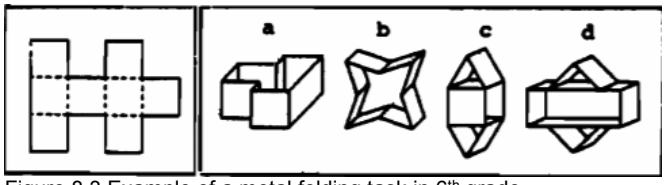

Figure 8.3 Example of a metal folding task in 6th grade.
Cited from Svensson, A (1984). Förändringar i testresultat under en 20-årsperiod [Changes over a 20-year period in test scores], p.90.

8.2.4 Crystallized Intelligence

Gc is here measured with two indicators of verbal comprehension (vocabulary and reading comprehension) that have been shown to be at the core of crystallized intelligence (Kan et al., 2011).

In 3rd grade, a test on Swedish antonyms and a reading comprehension test were used as indicators of Gc:

Antonyms: The test includes 40 items that require students to find the word that is the exact opposite among a set of words. An example item is:

Find the word which is the exact OPPOSITE of following words:

	1	2	3	4	
LIGHT	Heaven	Mirror	Lamp	Dark	[ ]

Figure 8.4 Example of verbal opposite item

The students should decide which number should be inserted within the brackets. The test was developed by Härnqvist (SOU 1960:13).

Reading comprehension test: The test includes 32 items that require students to comprehend the instructions to identify the correct picture. The students should mark the picture that matches the sentence best. An example item is shown in Figure 8.5:

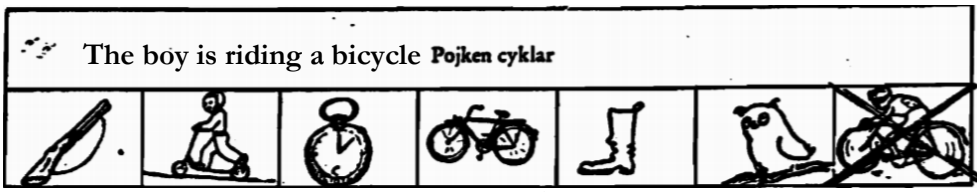

Figure 8.5 Example of reading comprehension item in 3rd grade.
Cited from Ek, K & Pettersson, A (1985). Appendix 10, (p.8)

The test was adopted from the Bergen project in Norway (Pettersson, 1984) and was developed by Gjessing (1989).

In 6th grade, an antonyms test and a reading comprehension test were used as indicators of Gc.

8.2.5 Anxiety

In 3rd grade, the following items were selected to measure anxiety:
(a) Are you scared about having to answer questions at school? [A31]
(b) Are you afraid of someone at school? [A32]
(c) Do you worry about things that happen at school? [A33]

In 6th grade, the following items were selected to measure anxiety:
(a) Do you think it is unpleasant to answer questions at school? [A61]
(b) Do you fear someone at school? [A62]
(c) Do you worry about things that happen at school? [A63].

As seen in Table 8.2, the tetrachoric correlations among the items were moderate (i.e., .38 to .46) in 3rd grade and moderate to strong (i.e., .36 to .56) in 6th grade.

Table 8.2. Tetrachoric correlations and composite index alpha of items measuring anxiety in 3rd grade (A31-A33) and in 6th grade (A61-A63)

	A31/A61	A32/A62	A33/A63	Alpha (Tetr.)
A31/A61	1.0 / 1.0			
A32/A62	.38 / .36	1.0 / 1.0		
A33/A63	.42 / .47	.46 / .56	1.0 / 1.0	.68 / .72

Note: A31-A33, N=8501; A61-A63, N = 7799. All correlations are significant, p = <0.0001. All tetrachoric correlations have computed in Mplus version 7.4.

Based on these tetrachoric correlations, reliability indices of .68 and .72 were calculated for the anxiety construct in 3rd and 6th grade, respectively.

8.2.6 Academic Self-concept

Four items were selected to measure Academic Self-Concept, and they were identically formulated in 3rd and 6th grade:
(a) Do you think you are good at mathematics? [Asc31/Asc61]
(b) Do you think you are good at spelling? [Asc32/Asc62]
(c) Do you think you are good at reading? [Asc33/Asc63]
(d) Do you think you are good at school? [Asc34/Asc64].

The correlations among these items were weak to strong (i.e., .25 to .66) in 3rd grade and 6th grade, which is shown in Table 8.3.

Table 8.3. Tetrachoric correlations and composite index alpha of items measuring academic self-concept in 3rd grade (Asc31-Asc33) and in 6th grade (Asc61-Asc63)

	Asc31/61	Asc32/A62	Asc33/A63	Asc34/64	Alpha
Asc31/Asc61	1.0 / 1.0				
Asc32/Asc62	.28 / .20	1.0 / 1.0			
Asc33/Asc63	.35 / .25	.54 / .53	1.0 / 1.0		
Asc34/Asc64	.66 / .70	.49 / .45	.51 / .48	1.0 / 1.0	.79 / .76

Note: Asc31-Asc34, N = 8498; Asc61-Asc64, N = 7770. All correlations are significant, p = <0.0001. All tetrachoric correlations have computed in Mplus version 7.4.

Reliability indices of .79 and .76 was calculated for the Academic Self-Concept construct in 3rd and 6th grade, respectively.

8.2.7 Perseverance

Three items measuring aspects of Conscientiousness were selected, and they were identically formulated in 3rd and 6th grade:
(a) Do you often sit and think of other things when you are going to do math or write at school? [P31/P61]
(b) Is it easy to give up if you encounter a difficult task? [P32/P62]
(c) Do you do your very best, even in subjects that you find boring? [P33/P63].

The first two items were reverse coded, since the items were stated negatively.

Table 8.4. Tetrachoric correlations and composite index alpha of items measuring perseverance & procrastination refrainment in 3rd grade (P31-P33) and in 6th grade (P61-P63)

	P31/P61	P32/P62	P33/P63	Alpha (Tetr.)
P31/P61	1.0 / 1.0			
P32/P62	.25 / .36	1.0 / 1.0		
P33/P63	.25 / .33	.24 / .20	1.0 / 1.0	.50 / .56

Note: P31-P33, N = 8499; P61-P63, N = 7798. All correlations are significant, p = <0.0001. All tetrachoric correlations have computed in Mplus version 7.4.

The correlations among these items were weak (i.e., .24 to .25) in 3rd grade and weak to moderate (i.e., .20 to .36) in 6th grade (Table 8.4). Although the latent variable consists of two items belonging to perseverance and one item to procrastination refrainment (e.g., MacCann et al., 2009), for simplicity, this construct will be called perseverance in this thesis.

8.2.8 Some Reliability and Validity Issues

Reliability indices of .50 and .56 was calculated for the perseverance construct in 3rd and 6th grade, respectively, which are lower than those of the other personality constructs. One reason for the lower reliability indices could be that the items reflect two different facets of Conscientiousness. Perseverance and procrastination refrainment were among the eight facets of Conscientiousness identified by MacCann et al. (2009). Perseverance was measured by reverse-coded items such as: "I give up easily," and "I am easily discouraged." Procrastination refrainment was assessed by reverse-coded items such as: "I am easily distracted," and "I put off unpleasant tasks." Thus, the first item: "Do you often sit and think of other things when you are going to do math or write in school?" reflects procrastination refrainment whereas the last two items reflect perseverance (i.e., "Is it easy to give up if you get a difficult task?" and "Do you do your very best, even in subjects that you find boring?"). With at least three indicators from each factor, it would have been possible to create a higher-order variable, but unfortunately, the available data set only includes two variables from one facet and one indicator from another facet of the higher-order trait of Conscientiousness.

Fewer items per construct also results in lower alphas, compared to constructs with more items (Mueller & Plug, 2006). Thus, although these reliability coefficients based on tetrachoric correlations are at the lower range of acceptable alpha values, they point to a reasonable amount of internal consistency, given the limited number of items per construct. However, the alpha levels of constructs are more important when the items are treated as observed rather than latent variables. Cunningham, Preacher, and Banaji (2001) argued:

> "Contrary to popular opinion, low reliability (high measurement error) need not be a threat to construct validity (see Bollen, 1989). That is, although correlations between measured variables can be only as valid as their reliabilities will allow, analyses that utilize latent variable models, with multiple measures of each construct, circumvent this problem. In several

> simulation studies, Little, Lindenberger, and Nesselroade (1999) found that such analyses provided unbiased estimates of the true population correlations and, perhaps more important, did not overcorrect for measurement error. Reliability does not constrain validity in latent variable analyses (Cunningham, Preacher, & Banaji, 2001, p.163).

Prior research shows that procrastination refrainment was highly correlated with the Big Five trait of Conscientiousness (r = .72), as was perseverance (r = .68). Thus, perseverance & procrastination refrainment could be regarded as a *proxy* of the trait Conscientiousness. In relation to the Big Five trait Neuroticism, perseverance shows the highest association (r = -.55) and procrastination refrainment is also highly negatively related to Neuroticism (r = -.29). Furthermore, both procrastination refrainment and perseverance are weakly related to GPA, with r = .06 and r = .12, respectively (MacCann et al., 2009). These correlations indicate that these two facets are quite homogeneous in their relationship to Big Five constructs and to GPA.

By using a more global construct of Academic Self-Concept, and not only subject-specific Academic Self-Concepts, it is posited that this construct is more applicable to various school contexts (Wengler, 2009). Furthermore, when broadly conceptualized, the Academic Self-Concept construct has been shown to predict overall grade point average (Cokley, 2000).

8.3 Analytical techniques - Structural Equation Modeling (SEM) and Survival Analysis

Below the main analytical techniques used in the studies are presented.

8.3.1 Basic Ideas of Structural Equation Modeling

As has already been mentioned, this thesis utilizes Structural Equation Modeling (SEM) in all studies. Within this modeling framework, latent constructs defined with observable indicators can be analyzed. Hence, SEM analyses provide results that are best interpreted as relationships between latent variables measured without error. On the contrary, in Multiple Regression Analysis, only observed variables can be part of the model. Therefore, such analyses are affected by measurement error, which often cause the strength of relations to be underestimated. SEM, in contrast, provides estimates of relations

between latent variables that are unaffected by unreliability in the observable indicators.

Another advantage of SEM is that complex theories, models, and hypotheses can be tested by comparing alternative models.

Software for SEM, such as Mplus (Muthén & Muthén, 2012), also offers great flexibility, allowing specialized models, such as survival models or models for highly skewed distal outcome variables, to be incorporated with the SEM framework.

SEM is sometimes perceived as a hybrid of two different statistical traditions, namely factor analysis from psychometrics and path analysis from econometrics (Kaplan, 2000). Hence, the traditional SEM model as proposed by Jöreskog (1970) is described as combining a measurement model and a structural model. The measurement model depicts the associations between the observed variables and the latent constructs via a Confirmatory Factor Analysis (CFA) model. The structural model describes the paths between the latent constructs via links of simultaneous equations.

A rule of thumb of interpreting standardized factor loadings is to focus on those larger than 0.3 (i.e., indicating acceptable construct validity), but also on the size of the standard errors of the factor loadings (Asparouhov & Muthén, 2009; Zhang & Preacher, 2015).

The first research question will test the presence of a trait complex, i.e., with overlapping items. A complex variable is defined as a variable that loads at .32 or higher on two or more latent variables (Costello & Osborne, 2005). Based on large sample sizes, i.e., >300 observations, the chosen cut-off value of .32 indicates that approximately 10% of the variance in an indicator is an overlapping variance (Tabachnick & Fidell, 2007). Thus, complex trait indicators lower than .32 will be dropped from the interpretation of the latent variables.

8.3.2 Model Fit Indices and Estimators Used

Models were estimated using weighted least squares mean and variance adjusted (WLSMV) estimation, which is appropriate for categorical data (Muthén & Shedden, 1999).

The traditional statistical test of chi-square (χ^2) is sensitive to sample size, rejecting even models with small deviations from the true model as poorly fitting when sample size is large. Therefore, Hu and Bentler (1999) and Bentler

(2007) proposed that researchers should use indices such as the standardized root mean square residual (SRMR), the non-normed fit index (NNFI), the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI) and root mean square error of approximation (RMSEA). MacCallum and Austin (2000) particularly recommended the use of RMSEA, as it provides a confidence interval.

When multivariate normality is not assumed, the WLSMV estimator for non-normal data is more appropriate than other asymptotically distribution-free (ADF) estimators (Muthén & Muthén, 2006; Yu & Muthen, 2002). When using WLSMV, RMSEA is used as the primary index of model fit, with values ≤ .06 indicating a good fit (Loehlin, 1998; Yu & Muthen, 2002). More specifically, Yu and Muthén (2002) reported that CFI and TLI are not as robust as RMSEA when the WLSMV estimator is used with large samples (i.e., N = 1000). Therefore, this thesis uses RMSEA estimates of .06 or lower, as the primary criterion for good model fit, and CFI and TLI as secondary model fit criteria. Hu and Bentler (1999) argued that CFI and TLI values of ≥ .95 indicate good model fit.

Many researchers suggest that the maximum likelihood estimator with robust standard errors (MLR) should be used when modeling data that depart from the multivariate normality assumption (e.g., Muthén & Muthén, 1998-2010; Yuan & Bentler, 2000). However, the assumption of normality is unreasonable when analyzing time variables, e.g., event-based variables. In such cases, the distribution might contain three types of observations, for example, when investigating employment: (1) a certain proportion becomes unemployed after completing upper secondary school; (2) those who get a job may reexperience unemployment; and (3) a majority that never experiences the event of being unemployed. In addition, time to event is always positive, while the theoretical normal distribution can include negative values (Cleves, Gould, Gutierrez, & Marchenko, 2016). Thus, MLR appears to be more appropriate for estimating the models in research question 3. Thus, the MLR estimator has been used in modeling time to event (i.e., survival analysis).

For models that utilize statistical techniques such as survival analysis and two-part latent growth curve modeling, traditional model fit measures such as CFI, TLI, or RMSEA are not available. Instead, model fit measures in terms of BIC and AIC, or -2*Log Likelihood are provided.

When the aim is to select between alternative models that are based upon different sets of predictors, the relative goodness-of-fit is, in most cases,

evaluated with the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Both AIC and BIC "penalize" (i.e. decrease) the log likelihood upon the number of model parameters, since the more parameters that are added to the model, the better the model fit. In addition, the BIC goes one step further than AIC by also taking the sample size into account in the penalty. Therefore, the researcher should choose the model that shows the smallest information criterion value (Singer & Willet, 2003).

8.3.3 Direct effects, indirect effects and total effects

A relationship between an independent (X) and a dependent variable (Y) can be described in a diagrammatic form as:

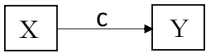

Figure 8.6 Relationship between X and Y

This relationship is described in terms of c, which is called the *total effect*. Nevertheless, the effect of X on Y may be mediated by another variable, called M, while X is still influencing Y. Diagrammatically, these relationships can be depicted as:

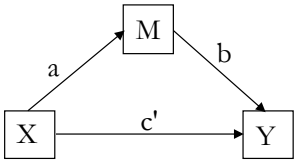

Figure 8.7 Path diagram that illustrates a mediational relationship between X and Y via M

Now, the relationship between X and Y is called the *direct effect* (denoted c'). The mediation reflects the indirect effect, i.e., a * b. The total effect is the sum of the direct effect and the indirect effect. Suppose that earnings, as a distal outcome, should be predicted by Grades, which, in turn, is influenced by Crystallized Intelligence (Gc), Academic Self-Concept (Asc), and Perseverance.

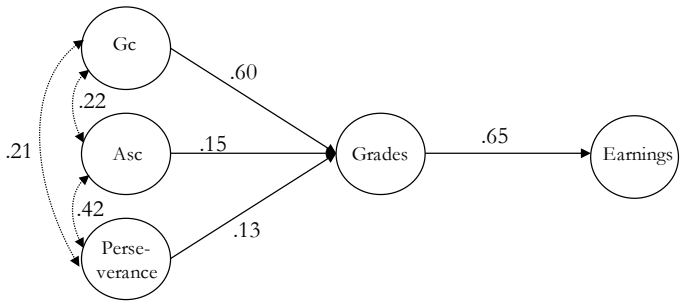

Figure 8.8. A structural model describing the influence of Crystallized intelligence (Gc), Academic self-concept (Asc), and Perseverance on Grades and Earnings

A direct path is present between Gc and Grades:

$$Gc \rightarrow Grades = 0.60$$

Two indirect paths are identified:

$$Gc \rightarrow Academic\ Self\text{-}Concept \rightarrow Grades = 0.22 * 0.60 = .13$$
$$Gc \rightarrow Perseverance \rightarrow Grades = 0.21 * 0.13 = 0.03$$

Total effect:

$$Direct + Indirect = .60 + .13 + .03 = .76$$

In this case, the estimated correlation between Gc and Grades is.76, which includes both the direct and indirect effects.

One rule of interpretation of indirect effects that has been proposed by David Kenny is to see it as a product of two effects. Thus, instead of using the traditional Cohen (1988) classification, where .1 is small, .3 is medium, and .5 is large, these cut-off correlations should be squared. This implies that an indirect effect of .01 is considered as small, .09 is medium, and .25 as large (Kenny, 2016).

8.3.4 Missing data

Most frequently, variables contain missing data to some extent. The data in this study is assumed to be missing at random (MAR), i.e., that missing data is due to values that are observed. To put it in other terms, two individuals that share

two behavior items (i.e., observed values) have the same statistical traits on the other observations, regardless if these are observed or not (Little, 2013). The term "random" in MAR indicates that once other variables have been controlled for in the model, the missing data are then completely random (Graham, 2009). As an example, while examining test anxiety, it is possible that test anxiety data for a specific test was missing, not due to the student's test anxiety for this test, but because of another personality trait such, as Academic Self-Concept (or test anxiety at a previous time point). If we control for Academic Self-Concept, missing test anxiety observations would be considered completely random and parameter estimates would be unbiased (Graham, 2009). The Full Information Maximum Likelihood (FIML) procedure implemented in Mplus to deal with missing data is based on the MAR assumption that missing observations are random once other variables in the model are controlled for. FIML has been found to provide estimates that are less biased than those generated by listwise deletion or mean imputation (Acock, 2005).

8.3.5 Basic Ideas of Survival Analysis

Survival analysis (also called event history analysis) is a generic term given to statistical analyses in order to identify movement among states. In the labor market context, one can estimate the effect of personality traits and achievement on the probability of unemployment occurring at selected points in time. Thus, survival models control both the occurrence and the timing of the events. For example, one may ask: Are persons with high final grades more likely than their peers with lower final grades to enter unemployment faster? Does this pattern vary by ethnicity or gender?

When using socioemotional trait measures in early adolescence as time-invariant predictors, traditional survival analysis is a more appropriate method to use than other methods that model reoccurring events (e.g., gap time analysis, which is another survival analysis technique). The traditional survival analysis investigates the time-to-first-event. Models that take the second, third, or fourth unemployment period for a person into account might result in biased estimates due to omitted variables. For example, Boyce et al. (2015) found that periods of unemployment had a negative impact on individuals' Conscientiousness and Openness to Experience. They speculated that long-term experience of

unemployment makes such individuals less inspired as they receive more rejected job applications. Although the authors did not test this hypothesis, the negative effects of unemployment experiences on socioemotional traits such as Conscientiousness and Openness were found. With no time-variant measures of socioemotional traits, traditional survival analysis with time-to-first-event is deemed to be most appropriate method of choice.

8.3.5.1 Events and duration intervals (spells)

Two fundamental concepts of survival analysis are events and spells. Events are the phenomena that the researcher will study, i.e., the dependent variable, for example, unemployment or school dropout. The event will then be studied over time, where spells are the duration of time between events (Allison, 1984). In survival analysis, it is crucial to understand the difference between calendar time and time in a study. For example, register based information about unemployment (the event) is collected each year during November, i.e., annually (spells). In other cases, sociologists might be interested in studying marriages that ends up in divorces (the event), which could be measured in days, weeks, months, or years (spells) from the day the individuals were married. The time when the researcher starts to measure does not have to be January 1. Instead, it could be when the subject is first observed.

In survival analysis, clearly defined events of interest are crucial if time is measured precisely. Some events are easier than others to define. For example, the birth of a child or high school graduation are events that are easy to define, whereas entering a therapeutic program or being unemployed could be harder to define. Does program participation begin at the consultation meeting, the day the person is supposed to attend, or on the actual day the person attends? In a similar vein, when does unemployment being? Is a person unemployed when he or she chooses to pursue a college program, or when somebody of working age is in a work training program sponsored by the government? In this thesis, an unemployed person has mostly been defined (according to Sweden Statistics) as individuals who were without work during a given week in November (the reference week), but who have sought work during the last four weeks (the reference week and three weeks back) and could work during the reference week or begin within 14 days of the reference week. Unemployed persons also include persons (between 16 and 64 years old) who have found a job that starts within three months, provided they could have worked during

the reference week or begin within 14 days of the reference week. This definition was valid until October 2007, when the definition was expanded to include full-time students who have been searching for a job position. In addition, the age interval was adjusted from previously 16-64 to 15-74 years. Thus, the later definition was aligned with the definition of unemployment of the European Union. Since this thesis includes unemployment data between 1991 and 2009, it covers the first definition (16-64 years old), not including full-time students looking for a job between 1991 and 2006. The later definition, between 2007 and 2009, includes persons between 15 and 74 years of age and full-time students searching for a job. Although the definition of unemployment has changed, it did not affect the analyses in this thesis, since only one cohort (those who were born in 1972) was included. In year 2007, persons born in 1972 were 35 years old, which means that the adjustment from 16 to 15 years of age did not affect the analyses. Similarly, the expansion from 64 to 74 years of age did not affect the probability of being unemployed, since these individuals were 37 years old in 2009.

Events are usually coded as 1. All individuals that escape unemployment (i.e., the event in this thesis) are called censored cases. Censored cases are persons who have not experienced the event, or who have disappeared from the data set for unknown reasons, e.g., moved abroad. It could also involve such cases that have already experienced the event prior to the starting point of the evaluation. In this sense, censoring is a lack of information (Allison, 1984). Censored cases are usually coded as 0.

8.3.5.2 Risk set and hazard

Two additional fundamental terms in survival analysis are the *risk set* and the *hazard*. The risk set refers to the group of subjects that have not experienced the event at given time point, i.e., that are "at risk" of experiencing the event (i.e., unemployment in this thesis) at a specific time point. The hazard refers to the probability or likelihood of an individual experiencing the event of interest, given that he or she is at risk at that time (see Allison, 1984). In this thesis, the risk set includes all individuals who have not yet experienced unemployment, and are, therefore, at risk of experiencing the event of interest. The hazard is the probability of unemployment during a certain year, given that he or she is at risk during that year.

Those who experienced the event (coded as 1) are no longer part of the risk set. In Mplus, all the remaining years are coded as missing (e.g., -99).

Table 8.5 Coding patterns for discrete-time survival analysis in Mplus during 11 years

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Individual 1	0	0	0	0	0	0	1	-99	-99	-99	-99
Individual 2	0	1	-99	-99	-99	-99	-99	-99	-99	-99	-99
Individual 3	0	0	0	0	0	0	0	0	0	0	0

Note: -99 indicates a missing value, 0 = the event has not happened, 1 = the event has happened.

Individual 1 in Table 8.8 experienced the event in year 7. All the other remaining years are coded as missing (-99 in this case). Individual 2 experienced the event in the second year. All the remaining nine years are coded as missing (-99 in this case). Individual 3 did not experience the event during this 11-year period, as this example illustrates. Therefore, all the years are coded as 0. A person who never experiences the event is called censored.

8.5 Validity

This thesis investigates socioemotional and cognitive skills that influence outcomes, such as grades, that have consequences for students. Consequently, the validity of these constructs is important to consider when discussing the implications of the results.

8.5.1 A retrospective view of validity

In general terms, validity is about "the degree to which a test measures what it claims, or purports, to be measuring" (Brown, 1996, p. 231). Validity is usually subdivided into three categories: criterion validity, content validity, and construct validity (Law & Baum, 2005). Criterion validity reflects how well a test represents a given set of abilities in relation to another external criterion (e.g., a gold standard) or to itself over a period of time. Criterion validity can be categorized into concurrent and predictive validity. When the test is

benchmarked against an established measure it is known as concurrent validity; testing it over time it is more known as predictive validity. The predictive validity examines the construct's ability to predict a phenomenon it should theoretically be able to predict. For example, we might theorize that a measure of verbal ability, i.e., crystallized intelligence, should be able to predict a student's grades. A high correlation indicates that you have high predictive validity, since the measurement can predict the outcome variable. Concurrent validity involves a test that is compared to an established measure (e.g., a gold standard) that occurs within the same time frame (Messick, 1990), or that two tests are administered at the same time. (Kaplan & Saccuzzo, 2013).

8.5.2 Construct validity

Cronbach and Meehl (1955) proposed the concept of construct validity when a researcher uses a measure as an index of a variable that is not directly observable (e.g., intelligence, aggression). The concept of validity has been the focus in educational and psychological research for several decades (Urbina, 2014; Nunnally & Bernstein, 1994). The lack of construct validity could pose a problem, since this would indicate that the test does not measure what it purports to be measuring (Westen & Rosenthal, 2003). In this thesis, based on observed scores, three tetrachoric alphas fell below the conventional threshold of 0.70. However, it is important to distinguish between composite indices based on observed scores and latent variables. As previously indicated by Cunningham, Preacher, and Banaji (2001), the latent variable approach circumvents the problem with poorer reliability scores. Furthermore, Campbell and Fiske (1959) added two aspects to construct validity: convergent validity and discriminant validity. Convergent validity refers to how well multiple items measure the same concept. When two or more items of the same phenomenon are highly correlated, then the researcher has a high degree of convergent validity for this construct. Discriminant validity describes the degree to which measures of different constructs are distinct. The idea is that, if two or more constructs are unique, they should not be too highly associated. If the assumption of discriminant validity is violated, i.e., two or more constructs are too highly correlated, a higher-order model proposed by Marsh and Hocevar (1988) may be utilized for such constructs.

In addition, constructs could provide information that are aligned with both empirical and theoretical perspectives, which is in line with Messick's reasoning

about construct validity: "What needs to be valid are the inferences made about score meaning, namely, the score interpretation and its action implications for test use. Because value implications both derive from and contribute to score meaning, different value perspectives may lead to different score implications and hence to different validities of interpretation and use for the same scores" (Messick, 1998, p. 37). Messick (1998) argued that constructs represent our best efforts to measure the essence of a trait or behavior. Thus, Messick widened the perception of construct validity to include aspects that go beyond the property of a test in the sense that validity revolves around the interpretation of a score and how it is applied in a research context. Hence, Messick applied an argument-based approach to validity. In this regard, Messick (1989) added evidential and consequential aspects of the interpretation and use of a test when validity is discussed. The evidential aspect takes its point of departure from the empirical study of construct validity, whereas the consequential aspect aims at making judgments of the value implications that the construct has. This implies that a construct, such as crystallized intelligence, grade, or another type of outcome, is used and interpreted. Furthermore, the evidence and consequences of the construct is also taken into account.

8.5.3 Threats to validity

Messick (1995) proposed two types of threats to validity: construct underrepresentation and construct irrelevant variance. Underrepresentation refers to a situation when a measure is too narrow and misses relevant aspects, whereas construct irrelevant variance refers to when a measure includes irrelevant information (i.e., information that does not contribute to the construct). Construct irrelevant variance, i.e., when the measure is too broad, reflects systematic variance related to other distinct constructs. Construct underrepresentation occurs when the measure does not capture all the key features of that construct. An example of construct representation is the investigation of Carpenter et al. (1990), who demonstrated through the use of correlational analysis that working memory, and not short-term memory, was associated with measures of fluid intelligence. For many researchers, construct representation reveals the validity of endogenous variable(s) as a construct(s) (Borsboom et al., 2004).

When these two threats to validity are not taken into consideration, the appropriateness and usefulness of a construct becomes questionable (Messick, 1989).

In this thesis, these threats to validity are important to take into account for several reasons. First, one aim is to investigate if the Gc reading achievement trait complex could be identified. If overlapping factor loadings to this Gc reading achievement trait complex are weak, i.e., ≤.30, then this would be an indication of construct irrelevant variance. Second, since the ETF database only included two to three indicators of the cognitive constructs, and three indicators for most of the socioemotional constructs, it also important to consider underrepresentation when discussing the validity of the results.

Chapter 9. The development of cognitive and socioemotional traits between 3rd and 6th grade

9.1 Introduction

As was described in Chapter 7, the first aim is to investigate the longitudinal and dynamic development of cognitive and socioemotional traits from 3rd grade to 6th grade. This involves investigation of the following six research questions:

RQ 1.1: Is there a positive effect of Gf measured in 3rd grade on Gc measured in 6th grade, as is expected from the Investment Hypothesis?

RQ 1.2: Is there a negative relationship between Gc in 3rd grade and Gf in 6th grade, as is expected from the Functional Fixedness Hypothesis?

RQ 1.3: Is there a negative relationship from Gf in 3rd grade to conscientiousness in 6th grade, as is expected from the Compensation Hypothesis?

RQ 1.4: Is there a positive relationship from cognitive traits in 3rd grade to Academic Self-Concept in 6th grade, as is expected from the Skill-Development Model; or, is there a positive relationship from Academic Self-Concept in 3rd grade to cognitive traits in 6th grade, as is expected from the Self-Enhancement Model?

RQ 1.5: Are there negative relationships between anxiety in 3rd grade and cognitive abilities in 6th grade?

RQ 1.6: Can trait complexes for Gc be identified that involve reading traits and socioemotional traits in 3rd and 6th grade?

The first five research questions concern structural relations among latent variables in a cross-lagged model, while RQ 1.6 concerns issues of measurement. In order to provide an answer to the question of whether a trait complex for Gc may be identified, three alternative models were specified that only differed with respect to the number of indicators used for Gc.

9.2 Hypothesized Trait Complexes for Gc

Alexander (1935) found in a factorial study, which included both cognitive and non-cognitive variables, that a general intelligence factor (g) along with two

overlapping factors were related to school grades. The first and strongest factor was labeled X. This factor captured an "interest" or "school readiness" ability, which he called the "will to succeed." The second factor identified by Alexander was only weakly correlated with school grades. This factor was related to mathematics, number tests, English, and "Shop Work" (p. 128). The first factor (X factor) could be viewed as a school performance-relevant construct, which combined cognitive abilities, interest, and motivation, and it may be interpreted as a trait complex.

As previously suggested by Kanfer and Ackerman (2005) and Snow (1963), some socioemotional trait items tend to load with certain domains of knowledge, which provides at least weak support for a Gc trait complex. Cattell (1971) also argued that Gc was more likely to be involved with personality traits than Gf. Subsequent research (e.g., Bråten et al, 2013; Furnham, 2008; Guthrie & Wigfield, 2005) has provided evidence that Conscientiousness items, such as perseverance and effort, are correlated with reading achievement. Other studies (e.g., Sahranavard, 2015) have shown that Academic Self-Concept and fear are also positively associated with high-stakes verbal tests. Hence, perseverance, Academic Self-Concept, and fear are hypothesized to relate to high-stakes reading achievement tests. However, Goleman and Senge (2015) suggested that attention and effort go hand in hand and become more and more important as tasks increase in difficulty. As students advance in primary school, the content also becomes more complex, abstract, and demanding, which requires the students to be able to stay focused on the tasks. In addition, students in grade 6 are subjected to more tests than students in grade 1, and are, therefore, provided with more feedback about their performances from both teachers and peers (Cole et al., 2001). With the increased frequency of social comparison processes as children progress through school, their self-concept tends to decline as they have been prone to overestimating their previous levels of self-concept (Pajares & Schunk, 2001). Thus, it seems that the association between Academic Self-Concept and reading achievement tests is attenuated, whereas the students' ability to stay focused becomes more important as they progress in primary school. This suggests that Academic Self-Concept, perseverance, and fear are items that could be associated with reading achievement tests in the early years of primary school, while concentration, fear, and perseverance could be related to reading achievement at the end of primary school (6^{th} grade). Such a dynamic Gc trait complex will be tested in Model 2.

9.3 Models Specified

Two models will be tested that all include cross-lagged effects between latent constructs of Gf, Gc, Anxiety, perseverance, and Academic Self-Concept between 3rd and 6th grade. A schematic form of the basic model is shown in Figure 9.1

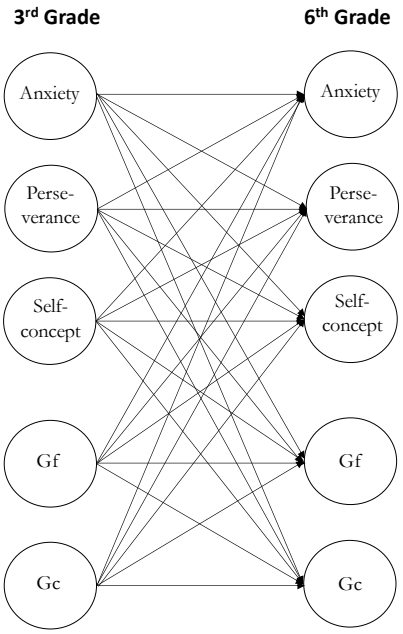

Figure 9.1 Illustration of cross-lagged model, Models 1 and 2.
For sake of simplicity, only latent variables and cross-lagged paths are shown. Latent variables are depicted as circle and paths as arrows. Correlations between and factor item loadings are not shown.

The latent variables in this model are measured by observed variables in the way described in Chapter 8.2. All possible relations from the 3rd grade variables to the 6th grade variables have been included, but this saturated model was simplified in a later step. In Figure 9.1, there are bidirectional curved arrows to indicate that correlations among the latent variables are shown, but in the model, there were correlations among the latent variables in the 3rd grade part and in the 6th grade part. The model also includes covariances among the residuals of identical items in 3rd and 6th grade, which are not shown in Figure 9.1.

The difference between Models 1 and 2 is how Gc is measured. In Model 1, Gc is measured by the reading comprehension test (RA3, RA6) and the vocabulary test (VO3, VO6). This is the narrow, traditional way to measure Gc (Carroll, 1993). Model 2 includes the same indicators, but it also adds perseverance (P32), Fear (A32), and Academic Self-Concept items (Sc32, Sc33) in 3rd grade, and includes perseverance (P62), concentration (P61), and fear (A62) to the Gc construct.

In conclusion, in order to reflect the increasing importance of the ability to concentrate and the diminishing association of reading self-concept items with reading achievement in 6th grade, Gc here has been taken to be indicated by reading comprehension and vocabulary tests (RA6, VO6), along with perseverance (P62), fear (A62), and the ability to concentrate (P61). The two alternative models are presented in Figure 9.2.

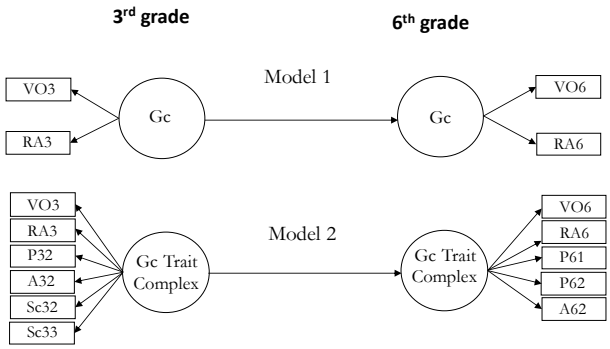

Figure 9.2 Two hypothesized models to represent Gc trait complexes.
Model 1 is the narrow Gc factor without socioemotional indicators; Model 2 adds items measuring fear, perseverance, and self-concept for 3rd grade, but includes perseverance, fear, and concentration in 6th grade.

9.4 Model Estimation

All models were estimated with the weighted least square estimators with robust standard errors and mean and variance adjusted chi-squared test statistics (WLSMV) implemented in Mplus. The WLSMV estimator is suitable when dealing with non-normal or categorical data, since it is robust to violations of multivariate normality (Glanville & Wildhagen, 2007; Muthén & Muthén, 1998-2012). All dichotomous items were declared as categorical in *Mplus* version 7.4.

Missing data was handled by using full information maximum likelihood (FIML), which uses all available data points (n = 9080) to estimate the model parameters (Muthen & Shedden, 1999).

The models were evaluated by assessing the strength of factor loadings, theoretical interpretability of the solution, and the goodness-of-fit statistics (Brown, 2006; Campbell-Sills, Liverant, & Brown, 2004). In addition, modification indices were screened to identify local areas of strain in the models.

9.5 Results

9.5.1 Descriptive statistics

Table 9.1 presents descriptive statistics for the observed variables questionnaire items. The distributions across the items remained relatively stable between 3rd and 6th grade, except for the following three items: "Are you afraid of someone at school?" "Do you worry about things that happen at school?" and "Do you do your very best, even in subjects that you find boring?" These three items showed relatively large differences in the percentage of yes-responses (Table 9.1). More precisely, 32% of the respondents answered yes to fearing someone at school in 3rd grade, compared to 20% in 6th grade. In addition, 24% of the students worried about things that happened at school in 3rd grade, compared to 14% in 6th grade. Finally, the percentage of respondents stating that they did their best, even in subjects that they find boring, was 91% in 3rd grade. In 6th grade, this share dropped to 77%, i.e., a decrease of 14 percentage points between 3rd and 6th grade.

Table 9.1 Descriptive statistics for socioemotional variables used in the analyses (3rd and 6th grade). Headings in bold font illustrate latent variables (Anxiety, Academic self-concept, and Perseverance)

3rd Grade	Abbrev.	Prop. Yes	Prop. No	N	Missing
Anxiety (A)					
- Scared about having to answer questions in school?	(A31)	.10	.90	8443	637
- Are you afraid of someone at school?	(A32)	.32	.68	8423	657
- Worry about things that happen in school?	(A33)	.24	.76	8411	669
Academic self-concept (Sc)					
- Do you think you are good at mathematics?	(Sc31)	.75	.25	8410	670
- Do you think you are good at spelling?	(Sc32)	.67	.33	8385	695
- Do you think you are good at reading?	(Sc33)	.81	.19	8412	668
- Do you think you are good in school?	(Sc34)	.74	.26	8302	778
Perseverance (P)					
- Do you sit often and think of other things when you are going to do maths or write in school? (R)	(P31)	.70	.30	8437	643
- Is it easy to give up if you get a difficult task? (R)	(P32)	.90	.10	8473	607
- Do you do your very best, even in subjects that you find boring?	(P33)	.91	.09	8458	622
6th Grade					
Anxiety (A)					
- Think it is unpleasant to answer questions in school?	(A61)	.11	.89	7754	1326
- Do you fear someone at school?	(A62)	.20	.80	7743	1337
- Worry about things that happen in school?	(A63)	.14	.86	7689	1391
Academic self-concept (Sc)					
- Do you think you are good at mathematics?	(Sc61)	.80	.20	7603	1477
- Do you think you are good at spelling?	(Sc62)	.74	.26	7638	1442
- Do you think you are good at reading?	(Sc63)	.87	.13	7683	1397
- Do you think you are good in school?	(Sc64)	.80	.20	7452	1628
Perseverance (P)					
- Do you sit often and think of other things when you are going to do maths or write in school? (R)	(P61)	.63	.37	7652	1428
- Is it easy to give up if you get a difficult task? (R)	(P62)	.88	.12	7714	1366
- Do you do your very best, even in subjects that you find boring?	(P63)	.77	.23	7709	1371

Note: *Abbrev. = Abbreviation of item to each latent variable. Prop. Yes = Proportion of respondents answered Yes. Prop. No = Proportion of respondents answered No. N = number of respondents who have answered the item in question. Missing = Number of respondents who have not answered the item in question. (R) indicates that these questions have been reverse coded. For example, 70 percent answered "No" to the question: "Do you sit often and think about other things when you are going to do maths or write in school?" in 3rd grade. The answers have been reverse coded so it means that 70 percent states that they do not sit and think of other things… …in school?*

The Gf items consisted of a mathematical test with a maximum score of 15 points in 3rd grade and 19 points in 6th grade. A spatial ability test was administered in both 3rd and 6th grades. In addition, the respondents answered an inductive (number series) test in 6th grade. Most of the means were close to the middle point of the distribution, e.g., the mean of the spatial ability test in 3rd grade was 15.6 with a maximum value of 30 and a minimum value of 0 – see Table 9.2 below. The missing values increased from 7-8% in 3rd grade to approximately 15% in 6th grade. This pattern was similar to the socioemotional items and the Gc items.

Table 9.2 Descriptive statistics of Gf items in 3rd and 6th grade

	Abbrev.	*Mean*	*Std.*	*Min*	*Max*	*N (%)*	*Missing (N)*
Gf, 3rd Grade							
Mathematical Ability Test	(MA3)	8.08	3.22	0	15	8465 (93)	615
Spatial Ability Test	(SA3)	15.60	6.45	0	30	8472 (93)	608
Gf, 6th Grade							
Mathematical Ability Test	(MA6)	13.57	3.22	0	19	7640 (84)	1440
Spatial Ability Test	(SA6)	24.80	7.40	0	40	7713 (85)	1367
Inductive Ability Test	(IND6)	22.38	8.21	0	40	7702 (85)	1378

Note: Abbrev. = Abbreviation of the item used in the measurement model, Std. = Standard deviation, Min = Minimum value, Max = Maximum value, N = Total number of valid respondents with percentage within parenthesis, Missing (N) = Total number of missing respondents.

The Gc tests included a vocabulary (synonyms in 3rd grade and antonyms in 6th grade) test and reading ability tests in both 3rd and 6th grade as described in Table 9.3 (see also Section 8.2).

Table 9.3 Descriptive statistics of Gc items in 3rd and 6th grade

	Abbrev.	*Mean*	*Std.*	*Min*	*Max*	*N (%)*	*Missing (N)*
Gc, 3rd Grade							
Verbal Opposite Ability Test	(VO3)	19.17	7.41	1	40	8481 (93)	599
Reading Ability Test	(RA3)	26.08	4.09	1	32	8442 (93)	638
Gc, 6th Grade							
Verbal Opposite Ability Test	(VO6)	23.27	6.01	0	40	7743 (85)	1337
Reading Ability Test	(RA6)	25.47	2.00	0	27	7722 (85)	1358

Note: Abbrev. = Abbreviation of the item used in the measurement model, Std. = Standard deviation, Min = Minimum value, Max = Maximum value, N = Total number of valid respondents with percentage within parenthesis, Missing (N) = Total number of missing respondents.

In both vocabulary tests, the maximum reported value was 40. However, the mean was 19.2 points in 3rd grade and 23.3 points in 6th grade, which may indicate that the students performed somewhat better on the test administered in 6th grade. However, the items were not identical, so the tests were not necessarily equally difficult. A similar pattern was observed for the reading ability tests in 3rd and 6th grade.

9.5.2 Estimates of Structural Relations in Model 1

To investigate the dynamic relationships between cognitive and socioemotional constructs (i.e., between 3rd and 6th grade), a cross-lagged model was fitted to data (Model 1, Figure 10.1). Although the initial models had RMSEA values of .058, showing good model fit, the CFI stayed as low as .88. Screening the modification indices identified several local areas of strain in the model. In total, 16 residual covariances of the corresponding items measured in 3rd and 6th grades were taken into account. For example, the residual of the item "Do you think you are good at reading?" in 3rd grade was correlated with the residual of the item "Do you think you are good at reading?" in 6th grade.

As described in Section 8.3.3, the favored goodness-of-fit index with the WSMLV estimator is RMSEA. The results for this indicator, along with other well-established indices are presented in Table 9.4.

Table 9.4. Goodness of fit indices for Models 1 and 2.

Model	No of parameters	Df	χ^2	RSMEA	CFI	WRMR
Model 1	128	316	4968.768	0.041	0.920	3.143
Model 2	135	309	3431.099	0.034	0.946	2.497

Note: The SRMR is replaced with the weighted root mean square residual (WRMR) with ordered categorical data using the WLSMV estimator, of which no standards are available. However, some researchers suggest that WRMR should be ≤1.

All indices suggest a similar pattern of results, the fit being the worst for Model 1, while a somewhat better fit is obtained for Model 2. Nevertheless, the fit for both models may be regarded as acceptable.

Given the good fit of both models, the estimates of the structural relations in Model 1 are presented first. Then, the issue of the Gc trait complex is addressed through comparisons of the factor loadings on Gc in the two models, along with comparisons of the estimates of the structural relationships across the models.

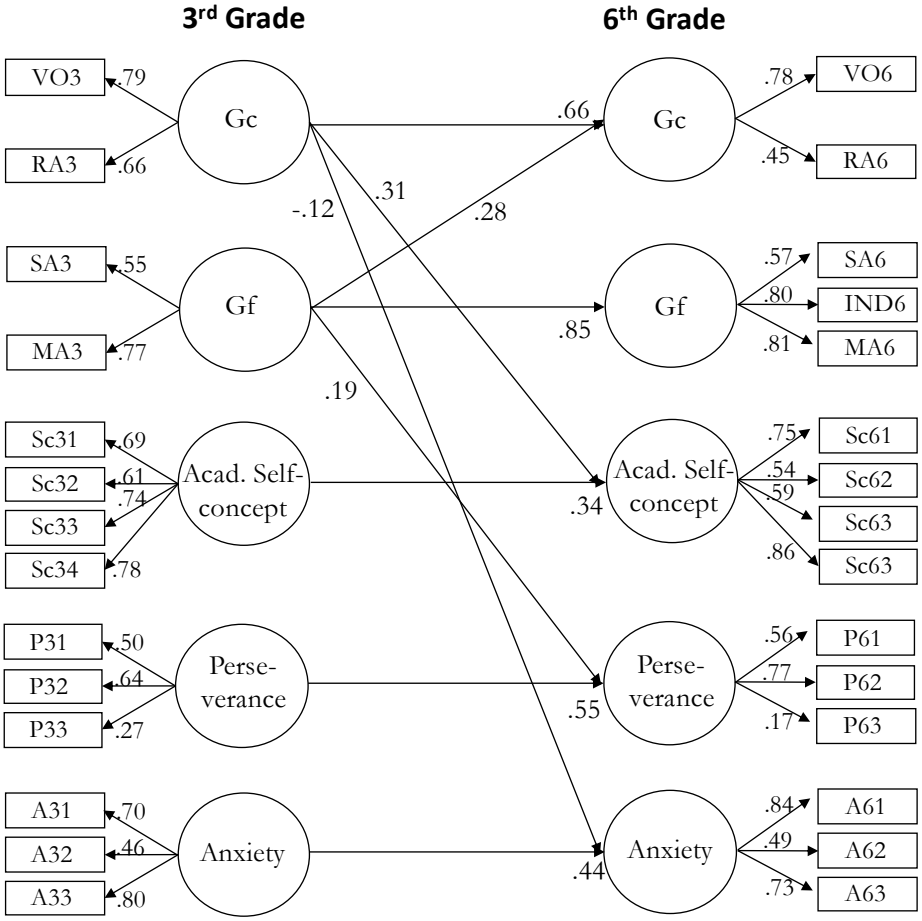

Figure 9.3. Model 1. Structural equation model with standardized regression weights for path coefficients ($p < 0.05$) between 3rd and 6th grade.

Only significant regression coefficients were presented in the path-diagram for the sake of simplicity. All latent variables were correlated with each other within each grade, and those in 6th grade were regressed on those in 3rd grade (i.e., saturated model). Squares represent manifest variables along with their factor loadings and ovals represent latent variables. Solid lines represent significant paths.

The results provide supporting evidence for the Investment Hypothesis as a significant path coefficient of .28 was found between Gf in 3rd grade and Gc in 6th grade, even after controlling for prior levels of Gc. In addition, prior levels of Gf influenced subsequent levels of perseverance positively ($\beta = .19$).

Gc influenced more socioemotional constructs than Gf did. Gc had a positive effect on Academic Self-Concept ($\beta = .31$). Gc also had a negative

impact on Anxiety (β = -.12), i.e., the higher the Gc, the lower the Anxiety, controlling for prior levels of Anxiety.

The strongest autoregressive relations were found between the cognitive variables. The autoregressive coefficient was .85 for Gf between 3rd and 6th grade, and .66 for Gc. The autoregressive coefficients for Anxiety, perseverance, and Academic Self-Concept were .44, .55, and .34, respectively.

9.5.3 Model 2 - evidence for a Gc trait complex

Estimates of factor loadings and structural relations in Model 2 are presented in Figure 9.4

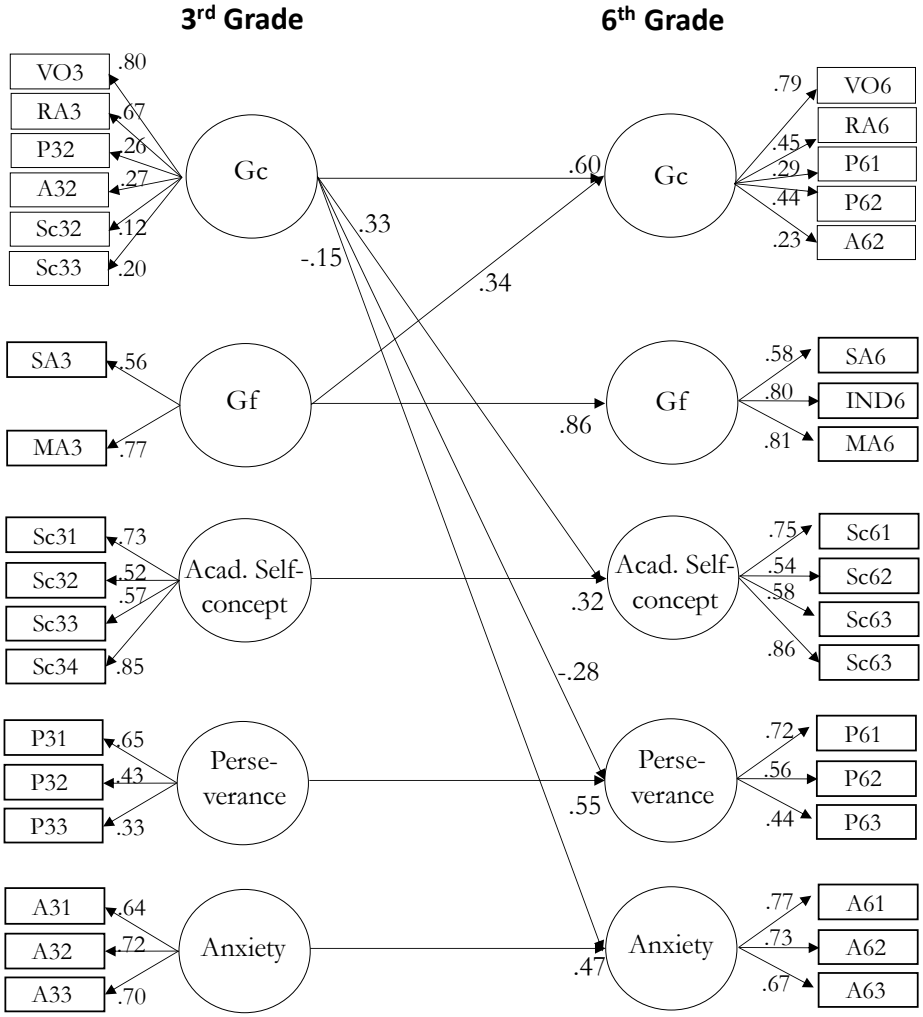

Figure 9.4. Model 2. Structural equation model with standardized regression weights for path coefficients ($p < 0.05$) between 3rd and 6th grade

Squares represent manifest variables along with their factor loadings and ovals represent latent variables. Solid lines represent significant paths. Non-significant paths are not shown for model simplicity purposes.

The results from this analysis are very similar to those of Model 1, with minor exceptions. In Model 2, no significant relationship is found between Gf and perseverance. Instead, Gc is negatively related to perseverance ($\beta = -.28$). This implies that higher levels of Gc lowers subsequent levels of perseverance, controlling for prior levels of perseverance.

Furthermore, the zero-order correlations between the latent variables of Model 1 and Model 2 are similar as shown in Table 9.5, with few exceptions.

Table 9.5. Zero-order correlations between the latent variables of model 1 and model 2 in 3rd and 6th grades

	3rd Grade					6th Grade				
	1	2	3	4	5	1	2	3	4	5
1. Gc	1.00	.80	.17	.32	-.34	1.00	.90	-.27	.50	-.36
2. Gf	.82	1.00	.21	.30	-.39	.89	1.00	-.13	.48	-.33
3. Perseverance	.35	.37	1.00	.61	-.61	.26	.35	1.00	.36	-.21
4. Acad. Self-Concept	.42	.36	.67	1.00	-.40	.49	.48	.62	1.00	-.49
5. Anxiety	-.23	-.31	-.66	-.38	1.00	-.27	-.25	-.42	-.47	1.00

Note: The upper diagonal shows the zero-order correlations between the latent variables in Model 2, whereas the lower part describes the zero-order correlations for Model 1. All zero-order correlations are significant at 0.01 level.

In 3rd grade, perseverance is positively related to Gc and Gf for both Model 1 and Model 2. However, in 6th grade, perseverance is negatively associated with Gc and Gf (r = -.26, and r = -.13 respectively).

Model 2 showed better model fit than Model 1, as it was associated with the lowest RMSEA value of .034. The established Gc measures showed strong factor loadings, with loadings around .80 for vocabulary and .66 for reading comprehension in 3rd grade. In the 6th grade models, the reading comprehension test had lower loadings (.44). This estimate was also found in Model 1, so the most likely explanation of the relatively low loading is that the test had low reliability. The added personality items had relatively weak loadings on Gc, ranging between .11 and .29 in 3rd grade, and between .11 and .43 in the 6th grade in Model 2. In Model 2, the factor loadings for the reading and writing self-concept items were weak (around .12 and .20) in 3rd grade. In addition, the factor loadings for perseverance and fear were .26 and .27, respectively, in 3rd grade. However, the factor loading for perseverance increased to .44 in 6th grade. The remaining loadings for fear and the ability to concentrate were .23 and .28, respectively. Thus, the perseverance items showed the strongest factor loading among the socioemotional items.

Table 9.6 Cross-lagged effects between cognitive skills and socioemotional traits in 3rd and 6th grade. Standardized path coefficients and 95% bootstrap confidence intervals.

	Model 1				Model 2			
	Coeffi-cients	*LCI*	*UCI*	*T-value*	*Coeffi-cients*	*LCI*	*UCI*	*T-value*
DV: Gc 6	*ON*				*ON*			
Gc 3	0.66	0.54	0.77	11.16	0.60	0.50	0.70	12.06
Gf 3	0.28	0.17	0.40	4.82	0.34	0.24	0.44	6.62
Perseverance 3	-0.04	-0.17	0.08	-0.59	-0.05	-0.15	0.04	-1.05
Acad. Self-Concept 3	-0.04	-0.11	0.04	-1.03	-0.03	-0.09	0.03	-0.93
Anxiety 3	-0.05	-0.13	0.03	-1.16	-0.04	-0.11	0.03	-1.07
DV: Gf 6	*ON*				*ON*			
Gc 3	0.04	-0.06	0.11	0.87	0.04	-0.04	0.11	0.10
Gf 3	0.85	0.76	0.93	18.59	0.86	0.78	0.94	20.92
Perseverance 3	0.03	-0.08	0.12	0.49	0.03	-0.05	0.11	0.73
Acad. Self-Concept 3	-0.02	-0.09	0.03	-0.68	-0.02	-0.08	0.03	-0.90
Anxiety 3	0.01	-0.05	0.07	0.40	0.02	-0.04	0.08	0.58
DV: Acad. Self-Concept 6	*ON*				*ON*			
Gc 3	0.31	0.20	0.39	5.68	0.33	0.24	0.43	7.04
Gf 3	0.08	-0.03	0.17	1.47	0.09	-0.01	0.18	1.76
Perseverance 3	0.03	-0.14	0.17	0.31	0.04	-0.08	0.16	0.57
Acad. Self-Concept 3	0.34	0.24	0.42	6.81	0.33	0.24	0.40	8.13
Anxiety 3	-0.06	-0.16	0.02	-1.18	-0.06	-0.15	0.03	-1.36
DV: Anxiety 6	*ON*				*ON*			
Gc 3	-0.12	-0.24	-0.01	-1.95	-0.15	-0.25	-0.04	-2.64
Gf 3	-0.01	-0.14	0.10	-0.14	-0.02	-0.13	0.08	-0.40
Perseverance 3	-0.06	-0.26	0.11	-0.58	-0.04	-0.17	0.11	-0.48
Acad. Self-Concept 3	0.01	-0.11	0.10	0.01	0.01	-0.08	0.10	0.31
Anxiety 3	0.44	0.31	0.55	6.73	0.47	0.37	0.57	8.96
DV: Perseverance 6	*ON*				*ON*			
Gc 3	-0.10	-0.25	0.02	-1.31	-0.28	-0.41	-0.14	-4.07
Gf 3	0.19	0.03	0.31	2.35	-0.01	-0.14	0.13	-0.07
Perseverance 3	0.55	0.30	0.82	3.67	0.55	0.36	0.77	5.10
Acad. Self-Concept 3	-0.05	-0.23	0.08	-0.56	-0.03	-0.16	0.09	-0.39
Anxiety 3	0.06	-0.10	0.22	0.60	0.09	-0.04	0.25	1.26

Note: The same adjusted residual correlations as those modeled in Model 1 have been used. Grey shaded values indicate significance. DV = Dependent variable. LCI = Lower Confidence interval, UCI = Upper Confidence interval. LCI and UCI values are the 95% confidence intervals for the standardized coefficients estimated with bootstrap procedure with 5000 resamples.

The path coefficients were generally quite similar across both models. For example, the path from Gf in 3rd grade to Gc in 6th grade was .28 in Model 1 and .34 in Model 2. As shown in Table 9.6, all estimates in the models are statistically insignificant between the models, except from the prediction of perseverance in 6th grade.

9.6 Discussion and conclusions

9.6.1 A Gc Trait Complex?

The results from Model 2 provide some, but weak, support for a Gc trait complex, in that the loadings of the socioemotional items on Gc were positive and significant. Although the perseverance item in 6th grade showed a higher factor loading than .30, the remaining factor loadings of the overlapping socioemotional items showed weaker factor loadings on the Gc trait complex in 3rd and 6th grade.

The question is, however, how such a trait complex could be interpreted. In the case of Gc, the discussion about its conceptualization has mainly revolved around a narrower definition in terms of verbal comprehension versus a broader conceptualization in terms of knowledge and skills across heterogeneous domains (cf. Kan et al., 2011). However, it is interesting to observe that Alexander (1935) interpreted the X factor as a school adaptation factor, emphasizing motivation, interest, and support from the home. While the present model does not include measures of motivation and interest, it could be argued that perseverance and Academic Self-Concept both may be interpreted as indicators of school adaptation. The Anxiety item also refers to the school situation. It may, thus, tentatively be suggested that the mixture of cognitive and socioemotional items loading together on the Gc factor may be interpreted in terms of school adaptation. This hypothesis is also supported by the increase of the factor loading measuring perseverance to .43 in Model 2, when the verbal self-concept items were removed and the ability to concentrate was introduced to the construct. This might be an indication of a possible involvement of perseverance in Gc. The involvement of grit in high-stake reading achievement tests has also been reported by Duckworth, Peterson, Matthews, & Kelly (2007). These hypotheses could relatively easily be investigated in further research with data in the ETF database.

It may also be noted, that even though there were some slight differences in the estimates of the path coefficients across the three models, the overall impression was one of great stability and robustness of the structural relations. This is reassuring, given that they are of considerable substantive interest.

9.6.2 Does Gf Influence Development of Gc?

Support for the Cattell (1987) Investment Hypothesis, stipulating a direct influence of Gf on Gc, was found. This finding is in line with some previous studies (e.g., Thorsén, 2014), showing that Gf has a positive effect on the development of knowledge and skills as students advance through primary school. Gf reflects a person's ability to learn. Individuals who score high on Gf tests are better able to identify underlying principles to solve novel problems using logical thinking, compared to peers who score low on such tests (Schneider & McGrew, 2013). Mastering language requires phonological awareness and awareness of the grammatical rules of one's language (McGrew & Flanagan, 1998). Thus, the effect of previous levels of Gf on subsequent levels of Gc might reflect the increased complexity of the school tasks that the students meet, which requires an increasing investment of Gf. Hence, Gf, which reflects individual differences in cognitive processing, seems to play a vital role in knowledge acquisition in primary school. As a result, what has been achieved with Gf is added to a person's Gc.

Although the Investment Hypothesis is straightforward, few studies have found evidence in favor of it. Perhaps one explanation as to why studies have not found support of the Investment Hypothesis might be the use of heterogenous samples. For example, Schmidt and Crano (1974) found evidence of the Investment Hypothesis for middle-class students, but not for low SES students. This suggests that different subgroups within their population did not have similar opportunities to acquire the knowledge tested in the tests. This conclusion was also reached by Kvist and Gustafsson (2008). They demonstrated that *g* and Gf were equal entities in homogenous samples, and that Gc was equal to verbal comprehension. In homogenous samples, all subgroups have similar opportunities to develop Gc through logical and abstract thinking.

9.6.3 Does Gc influence Gf negatively?

The analyses showed no significant influence of previous levels of Gc on subsequent levels of Gf. Some studies (e.g., McArdle, 2001) found, based on the hypothesis of functional fixedness, that previous levels of Gc influenced subsequent levels of Gf negatively. However, in the context of Gc-Gf, no longitudinal study has provided evidence of functional fixedness as a driver of the negative effect of previous levels of Gc on subsequent levels of Gf, controlling for prior levels of Gf. Therefore, the negative relationship between Gc and Gf in terms of functional fixedness should be interpreted with caution, and possible alternative explanations could be sought, especially since these models showed no significant effect of Gc on Gf.

In addition, future research might investigate a possible interaction effect with verbal self-concept on the relationship between previous levels of Gc and subsequent levels of Gf. Although there is a positive relationship between Gf and Gc, the I/E frame of reference model postulates a negative correlation between verbal self-concept and numeric self-concept. A previous meta-analysis study (Möller et al., 2009) reported that the negative relationship between verbal achievement and math self-concept was stronger (β = -.27) than math achievement on verbal self-concept (β = -.21). The more verbally orientated the students think they are, the less numerically orientated they believe they are. Thus, a possible interaction effect of verbal self-concept on the relationship between Gc and Gf might also explain the mixed results reported by previous studies and the results in this thesis. The mixed results might be an indication of population heterogeneity, which should be explored in future studies.

Furthermore, the causal relationship between Gc and Gf could also be affected by the measurement of Gc. Although Gc is usually measured by vocabulary and reading comprehension tests, Cattell's (1971) original definition of Gc was broad and covered knowledge across many domains. Future longitudinal studies should investigate how a narrow versus broad definition of Gc affects the causal relationship between Gc and Gf. However, the robustness of the structural relations against different operationalizations of Gc appear to be reassuring.

9.6.4 Negative Effects of Gf on Perseverance?

The negative effect of Gf on perseverance and procrastination refrainment, which has been reported by previous investigations (Demetriou et al., 2003; Chamorro-Premuzic & Arteche, 2008; Chamorro-Premuzic, Furnham, & Ackerman, 2006), was not replicated in Model 1. Instead, a positive effect was found between previous levels of Gf on subsequent levels of perseverance. Thus, no support was found for the Compensation hypothesis.

The positive effect of Gf on perseverance could be attributed to the nature of problem-solving tasks. Such tasks require a large amount of concentration and mental effort. This means that working with problem-solving tasks also means that the individual enhances his or her ability to stay focused and to persevere. Hence, finding a positive relationship between Gf and perseverance in this thesis could be a consequence of the inclusion of a concentration ability item in the perseverance construct. If perseverance had been conceptualized in a different manner, a different result might have emerged. For example, Moutafi, Furnham, and Crump (2006) reported that order, self-discipline, and deliberation (facets of conscientiousness) are negatively related to Gf. In this thesis, perseverance and procrastination refrainment were used as indicators of latent perseverance.

Another explanation for the mixed findings could be related to the measurement of Gc, as the results in Model 2 diverged from Model 1. In Model 2, no significant effect was found for the influence of Gf on perseverance. Instead, previous levels of Gc was negatively related to subsequent levels of perseverance. Children that are successful at school do not have to spend a lot of time and effort on a task, an explanation provided by Macklem (2015).

However, since Model 1 and Model 2 diverged in the prediction of perseverance in 6th grade, the positive causal effect between previous levels of Gf on subsequent levels of perseverance and the negative effect of Gc on perseverance should be interpreted with caution.

9.6.5 How are Gc and Academic Self-Concept Related?

The relationship between Academic Self-Concept and achievement has been accounted for in terms of three models: (1) the Self-Enhancement Model, (2) the Skill-Development Model, and (3) the Reciprocal Model. Although many

studies have provided evidence for the Reciprocal Model, the results from the cross-lagged path analyses in this study show that only prior levels of Gc influenced Academic Self-Concept, controlling for prior levels of Academic Self-Concept. This finding is in line with Taube's (1988) research and with the Skill-Development Model. This suggests that self-concept is enhanced through Gc-related skill development. In addition, the path coefficient was the strongest among the effects that went from Gc to the socioemotional trait constructs (β =.33, Model 2).

9.6.6 Does Gc Reduce Anxiety?

The results from the analyses presented here indicate that higher Gc test scores reduce subsequent levels of anxiety. This finding is in line with Young et al. (2010), who argued that individuals that score high on trait anxiety (i.e., are generally anxious) might not be automatically anxious in test-taking situations. Depending on their personal histories and prior achievements, they might not feel more anxious than individuals who score low on trait anxiety items when taking a high-stakes test (Young, 2010). This might explain why prior levels of anxiety did not have any negative effects on subsequent levels of Gf or Gc. In addition, a student who scores high on the Gc achievement test has fewer reasons to feel anxious. High achievement scores are also associated with optimism and self-concept (Singh & Jha, 2013), which also has been found in the present study (i.e., the positive causal effect from Gc to Academic Self-Concept).

9.7 Educational importance

Previous studies (Horn, Donaldson & Engstrom, 1981; Belsky, 1990; Moutafi et al., 2004) have suggested that Gf has a declining trajectory after adolescence, while Gc increases in strength throughout the lifespan. This thesis provides evidence of a continuous influence of Gf in 3rd grade on the development of knowledge in primary school. As school advances and new tasks appear, the learner must invest fluid capacity in the learning process. However, once these tasks are learned, the student can rely more on his or her Gc. Hence, placing more emphasis on problem solving in teaching and assessments in primary school could lead to improved knowledge and understanding. Indeed, schools have been criticized for their inability to develop students' problem-solving

abilities and that classroom practices are characterized by students providing answers drawn from memory. Improving students' problem-solving abilities is one of the major challenges in education, since it is considered to be of importance in work life (Mayer & Wittrock, 2006; OECD, 2004). Therefore, Mayer and Wittrock (2006) suggested that schools need to educate students to improve their problem-solving abilities by creating tasks in which prior accumulated knowledge is of limited help to solve the problem, and in which well-defined goals are depicted. In this way, new knowledge can be acquired. In addition, by providing more stimulating tasks for students with high Gc, these students may also become more conscientious. Thus, the teaching will adapt to meet all students' needs, including those who find school demands to be low and tasks easy.

As a consequence of a continuous influence of Gf on the development of knowledge, this, in turn, increases students' Academic Self-Concept and lowers levels of trait anxiety. The results in this analysis highlight the importance of developing knowledge and not focusing on encouraging students to perform. Encouragement without knowledge development will not improve the student's Academic Self-Concept or Conscientiousness, or lower his or her anxiety. Instead, the underlying Investment Hypothesis appears to play a critical role in knowledge development as proposed by Cattell (1971), which, in turn, affects socioemotional constructs.

Chapter 10. The effects of cognitive and socioemotional traits on academic achievement

10.1 Introduction

The investigations presented here build upon the 6th grade model in the previous chapter, and extend this model in two ways. The first is that final grades from 9th grade in compulsory schooling are included in the model, and the second is that background variables are added to the model. The main aim is to determine the importance of cognitive and socioemotional traits in the prediction of academic achievement in 9th grade, and how effects of student background variables on achievement are mediated via such student traits. The more specific research questions that will be focused upon are:

RQ 2.1: What is the relative importance of cognitive and socioemotional traits in the prediction of academic achievement in 9th grade?

RQ 2.2: What are the direct and indirect effects of the student background variables, including SES, gender, parents' educational expectations, both parents living together, and ethnicity, on achievement in 9th grade, and how are the effects mediated via cognitive and socioemotional traits?

Previous investigations (e.g., Busato, Prins, Elshout, & Hamaker, 2000; Farsides & Woodfield, 2003; Gustafsson & Undheim, 1996) have demonstrated a solid link between intelligence and academic achievement. Intelligence has been found to be the strongest determinant of academic performance, with approximately 50% of the variation being attributed to intelligence (Gustafsson & Undheim, 1996). In a cross-lagged study, Watkins, Lei, and Canivez (2007) found that intelligence drives academic performance, but not vice versa, thus, providing evidence that intelligence causes academic achievement.

Although several studies have found that personality traits add variance far beyond Gf in predicting academic performance, expressed in terms of GPA (Di Fabio & Busoni, 2007; Furnham & Chamorro-Premuzic, 2004), few studies have included measures of Gc in order to investigate the validity of the Gf-Gc-model with respect to personality traits. In Chapter 9, support was found for the Gf-Gc model, according to Cattell's Investment Hypothesis. Evidence in support of the Investment Hypothesis has also been provided by Thorsén

(2014), and assumptions of its existence have been made by other researchers. For example, Fabio and Palazzeschi (2009) concluded: "Thus, even in this study, the influence exercised by Gf on performance seems to express itself through facilitating comprehension and learning in a scholastic context" (p. 584).

In addition, an ongoing discussion concerns the relative importance of cognitive abilities and socioemotional traits in the prediction of academic performance. In this regard, some studies (e.g., Moreira et al., 2012; Rosander, 2013; Spengler, Lüdtke, Martin, & Brunner, 2013) have reported that personality predicts academic performance to a higher extent than IQ.

Furthermore, children's social background, referred to as SES (socioeconomic status), has been identified as another important determinant of academic achievement. Some theorists (e.g., Bourdieu, 1986; Laosa, 1982) have argued that parental education plays a crucial role for the children's academic performance. For example, Laosa (1978) found that parents' education, and not their job position, was correlated with the child's personality. Highly educated parents tend to have higher educational expectations and demands on their children to perform at school. In line with this rationale, Bourdieu (1986) argued that, in a long-lasting process, parental cultural capital is transmitted to their child's educational attainment. In addition, Laosa (1982) argued that parents' education is related to how they foster their children, and, in this way, they promote the development of certain personality traits, such as exerting effort.

Research has found that children of parents with high educational expectations are prone to be more academically motivated and engaged at school. They also perform better on achievement tests and are, therefore, more likely to succeed at school (Beal & Crockett, 2010; Domina, Conley, & Farkas, 2011). Thus, educational expectations affect students' socioemotional traits.

Relationships have been identified between SES and performance on cognitive tests (Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998). Brook-Gunn et al. (2002) and Linver et al. (2002) have also demonstrated that families with higher SES supply their children with a stimulating home environment (including book reading), which mediates the relationship between SES and children's cognitive outcomes. Although neighborhood-level effects have been found to be much smaller than family-level effects, many investigations have reported negative relationships between neighborhood disadvantage and children's cognitive outcomes (e.g., Leventhal & Brooks-

Gunn, 2000; Schaefer-McDaniel et al., 2009). This finding is in line with the perception that parents with fewer economic resources have also less access to other types of resources, such as books, quality child care, child rearing, and extracurricular activities (Leventhal & Brooks-Gunn, 2000).

Farkas (2003) also suggested that parental resources are important for the development of socioemotional traits; when both parents live together, they can exert double parental child rearing resources compared to a single-parent household. Thus, it is important to include parents' SES, educational expectations, and whether parents live together as confounders in the analysis.

Finally, two other influential variables that affect academic achievement are gender and ethnicity. Research has demonstrated that girls outperform boys at various stages in the school system, i.e., have higher grades and reach tertiary education in higher numbers (Duckworth et al., 2015; Voyer & Voyer, 2014). However, no significant relationship has been found between gender and intelligence (Petuzzi & Orsini, 2016; Zell, Krizan, & Teeter, 2015).

Girls tend to show lower levels of Conscientiousness, but higher levels of Neuroticism as compared to boys (Soto, et al., 2011; Vecchione et al., 2012). However, Duckworth, et al. (2015) demonstrated that self-control, and not school motivation, contributed to explaining the gender differences in academic achievement. This finding is in line with previous studies indicating that girls spend more time and effort on school-related work in middle school (e.g., participating in class, completing homework) compared to boys (Jacob, 2002; Willingham, Pollack, & Lewis, 2002).

In conclusion, prior research has not only found that grades are influenced by behavioral, attitudinal, and personality traits (Lekholm & Cliffordson, 2008; Noftle & Robins, 2007), but also by gender, SES, parents' educational expectations, both parents living together, and ethnicity.

10.2 The variables

This analysis encompasses 6th grade and 9th grade, and includes measures of Anxiety, Academic Self-Concept, perseverance and procrastination refrainment, Gf, Gc, and academic achievement. In addition, the model includes the background variables of gender, SES, parents' educational expectations, whether both parents live together, and ethnicity.

The 6th grade model was described in the previous chapter, and the variables included in this model were described in Chapter 8. Academic achievement in

9th grade was measured by grades in Swedish, English, and Mathematics, and more detailed information about these variables and the process of grading is available in Chapter 8.2.1.

SES is often measured by parents' occupation, education, or income (Bradley & Crowyn, 2002). In this thesis, the SES variable is a combination of occupation and education measured when children attended 3rd grade. The SES variable has three categories: Low SES, Middle SES, and High SES. Although this variable is ordinal, it has been treated as continuous. Using it as a dummy coded variable or as a continuous variable does not affect the estimations.

Parents' educational expectations were measured as parents' perception of how many additional years of study they expect that their child will pursue after completing compulsory schooling. This variable was coded as (1 = No more years, 2 = 1 more year, 3 = 2 or 4 more years, and 4 = 4 years or more), and it also was treated as a continuous variable.

Ethnicity is dichotomized into one category encompassing the group with both parents born in Sweden vs all others (1 = Both parents Swedish, 0 = Other).

Parents living together or not is also a dichotomous variable (1 = Both parents live together, 0 = Other).

10.3 Results

The model was constructed in such a way that a sixth latent variable (AcadAch) indicated by the three grades assigned in 9th grade was added to the five latent variables in the 6th grade model. The correlations between AcadAch and the other latent variables were all significant, and were all positive, except for Anxiety (Table 10.1). The highest correlation was observed between Gc and AcadAch (.81) followed by Gc-Gf (.78), and Gf-AcadAch (.74). There also was a strong relationship between AcadAch and Academic Self-Concept (.54) and a moderate correlation with Perseverance (.36). Anxiety was negatively correlated with all latent variables, and most strongly so with Academic Self-Concept (-.46).

This pattern of correlations is in agreement with previously reported research, but it may be observed that Gc measured three years before the grades were assigned accounted for 66% of the variance in AcadAch. This is higher than the typical estimate of around 50% explained variance that is reported in

the literature. However, one partial explanation for this high estimate is that it is based on two latent variables, so the relation is not attenuated by errors of measurement in observed variables.

Table 10.1 Zero-order correlations between cognitive abilities, socioemotional traits, academic achievement, and background variables

	1	2	3	4	5	6	7	8	9	10	11
1. Grades											
2. Gc	0.81**										
3. Gf	0.74**	0.78**									
4. Perseverance	0.36**	0.21**	0.29**								
5. Acad. Self-Concept	0.54**	0.48**	0.46**	0.60**							
6. Anxiety	-0.20**	-0.24**	-0.22**	-0.40**	-0.46**						
7. Female	0.22**	0.08**	-0.02	0.03	-0.03	0.19**					
8. SES	0.35**	0.29**	0.28**	0.13**	0.19**	-0.12**	-0.01				
9. Both parents live together	0.12**	0.04*	0.08**	0.11**	0.06*	-0.04*	-0.01	0.10**			
10. Both parents Swedish	0.06**	0.17**	0.10**	0.04*	0.05*	-0.05*	0.01	0.14**	0.07**		
11. Educational Expectations	0.37**	0.35**	0.32**	0.10**	0.24**	-0.10**	-0.01	0.35**	0.06**	-0.03*	

*Note: Acad. Self-Concept = Academic Self-Concept, SES = Socioeconomic Status, **p < 0.01, *p < 0.05.*

The parameter estimates for the measurement model were more-or-less identical with those reported for the latent variables in the 6th grade part of the model in Chapter 9 (Figure 9.3 and Figure 10.1). This is to be expected, given that they are based on the same data, but it is reassuring to see that the models are stable across contexts.

The structural model was specified in such a way that all five latent 6th grade variables were hypothesized to influence AcadAch. However, in line with the results concerning the Investment Model in the previous chapter, Gf was specified to influence Gc, as well (see Figure 10.1). With this specification, Gf has both a direct and an indirect effect on AcadAch.

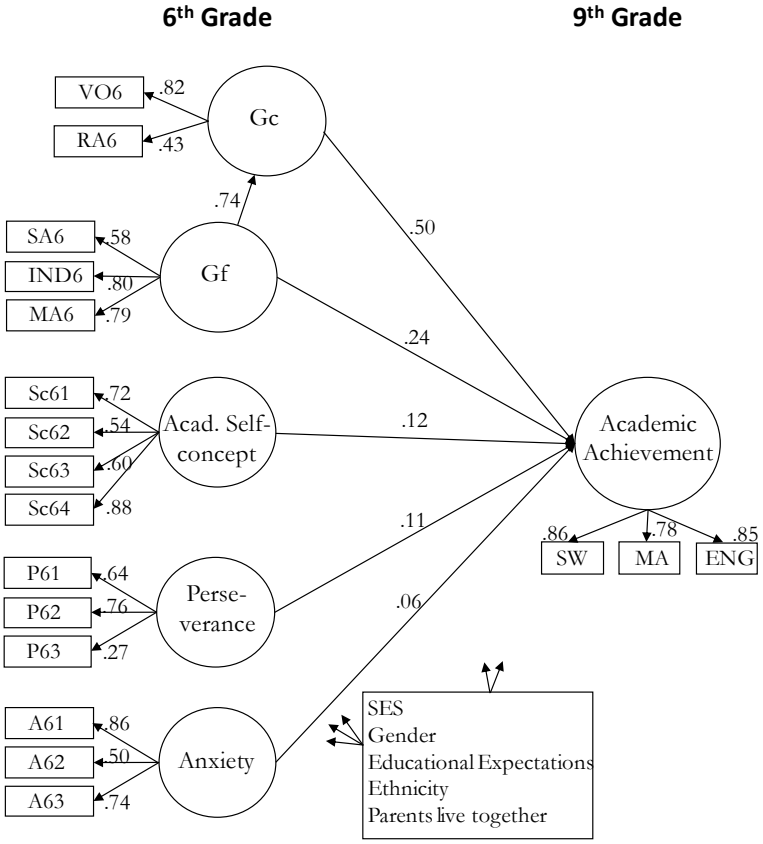

Figure 10.1 Direct effects (path model) of socioemotional traits and cognitive abilities on academic achievement.

All latent variables were measured in grade 6 except from academic achievement which was measured in grade 9. Structural equation model with standardized regression weights for path coefficients ($p < 0.05$) between 3rd and 6th grade. Squares represent manifest variables along with their factor loadings and ovals represent latent variables. Solid lines represent significant paths.

In the structural model, Gc had the strongest direct effect on AcadAch ($\beta = .50$). The second strongest direct effect was found between Gf and AcadAch ($\beta = .24$, $p < 0.0$). However, the indirect effect of Gf on AcadAch via Gc was even stronger than the direct effect ($\beta = .37$) (see Table 10.2). In addition, Academic Self-Concept ($\beta = .12$, $p < 0.001$), perseverance ($\beta = .11$, 0.001), and Anxiety ($\beta = .05$, $p < 0.008$) all had positive direct effects on AcadAch.

The largest direct effects of the control variables were found between gender and academic achievement ($\beta_{standardized} = .18$), followed by socioeconomic status ($\beta_{standardized} = .09$).

Furthermore, several background variables were associated with several cognitive abilities, socioemotional traits, and grades. Both SES and parents' educational expectations had the strongest influence on Gf and Academic Self-Concept. Gc was mostly influenced by gender (being female) and parents' educational expectations (see Table 10.2).

Table 10.2 Direct effects of endogenous and exogenous variables on dependent variables. Standardized coefficients with 95% confidence intervals

Variables	*Coeffi-cients*	*LCI*	*UCI*	*T-value*	Variables	*Coeffi-cients*	*LCI*	*UCI*	*T-value*
DV: Academic Achievement					***DV: Acad. Self-Concept 6***				
Gc	0.50	0.37	0.66	6.48	Female	-0.03	-0.07	0.01	-1.63
Gf	0.24	0.11	0.34	3.86	SES	0.11	0.07	0.15	5.20
Pers.	0.11	0.05	0.18	3.34	BPTG	0.04	-0.00	0.07	1.91
Asc	0.12	0.03	0.19	2.95	BPSW	0.01	-0.03	0.04	0.30
Anxiety	0.06	0.01	0.10	2.34	PEE	0.19	0.16	0.23	10.38
Female	0.18	0.15	0.22	10.63					
SES	0.09	0.07	0.12	7.30	***DV: Anxiety 6***				
BPTG	0.06	0.03	0.08	4.66	Female	0.16	0.11	0.20	7.22
BPSW	-0.04	-0.06	0.01	-3.04	SES	-0.07	-0.12	-0.03	-3.12
PEE	0.06	0.03	0.08	3.87	BPTG	-0.01	-0.06	0.03	-0.64
					BPSW	-0.03	-0.07	0.02	-1.22
DV: Gc					PEE	-0.07	-0.11	-0.03	-3.31
Gf	0.74	0.69	0.78	30.92					
Female	0.10	0.07	0.13	7.15	***DV: Perseverance 6***				
SES	0.05	0.02	0.08	3.46	Female	0.04	-0.01	0.09	1.64
BPTG	-0.03	-0.06	0.01	-2.44	SES	0.06	0.01	0.11	2.17
BPSW	0.04	0.02	0.07	3.02	BPTG	0.09	0.05	0.14	4.12
PEE	0.10	0.07	0.13	5.91	BPSW	0.00	-0.05	0.05	0.01
					PEE	0.05	0.01	0.10	2.31
DV: Gf 6									
Female	-0.03	-0.06	0.00	-1.68					
SES	0.16	0.13	0.19	9.60					
BPTG	0.04	0.01	0.08	2.77					
BPSW	0.02	-0.01	0.05	1.30					
PEE	0.26	0.23	0.29	15.77					

Note: Academic achievement is measured in 9th grade, whereas all the remaining dependent variables were measured in 6th grade. Pers. = Perseverance, Asc = Academic self-concept, SES = Socioeconomic status, BPTG = Both parents live together, BPSW = Both parents Swedish, PEE = Parents' educational expectations. DV = Dependent variable. LCI = Lower Confidence interval, UCI = Upper Confidence interval. LCI and UCI values are the 95% confidence intervals for the standardized coefficients estimated with bootstrap procedure with 5000 resamples. T-value: a higher value than 1.96 or lower than -1.96 indicates significance at 0.05 level.

Background variables that are significantly related to perseverance are SES, parents living together, and parents' educational expectations. Finally, grades are significantly influenced by all background variables, mostly by being female. All variables were positively related to grades, except ethnicity. Ethnicity

showed a small negative effect on academic achievement, suggesting that having two Swedish parents decreases the child's grades.

In the model, the background variables were entered as exogenous variables, which affected all the latent variables. Therefore, they exerted both direct and indirect effects on academic achievement.

The standardized direct, indirect, and total effects are presented in Table 10.3. The strongest total (direct and indirect) effect was found for parental educational expectations on academic achievement via Gf and Gc. The second strongest total effect was identified from gender and socioeconomic status on academic achievement, with the effect favoring girls. While the total indirect effect of gender on academic achievement was small, it was slightly larger for socioeconomic status. The total of indirect effects contains all paths from one variable to another mediated by at least one added variable (Bollen, 1987).

In addition, there were a couple of indirect effects from the background variables to academic achievement via cognitive abilities and socioemotional traits.

The strongest indirect effect was found between parents' educational expectations and academic achievement via Gc and Gf, which is in line with the Investment Hypothesis. Both parents' educational expectations and SES influence academic achievement through the same paths, suggesting that these factors are similarly related.

Moreover, gender (i.e., being female) influenced academic achievement only through Gc and Anxiety.

Table 10.3. Decomposition of the effects in total effects, total indirect and specific indirect effects. Standardized coefficients with 95% confidence intervals

Links	*Coefficients*	*LCI*	*UCI*	*T-value*
Female to Acad. Achievement				
Total effect	0.23	0.21	0.25	18.73
Total indirect	0.05	0.01	0.08	2.49
Specific Indirect Effects				
Female → Gc	0.05	0.03	0.08	4.07
Female → Anx	0.01	0.01	0.02	2.25
SES to Acad. Achievement				
Total effect	0.23	0.20	0.26	16.61
Total indirect	0.14	0.11	0.16	9.97
Specific Indirect Effects				
SES → Gf	0.04	0.02	0.06	3.58
SES → Gc	0.03	0.01	0.06	2.99
SES → Asc	0.01	0.01	0.02	2.58
SES → Gf → Gc	0.06	0.04	0.09	4.78
Edu. Exp. to Acad. Achievement				
Total effect	0.28	0.26	0.31	21.98
Total indirect	0.23	0.20	0.26	14.84
Specific Indirect Effects				
Edu. Exp. → Gf	0.06	0.03	0.09	3.76
Edu. Exp. → Gc	0.05	0.03	0.08	3.88
Edu. Exp. → Asc	0.02	0.01	0.04	2.81
Edu. Exp. → Gf → Gc	0.10	0.06	0.13	5.15
Both Parents Live Together (BPTG) to Acad. Achievement				
Total effect	0.08	0.05	0.11	5.90
Specific Indirect Effects				
BPTG → Gf	0.01	0.01	0.02	2.22
BPTG → Gc	-0.02	-0.03	-0.01	-2.19
BPTG → Perseverance	0.01	0.01	0.02	2.50
BPTG → Gf → Gc	0.02	0.01	0.03	2.41
Both Parents Swedish (BPSW) to Acad. Achievement				
Total indirect	0.03	0.01	0.06	2.41
Specific Indirect Effects				
BPSW → Gc	0.02	0.01	0.04	2.50

Note: Only significant effects are shown of case of simplicity. For abbreviations, see table 10.2

All other significant indirect effects to academic achievement were small, i.e., ≤.02 for variables, such as both parents living together and ethnicity – see Table 10.3.

10.4 Discussion

The results show that Gf is related to Gc and adds a direct effect in explaining academic achievement, expressed in terms of latent grades.

In line with previous studies, personality plays an important role in facilitating academic achievement, once cognitive abilities have been taken into consideration. This might suggest that, in a daily learning context in which the GPA is an aggregated measurement of a student's achievement assessed by the teachers, the ability to regulate one's behaviors is beneficial. Thus, the evidence demonstrates that teachers' assessments are influenced by students' behaviors. This might imply that less conscientious students do not earn as high grades as their highly conscientious peers, despite the same achievements. In a similar vein, Klapp Lekholm (2008) found that measures of grades are not objective, since they include socioemotional components.

Empirical results have shown that academic achievement, on the one hand, includes the ability to regulate feelings and thoughts that are orientated towards perseverance and Academic Self-Concept. On the other hand, Anxiety has been found to have a small, but positive, effect on achievement. This small effect might conceal a non-linear relationship between trait anxiety and academic achievement. One possible explanation for their facilitating influence on performance is that Anxiety and Academic Self-Concept are influenced by previous levels of Gc, which, in turn, is Gf driven, which was found as an answer to the first research question.

Another stream of cognitive ability influence on perseverance stems from Gf, which was previously found in this thesis. Prior meta-analytic studies (e.g., Poropat, 2009; 2011) reported that Conscientiousness showed the strongest association with academic achievement. In this case, the path coefficient was slightly lower, which might be explained by the negative causal relationship between Gf and perseverance. This finding was in line with the Compensation Hypothesis, which postulates that students with lower levels of Gf compensate for this shortage by becoming more conscientious in order to accomplish school tasks, while their peers with higher levels of Gf do not have to invest a

lot of effort into their school work and, thus, become less conscientious. This does not mean that individuals with higher levels of Gf and lower levels of Conscientiousness perform worse than peers with lower levels of Gf and higher levels of Conscientiousness. Instead, it implies that high Gf and less conscientious students do not have to struggle much in order to achieve. Such heterogeneity will have an attenuating effect on the relationship between perseverance and academic achievement.

Additionally, research has emphasized the importance of gender, SES, both parents living together, educational expectations, and ethnicity when it comes to examining the relationships between socioemotional traits and academic performance. The results indicate that girls attained higher grades than boys ($\beta_{direct} = .37$). However, except for the direct effect of Gf on Gc (the Investment Hypothesis), the strongest indirect effects were found between SES, parents' educational expectations, and academic achievement. In this analysis, evidence was also found for the relationship between SES and cognitive test scores, which is line with Klebanov, Brooks-Gunn, McCarton, and McCormick (1998). One explanation provided by Brook-Gunn et al. (2002) and Linver et al. (2002) is that families with higher SES are supplied with a stimulating home environment (including book reading), which mediates the relationship between SES and children's cognitive outcomes. In the present study, the strongest indirect effect among the background variables was found between parents' educational expectations and academic achievement, and between SES and academic performance. This finding is not surprising, since parents' educational expectations and socioeconomic status are correlated as found in Table 10.1. Although several studies (e.g., Benner & Mistry, 2007; Jeynes, 2007) have demonstrated that students whose parents have high educational expectations are more motivated and engaged at school, earn higher grades, score higher on achievement tests, and attain more education. Parents' educational expectations are also highly related to SES.

These indirect effects imply that high-SES students or students whose parents have high educational expectations have cognitive abilities and socioemotional traits that are more appropriate for academic achievement. In other words, the school setting is beneficial to children with these specific traits.

In line with previous research (e.g., Duckworth et al., 2015; Voyer & Voyer, 2014), girls outperformed boys in terms of academic achievement and scored higher on Gc (e.g., Hyde, 2005, 2014; Voyer & Voyer, 2014). One explanation provided is that girls are more interested, motivated, and exert more effort in

their schoolwork than boys, which is rewarded by the teachers (Klapp Lekholm & Cliffordson, 2009). However, the indirect effect of being a female on academic achievement via perseverance was non-significant. A possible hypothesis could be that the effect of gender on academic achievement is mediated via interest and motivation. Since interest and motivation variables were not part of the ETF database, the relationship between interest, motivation, and Gc could not be tested.

Contrary to previous studies (e.g., Duckworth et al., 2015), no indirect effect was found between being a girl, perseverance, and academic achievement. Instead a significant path was identified via Anxiety to academic achievement ($\beta_{indirect} = .01$).

The results contribute to the accumulated knowledge about factors influencing academic achievement, which have been identified as important in the field of educational psychology (O'Connor & Paunonen, 2007). In addition, previous studies investigating the relationships between socioemotional traits, intelligence, and academic achievement are conducted abroad. These results show the incremental predictive ability of socioemotional traits in predicting academic achievement can be accounted for in Sweden, as well.

Maybe one way to improve the educational outcomes of children with low-SES backgrounds could be that teachers should focus on raising these children's aspirations.

Chapter 11. The effects of cognitive and socioemotional traits on academic achievement and time to unemployment between 1991 and 2009

11.1 Introduction

This chapter aims at investigating the predictive ability of socioemotional and cognitive abilities and academic achievement on unemployment. The variables included in the model tested will be placed in chronological order. Thus, the model starts with the latent cognitive and socioemotional constructs (as measured in grade 6), followed by latent grades (measured in grade 9) predicting risk of unemployment between age 19 and age 37. Based on the findings in research question 1, in which a significant effect was found for Gf on Gc, the Gf-Gc relationship will be included in the model in this chapter.

Academic achievement, intelligence, and socioemotional traits have all been found to influence the odds of unemployment, especially for individuals who are new labor market entrants and have no or little work experience. For example, a person who is perceived as conscientious and optimistic during the job interview increases his or her chances to attain a job (Turban et al., 2009). Not only do personality traits have an impact on recruiters' assessments of an applicant's employability, but intelligence and academic achievement play a role, as well.

Screening for intelligence has been advocated (e.g., Schmidt & Hunter, 2000), since it is believed to be a strong determinant of future job performance (McDaniel & Banks, 2010). Nevertheless, research has reported mixed results regarding the effects of intelligence on the likelihood of receiving a job position. Some studies have suggested that a majority of workplaces tend to require problem-solving skills and the ability to communicate effectively (e.g., Kuhn & Weinberger, 2005). In contrast, other studies (e.g., Lindqvist & Vestman, 2011) have reported that intelligence does not influence the risk of being unemployed. Instead, Lindqvist and Vestman (2011) found that socioemotional traits reduced the duration of unemployment, once being unemployed. In addition, research has reported mixed results regarding the effect of Conscientiousness on the event of unemployment. Some studies have reported a negative

association, whereas other studies have not found any significant relationship between Conscientiousness and unemployment.

In many countries, educational level is associated with the likelihood of finding a job. This is also reflected in the employment statistics. For example, in 2010, 86% of the Swedish individuals with a higher education had a job, compared to 62% among those with low education. Although academic performance and intelligence are identified as significant predictors of unemployment, they are rarely modeled in an appropriate way. For example, Lundin and Hemmingsson (2013) found a positive association between intelligence and adaptability to school, while intelligence was negatively related to unemployment. As most econometric studies use regression analysis, all variables, such as intelligence and GPA, are treated as exogenous variables, regardless of when these variables were measured. One explanation of this could be that economists rarely utilize structural equation modeling. Most econometric studies neglect to model academic achievement as a potential mediator in the relationships between cognitive, socioemotional traits, and labor market outcomes such as unemployment. Furthermore, most econometric studies in the field of educational psychology have yet to utilize statistical techniques that are able to take the time aspect into account, such as survival analysis or zero-inflated poisson modeling.

In addition, several econometric studies have used education as a proxy for intelligence. However, when using education as a proxy for intelligence, a potential interplay between these factors might be ignored, such as mediation and the influence this might have on unemployment. In addition, a prior research question (No. 2) in this thesis is in line with a plethora of studies that have demonstrated that academic achievement, as a measure, contains both cognitive and socioemotional aspects. By omitting intelligence as a variable from the analysis and keeping the socioemotional constructs, one might miss a potential significant role that intelligence plays directly or indirectly on an outcome, i.e., in this case, predicting risk of unemployment.

Furthermore, the previous two chapters present evidence in support of Cattell's Investment Hypothesis. Omitting Gf-Gc constructs would also lead to missed opportunities to investigate if these constructs have different effects on unemployment, as previously reported from the field of earnings. For example, based on the Armed Forces Vocational Aptitude Battery ASVAB, Bishop (1994) reported that verbal ability had a negative effect on wages. This finding has been confirmed by Blackburn and Neumark (1995).

Finally, investigations that have included Big Five constructs in their prediction of unemployment have reported mixed results. For example, Uysal and Polheimer (2011) reported a significant negative effect of Conscientiousness on unemployment. In contrast, Viinikainen and Kokko (2012) did not find any significant effect of Conscientiousness on unemployment. In addition, they found that Neuroticism was positively associated with unemployment spells, whereas Agreeableness was negatively correlated. However, none of these studies included intelligence or academic achievement as a predictor of unemployment. Thus, the aim of this study is to investigate the predictive ability of socioemotional and cognitive abilities and academic achievement on unemployment - see Figure 11.1

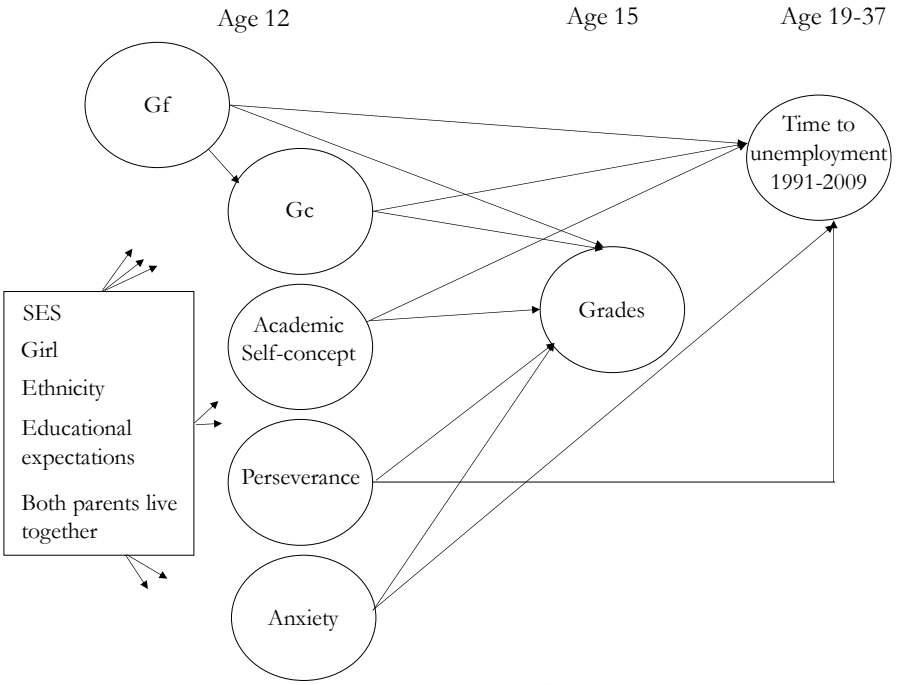

Figure 11.1 Illustration of the structural model between 6th grade and adulthood.
Circles represent latent variables. Single-headed black arrows represent paths. In the interest of clarity, error terms and correlations are not displayed. All exogenous variables i.e., within the rectangle, are observed and time-fixed. These exogenous background variables are regressed on all endogenous variables.

11.2 Methodology

To investigate the research question, survival analysis and zero-inflated poisson modeling were used within a structural equation modeling (SEM) framework. The analyses were performed with Mplus, version 7.4 (Muthén & Muthén, 1998-2015). Estimation of the proportional odds hazards requires the Maximum Likelihood estimator with robust standard errors (MLR).

11.3 Measurement

This analysis uses the same exogenous and endogenous variables as in the previous chapter when predicting academic achievement – see Section 10.2 for description. However, one additional variable was included into the model: occurrence of unemployment between the ages of 19 and 37 (defined as not working and not being a student) was retrieved from Sweden Statistics. Thus, study members who were registered as unemployed during November each year between 1991 and 2009 were classified as unemployed. The occurrence of unemployment for each year was coded as 1 and all other as 0.

In order to perform a survival analysis in Mplus, when a person experiences unemployment, the same person must be coded as missing for the remaining years. In this case, missing was symbolized by -99. Until a person experienced unemployment, he or she was coded as 0.

11.4 Results

The largest proportion of individuals born in 1972 did not experience unemployment between 1993 and 1996, which is illustrated in Figure 11.2.

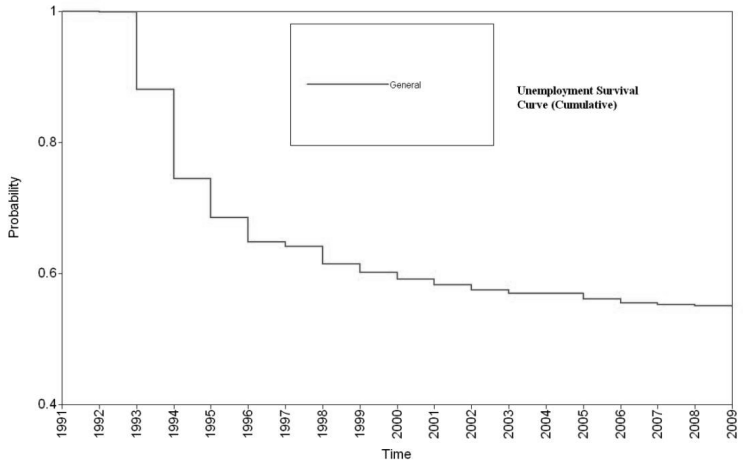

Figure 11.2 Cumulative Kaplan-Meier (Survival) Curve illustrating incidence of unemployment between 1991 and 2009 in Sweden

Y-axis shows the likelihood (proportion) of surviving unemployment at each time step (i.e., year). X-axis shows the years 1991-2009. This curve is exported from Mplus version 7.4.

The Kaplan-Meier (KM) curve shows that 65% of all individuals in the dataset did not experience unemployment between 1993 and 1996. Thus, 35% experienced unemployment between 1993 and 1996. Furthermore, the KM curve shows that unemployment accelerated in 1993 and 1994, as 25% of all respondents experienced unemployment, to attenuate after 1995. In total, during the period 1991 to 2009, more than 40% of the individuals born in 1972 experienced unemployment.

As a first step, the model was fit to data without covariates. The results from this analysis show that academic achievement and Gc are the only significant endogenous predictors of unemployment. Grades are negatively related to unemployment ($\beta_{standardized}$ = -.64), whereas Gc is positively associated with risk of unemployment ($\beta_{standardized}$ = .24). This means that when Gc increases with one standard deviation, time-to-unemployment increases with .24 standard deviation, i.e., higher levels of Gc when not mediated through grades result in higher unemployment risk.

No direct effects of socioemotional traits or Gf on the risk of unemployment were identified – see Table 11.1. Instead, exogenous variables such as socioeconomic status, both parents living together, and ethnicity were significantly associated with unemployment risk. While higher socioeconomic

status and having Swedish parents decreased the unemployment risk, both parents living together slightly increased the risk of becoming unemployed.

Table 11.1 Direct effects (standardized) on endogenous variables

	Coeffi-cients	*T-value*		*Coeffi-cients*	*T-value*
DV: Unemployment			*DV: Gf 6*		
Academic Achievement	-0.64	-7.88	Female	-0.01	-0.93
Gc	0.24	2.49	SES	0.16	9.94
Gf	0.01	0.19	Both parents live together	0.05	3.33
Perseverance	0.04	0.88	Both parents Swedish	0.02	1.29
Acad. Self-Concept	-0.04	-0.94	Educational Expectations	0.25	15.80
Anxiety	0.01	0.44			
Female	0.02	0.87	*DV: Acad. Self-Concept 6*		
SES	-0.10	-4.89	Female	-0.05	-2.77
Both parents live together	0.04	-1.98	SES	0.09	5.10
Both parents Swedish	-0.09	-4.81	Both parents live together	0.04	2.14
Educational Expectations	-0.02	-1.08	Both parents Swedish	-0.01	-0.16
			Educational Expectations	0.18	9.14
DV: Academic Achievement					
Gc	0.53	6.96	*DV: Anxiety 6*		
Gf	0.26	3.81	Female	0.11	5.49
Perseverance	0.11	4.57	SES	-0.07	-3.47
Acad. Self-Concept	0.06	2.67	Both parents live together	-0.01	-0.58
Anxiety	0.03	1.60	Both parents Swedish	-0.03	-1.61
Female	0.18	10.69	Educational Expectations	-0.06	-2.77
SES	0.09	7.08			
Both parents live together	0.05	4.66	*DV: Perseverance 6*		
Both parents Swedish	-0.04	-3.38	Female	0.07	2.71
Educational Expectations	0.05	3.27	SES	0.04	1.68
			Both parents live together	0.10	4.09
DV: Gc 6			Both parents Swedish	-0.01	-0.26
Gf	0.78	34.10	Educational Expectations	0.04	1.53
Female	0.10	7.25			
SES	0.06	3.81			
Both parents live together	-0.03	-2.39			
Both parents Swedish	0.04	2.86			
Educational Expectations	0.10	6.06			

Note: The MLR-estimator does not provide 95% confidence intervals.

In the model, one standard deviation increase in Gc increases academic achievement by .53 standard deviation followed by Gf (.26 standard deviation), Perseverance (.11 standard deviation), and Academic Self-Concept (.06 standard deviation).

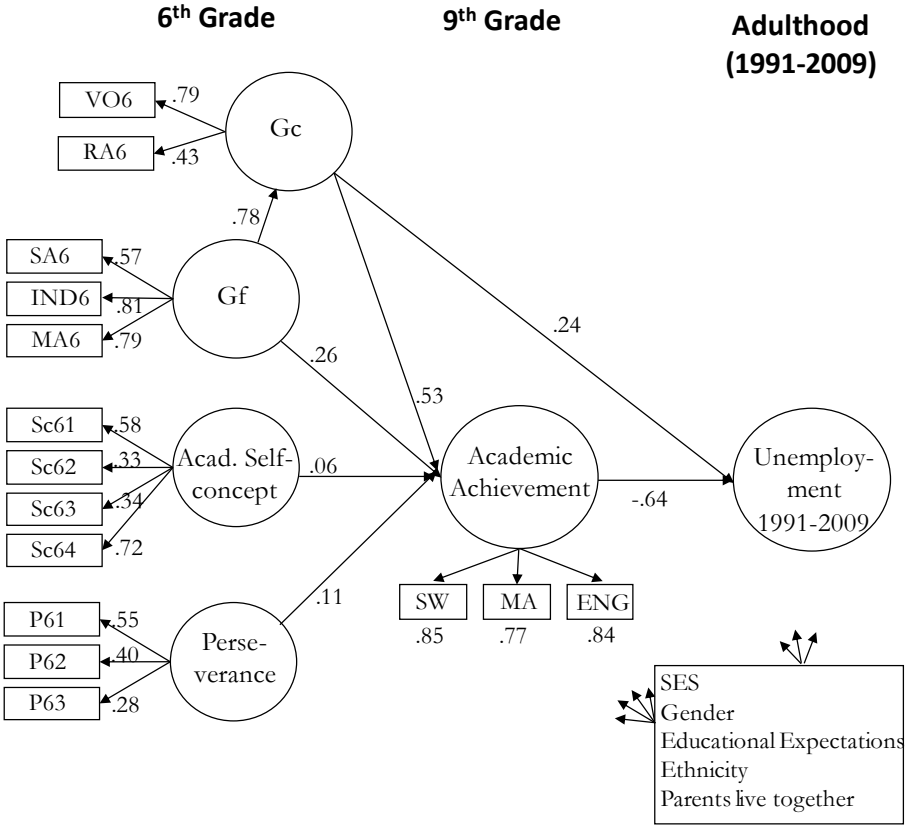

Figure 11.3 Structural equation model with standardized regression weights for path coefficients ($p < 0.05$) between 6th grade, grades in 9th grade, and time-to-unemployment.
Squares represent manifest variables along with their factor loadings and ovals represent latent variables. Solid lines represent significant paths. Nonsignificant paths are not shown for model simplicity purposes. This adjusted model does not show the path coefficients for the background variables, also for simplicity purposes.

Moreover, several significant direct effects from the background variables on the endogenous variables were found. The risk of unemployment was negatively influenced by SES and having two native parents (i.e., ethnicity). For the cognitive and socioemotional constructs and academic achievement, these coefficients were very similar to those reported in Chapter 10. In addition, SES

and ethnicity were the strongest determinants of unemployment, followed by both parents living together. This implies that individuals with more advantageous backgrounds, whose parents are Swedish, or whose parents live together have a lower risk of experiencing unemployment. Although gender was positively related to grades, Gc, and Anxiety, it was found to be a non-significant predictor of unemployment – see Table 11.1.

As mentioned before, only academic achievement and Gc were significant predictors of time-to-unemployment. In addition, Gf predicted Gc in 6th grade, which is in line with Cattell's Investment Hypothesis. One standard deviation increase in Gf was associated with a .78 increase in Gc.

A decomposition of the effects shows that the total effect was strongest between SES and unemployment risk ($\beta_{standardized}$ = -.21). The second and third strongest effects were found for parents' educational expectations and being a female on unemployment risk ($\beta_{standardized}$ = -.14 and $\beta_{standardized}$ = -.11 respectively) – see Table 11.3.

Table 11.3 Decomposition of the effects in total, total indirect and indirect effects. Standardized coefficients.

Links	*Coeffi-cients*	*T-value*	*Links*	*Coeffi-cients*	*T-value*
Female to Unemployment			***Parents Live Together (BPTG) to Unemployment***		
Total effect	-0.11	-5.95	Total effect	-0.08	-4.65
Total indirect	-0.13	-8.23	Total indirect	-0.05	-4.84
Specific Indirect Effects			*Specific Indirect Effects*		
Female → Gc	0.03	2.22	BPTG → Acad. Ach.	-0.03	-3.63
Female → Anx	0.01	2.25	BPTG → Gc	-0.02	-2.19
Female → Acad. Ach.	-0.12	-8.03	BPTG → Pers.	-0.01	2.77
Female → Gc → Acad. Ach.	-0.04	-3.36	BPTG → Gf → Acad. Ach.	-0.01	-2.56
Female → Asc → Acad. Ach.	0.01	1.98	BPTG → Gf → Gc	0.01	1.97
Female → Pers. → Acad. Ach.	-0.01	-2.27	BPTG → Gc → Acad. Ach.	0.01	2.08
			BPTG → Gf → Gc → Acad. Ach.	-0.01	-2.58
SES to Unemployment			***Edu. Exp. to Unemployment***		
Total effect	-0.21	-10.35	Total effect	-0.14	-7.07
Total indirect	-0.11	-10.63	Total indirect	-0.11	-10.16
Specific Indirect Effects			*Specific Indirect Effects*		
SES → Acad. Ach.	-0.05	-5.77	Edu. Exp. → Acad. Ach.	-0.03	-3.29
SES → Gc	0.01	2.13	Edu. Exp. → Gc	0.02	2.24
SES → Gc → Acad. Ach.	-0.02	-2.96	Edu. Exp. → Gc → Acad. Ach.	-0.03	-3.34
SES → Gf → Gc	0.03	2.33	Edu. Exp. → Gf → Gc	0.05	2.37
SES → Gf → Acad. Ach.	-0.03	-3.72	Edu. Exp. → Gf → Acad. Ach.	-0.04	-3.94
SES → Gf → Gc → Acad. Ach.	-0.04	-3.75	Edu. Exp. → Gf → Gc → Acad. Ach.	-0.07	-3.88
SES → Asc → Acad. Ach.	-0.01	-2.37	Edu. Exp. → Asc → Acad. Ach.	-0.01	-2.49
Both Parents Swedish (BPSW) to Unemployment					
Total effect	-0.07	-4.06			
Specific Indirect Effects					
BPSW → Acad. Ach.	0.03	2.94			
BPSW → Gc → Acad. Ach.	-0.01	-2.28			

Note: No 95% Confidence Interval can not be calculated for the indirect effects when using bootstrapping with the MLR-estimator, which is required in survival analysis. All estimators are fully standardized. Pers. = Perseverance, Asc = Academic self-concept, Gc = Crystallized intelligence, Gf = Fluid intelligence, Anx = Anxiety, Acad.Ach = Academic achievement, SES = Socioeconomic status, BPTG = Both parents live together, BPSW = Both parents Swedish.

The indirect effect between unemployment risk and gender (i.e., being a female) is related via Gc and grades. There is no significant mediation effect between gender via the Investment Hypothesis and unemployment risk. The gender effect on unemployment via grades and Gc is -.04 (p = .0001). This implies that higher Gc levels that are related to grades lower the risk of unemployment. However, the indirect effect of being a female on unemployment via Gc was .03 (p = .004). This implies an increased risk of unemployment. In addition, a very small indirect effect was found in favor of females via perseverance ($\beta_{indirect}$ = -.001, p = .017).

Weaker indirect path effects were found for parents' educational expectations and SES than for females, which went via Gf, Gc, academic achievement, and then to unemployment. All these indirect effects were negative, which implies that they lower the proportional odds hazard for experiencing unemployment.

11.5 Discussion

The results from this study imply that the cognitive and socioemotional factors responsible for academic performance may contribute to improving the prediction of future success on the labor market in terms of employment. Although employers use grades in the recruitment process, they also look for the ability to learn new things and personality traits such as the ability to work hard and interpersonal skills, since the employee should also represent the organization. Many employers use grades as an indicator of future job success and as a criterion in their hiring process, since the ability to learn (i.e., Gf) is a significant predictor of grades. In this way, grades are used to satisfy the eligibility criteria of the companies and as an indicator of cognitive abilities. Thus, grades could be used as an indicator of work ethic, given that both cognitive and socioemotional traits are mostly absorbed by academic achievement measures.

Considering academic performance as a protection factor with respect to unemployment, identifying students that underachieve in school is an important work to focus on. On the basis of the models presented in this thesis, it may be hypothesized that a student characterized by low SES, low parental educational expectations, and low academic achievement is potentially at risk of unemployment. Thus, students with such traits could benefit from an

intervention program that supports the learning process and the accumulation of Gc.

In contrast to some other studies (e.g., Lindqvist & Vestman, 2011), this analysis found no direct effects of socioemotional traits on unemployment risk. Instead, all effects of socioemotional traits on unemployment risk were mediated via grades. The different results may thus be explained by the fact that this thesis utilized structural equation modeling with grades as a mediating variable, while the Lindqvist and Vestman (2011) study did not consider any ordering of the variables.

The findings in the present thesis allow policy makers and educators to foresee who will perform better or worse in the labor market in terms of employment. While good grades have a protective effect on the risk of unemployment, Gc increases the unemployment risk. Future studies should aim at exploring how different study programs at the university level mediate the relationship between cognitive (Gf and Gc) traits and labor market outcomes, such as employment / unemployment and wage development.

Prior research (e.g., Robst, 2007) has found that companies and organizations value knowledge that is domain-specific. Thus, college programs that are more orientated towards developing domain-specific skills rather than domain-general skills provide students with better opportunities to find a job. Examples of programs that are orientated towards domain-general skills are found within the fields of Arts and Humanities. Fenesi and Sana (2015, p. 384) argued:

> "Research experience, (e.g., lab and field work), internships, computer and technology knowledge, persuasion and argumentative abilities, and knowledge of negotiation techniques are all skills that can be applied to specific domains, such as engineering, business, science, and some programs in social science (e.g., psychology, economics, geography). In contrast, domain-general skills, such as critical and analytical skills, are not tailored to specific fields of employment. Programs that promote domain-specific skills and practical knowledge increase opportunities for job-related employment to a greater extent than programs promoting the acquisition of domain-general skills and theoretical knowledge".

The authors suggest that some humanities and social sciences programs manage to provide students with critical and analytical tools, but the practical traits are too general to be applied to most occupations in the labor market. Companies

and organizations are searching for skills that are closely related to the knowledge needed in specific job positions. Subsequently, students that have pursued study programs that put more emphasis on domain-specific knowledge are also more likely to find employment, compared to students with more domain-general knowledge training (Fenesi & Sana, 2015). Robst (2007) has previously demonstrated that humanities graduates find it much more difficult to find a related job position compared to other graduates. In addition, studies in humanities are associated with uncertainty in future job stability. In contrast, programs such as education, business, and engineering provide students with job-related knowledge (e.g., field and lab experiences, negotiation strategies), which, in turn, increase their probability of finding employment. In a more recent study, Fenesi and Sana (2015) found that graduates from humanities were less likely to find a full-time job, and were more likely to be overqualified for their current job position, since they were less likely to find a job that was related to their program. The authors report that the odds of finding a closely related job was associated with 4.5 times higher odds for engineering and technology compared to humanities, 3.6 times higher odds for education, and 2.5 times higher odds for business compared to humanities.

However, it is important to bear in mind that the dependent variable in the present analysis is an indicator of unemployment (coded as 1) and all other activities, such as pursuing college studies, entering the labor market, etc., (coded as 0) for each year between 1991 and 2009. Thus, maybe some people pursued academic studies after they tried to enter the labor market, but failed. For example, if such persons made these attempts during January to June, and pursued college studies in September, they would not be registered as unemployed in this study. This could imply that, when investigating labor market entry and wage development, a slightly different pattern might emerge, since choice of study at college affects a person's odds for entering the labor market.

Chapter 12. Discussion and conclusions

Three main aims have been formulated for the thesis. The first is to unfold the longitudinal relationships between cognitive and socioemotional traits from 3rd to 6th grade. The second aim is to determine the relative importance of cognitive and socioemotional traits in the prediction of academic achievement in 9th grade, and how effects of student background variables on achievement are mediated via such student traits. The third aim is to determine the impact of cognitive and socioemotional traits and academic achievement on risk of unemployment in adult age.

More specific research questions in relation to these three aims are elaborated in Chapter 7, and in Chapters 9, 10 and 11 three empirical studies are presented which are designed to provide answers to the research questions. In each of the three empirical chapters the answers to these research questions are discussed. In this final chapter, the conclusions will be summarized and the discussion will be broadened to discuss more general issues related to the three main aims.

12.1 The development of cognitive and socioemotional traits between 3rd and 6th grade

The first main research question aims at answering how cognitive and socioemotional traits develop between 3rd and 6th grade, and if there is any evidence of a trait complex regarding Gc. This research question has been divided into five sub-questions and into a question concerning measurement of Gc. Given that the dynamic interrelations over time among cognitive abilities on the one hand and among cognitive ailities and socioemotional traits on the other hand are likely to involve different mechanisms these will be discussed separately.

12.1.1 Development of cognitive abilities

The main hypothesis that has been advanced to account for interrelations among cognitive abilities over time is Cattell's (1971) Investment Hypothesis, which posits a causal relationship between prior levels of Gf and subsequent levels of Gc. The results reported in Chapter 9 provided support for this hypothesis.

However, only few previous studies with such a cross-lagged panel design have found support for the Investment Hypothesis, even though studies with other designs have provided results which may be interpreted as supporting the Investment Hypothesis (e.g., Valentin Kvist & Gustafsson, 2008). As was observed in Chapter 2.6 Kan et al. (2011, p. 301; cf. Ackerman & Heggestad, 1997; Schmidt & Crano, 1974) argued that to study the Investment Hypothesis properly, sample homogeneity is essential, and they suggested that a longitudinal design with same-aged, same-sex, culturally and educationally homogeneous samples should be used. The current study comes close to this suggested ideal. Many other studies have, in contrast, been based on heterogeneous samples. For example, the Schmidt and Crano (1974) study had an overrepresentation of students of lower socioeconomic status, and many studies have used adult samples with a mixture of age groups (e.g., Schweizer & Koch, 2001). Given that the Investment Hypothesis is about development of cognitive abilities, it would seem natural that children would be the group of main interest to investigate. However, only few studies have been conducted with samples of children in the early years of schooling.

The present study investigated the Investment Hypothesis in a sample aged 10 to 13, which is a period when major development of skills and abilities takes place. At school, the period of learning to read in the first three grades is followed by a period of reading to learn, and the level of complexity of the knowledge and skills learned successively increases. These circumstances make it reasonable to assume that the degree of involvement of Gf in the processes of learning is high during the investigated period. However, it is also known that as knowledge structures get more complex and elaborated, the importance of Gc increases while the importance of investment of Gf in Gc declines. Hence, age is a factor that seems to influence the results of investigations of the Investment Hypothesis in both positive and negative directions. It would seem essential, therefore, that further research systematically investigates the validity of the Investment Hypothesis as a function of the age of the participants. To understand the mechanisms through which Gf influences the development of knowledge and skills it also seems essential that the mediating processes of learning behind the Gf influence are investigated (cf. Schweizer & Koch, 2001).

Another line of research has focused on possible negative effects of Gc on Gf, and particularly so in investigations of the Functional Fixedness hypothesis. However, the empirical support for this hypothesis is weak, and the study reported in Chapter 9 does not provide any supportive evidence (see Section

9.6.3). It should be observed, however, that the functional fixedness hypothesis is based on a line of reasoning which emphasizes negative effects on problem solving of certain strategies of teaching. Thus, this hypothesis does not express an expectation that an increasing Gc level in itself would impact negatively on Gf.

12.1.2 Interrelations among cognitive abilities and socioemotional traits

Most of the hypothesized relations involved socioemotional traits, but empirical support was not found for all of these. Thus, the Compensation Hypothesis, which states that individuals with lower intellectual capabilities compensate this deficit with higher levels of Conscientiousness, was not supported.

However, the results reported in Chapter 9 showed that only prior levels of Gc predicted subsequent levels of Academic Self-Concept, providing support for the Skill Development Model. Similarly, the results of the current study showed that prior levels of Gc predict subsequent levels of anxiety, a lower Gc being associated with a higher level of Anxiety.

12.1.3 A Trait Complex for Gc

Previous research has shown that cognitive and socioemotional traits tend to go together in what has been called trait complexes (see section 3.5). The review of the literature provided some indications that the broad construct Gc also reflects traits such as Academic Self-Concept, perseverance, fear, and the ability to concentrate, and that the relative importance of these traits tends to vary with age. Such findings support the existence of a Gc-related trait complex. There also are other supportive findings. Studies of young students suggest that verbal self-concept, fear, and perseverance are highly related to reading achievement (e.g., Putwain et al., 2015; Putwain et al., 2016; Sahranavard, 2015). However, as a function of developmental processes and social comparison processes, children become more accurate in assessing themselves and as a consequence, self-beliefs become more realistic. Furthermore, the ability to stay focused and persevere becomes more and more important as assignments increase in difficulty. Thus, a dynamic Gc trait complex emerges, characterized by traits that are conducive to school achievement. However, different traits tend to be important at different age levels so the trait complex is not easily defined in terms of a limited set of stable traits.

12.1.4 General Observations

The development of cognitive and socioemotional traits between 3rd and 6th grade is characterized by a striking lack of influence of the socioemotional constructs on subsequent levels of cognitive abilities. Only prior levels of Gf and Gc affect cognitive abilities and socioemotional traits. Gf has a positive effect on Gc. However, the results in this study do not support some previous studies (e.g., Baker & Bishel, 2006; Cheng & Furnham, 2014) that have reported that Conscientiousness predicts intelligence. Gc reduces Anxiety and it has a positive effect on Academic Self-Concept. Thus, cognitive abilities seem to drive the development of socioemotional traits.

One explanation why previous studies have found evidence of socioemotional traits, such as Conscientiousness, affecting intelligence may be differences in conceptualization of cognitive abilities. These studies did typically not use the Gf-Gc distinction. Instead, they focused on an undifferentiated general intelligence, or on a more finely grained differentiation, e.g., in terms of primary abilities such as inductive, spatial, and verbal abilities.

Thus, the dynamic development of the relationships between cognitive and socioemotional traits between 3rd and 6th grade is driven by cognitive ability factors. Prior levels of socioemotional traits do not influence subsequent levels of neither cognitive traits nor socioemotional traits, except from the autoregressive paths. However, Gf influences Gc positively. In addition, cognitive abilities affect subsequent levels of socioemotional traits. Gc has a positive effect on Academic Self-Concept and a negative effect on Anxiety. This pattern of relationships between cognitive and socioemotional traits between 3rd and 6th grade was replicated in both Gc reading achievement trait complexes.

12.2 Predictors of Academic Achievement

The second main aim was to find out how cognitive and socioemotional traits relate to academic achievement, i.e., final school grades in compulsory school. The results show that both cognitive and socioemotional traits are related to academic achievement. In line with previous studies, personality plays an influential role in facilitating academic achievement, once cognitive abilities have been taken into consideration. The strongest relationships are found between Gc and academic achievement and between Gf and academic achievement. The results also show that Anxiety, perseverance, and Academic

Self-Concept are positively related to academic performance. Thus, the socioemotional constructs show small incremental associations with academic achievement. However, these correlations are much smaller than those of the cognitive constructs.

In addition, several indirect effects are found. High-SES students, or those students whose parents have high educational expectations, have cognitive abilities and socioemotional traits that are more appropriate for academic achievement. Girls also perform better than boys on Gc tests and have higher academic achievement. Thus, the indirect effect of gender is mediated via Gc to academic achievement. However, the indirect effects of SES and parental educational expectations are slightly stronger than the effects of gender on academic achievement. Nevertheless, the strongest effects are found between Gc, Gf, and academic achievement, to which are added the substantially lower effects of socioemotional traits.

12.3 Predictors of Unemployment

The third main aim of the thesis is to determine the impact of cognitive and socioemotional traits and academic achievement on the risk of unemployment in adult age.

The total effects show that the path of Gf via academic achievement lowers the unemployment risk the most. The total indirect effects of SES and parental educational expectations, also both lower the risk of unemployment. Being female lowers the risk of unemployment, which effect is indirectly mediated via academic achievement. Furthermore, the risk of unemployment increases when individuals have at least one non-native parent.

In summary, grades mediate almost all cognitive and socioemotional traits, with the exception of Gc and Academic Self-Concept. Academic Self-Concept is a non-significant predictor of grades and the risk of unemployment. Grades lower the risk of unemployment, whereas the redundant part of Gc, which is not captured by academic achievement, increases the risk of unemployment.

12.4 General Discussion and Implications

Cognitive skills reflect how efficiently a child understands new information and recalls previously learned knowledge. This thesis identifies cognitive skills as drivers of socioemotional traits, measured as Academic Self-Concept, Anxiety,

and perseverance. Several studies, based on correlational analysis, have hypothesized that socioemotional traits influence performance on achievement tests. For example, Anxiety is hypothesized to have a negative effect, whereas perseverance is anticipated to have a positive effect on academic achievement. In contrast, the findings reported in Chapter 9 show that Gc does not reflect socioemotional traits. Furthermore, Gf tests also fail to reflect socioemotional traits. One explanation might be that this analysis was based on a longitudinal design, while many other studies have used a cross-sectional design. According to the correlational analysis in the present thesis Gf and Gc are negatively correlated with Anxiety in both 3rd and 6th grade, but there are no significant paths from Anxiety in Grade 3 to cognitive abilities in Grade 6. Similarly, perseverance is positively correlated with *Gf* and *Gc* in 3rd and 6th grade, but no significant path coefficient is found from perseverance to Gc. Another explanation might be that the latent variable of Anxiety reflects more of trait than state anxiety. State anxiety has been found to have a negative influence on performance on intelligence tests. In conclusion, prior levels of cognitive abilities influence subsequent levels of socioemotional traits, and not vice versa.

However, Chapter 10 reports much stronger effects of the cognitive constructs on academic achievement as measured by grades at the end of compulsory school, whereas socioemotional traits show small incremental effects on academic achievement. One explanation for this pattern is provided by Ackerman's PPIK theory (Ackerman, 1996; Ackerman & Heggestad, 1997). According to this theory cognitive abilities are the strongest predictors of academic achievement, throughout the pre-adult years, since all students follow the same curriculum at school. Thus, the students' freedom of choice is highly limited by the curriculum. However, as people grow older, they have more freedom to make decisions that are in line with their interests, i.e., they start specializing. In this regard, personality, time, and interests play a more prominent role for achievement, compared to the pre-adult period. As individuals discover their career and interests, they tend to spend large amounts of time mastering that field. One consequence of the limiting effect that the curriculum has on individual interests is that cognitive abilities will have a much stronger effect on achievement, compared to socioemotional traits. Hence, the PPIK theory might also explain the findings of Poropat (2009, 2014). Poropat (2009) concluded that socioemotional traits are stronger predictors of academic achievement than intelligence. He identified Conscientiousness and emotional stability as facilitating abilities, which help students to achieve more in academic

settings. However, based on elementary school students, Poropat (2014) reported that intelligence has a larger impact than socioemotional traits on achievement. The findings concerning determinants of achievement in Grade 9 (Chapter 10) are in line with the PPIK theory and Poropat's investigations, which, in turn, coincide with Cattell's (1971) Investment Theory. This theory posits that the investment of Gf into Gc takes place to a considerable extent during school years, when children learn complex activities such as writing, reading, and arithmetic. Hence, both Gf and Gc are strongly related to academic achievement (Cattell, 1971).

Ackerman's explanation, in terms of the impeding effects of the curriculum on students' interests, might also contribute to the understanding of why previous levels of socioemotional traits do not influence subsequent levels of Gc or Gf. Instead, cognitive abilities influenced subsequent levels of cognitive and socioemotional traits, in particular, prior levels of Gc influenced subsequent levels of Academic Self-Concept and Anxiety. Gc was also identified as the strongest determinant of academic achievement in Grade 9.

The strong predictive power of Gf and Gc of academic performance might be useful for various evaluative purposes. The Gf-Gc-model reflects a broad spectrum of academic performance areas, such as language abilities and cognitive processing. Since cognitive abilities are most strongly related to academic achievement, cognitive ability tests may, therefore, be used to identify students with cognitive processing weaknesses. Subsequently, this diagnostic information may be used to construct proper intervention plans to support the development of various socioemotional traits that facilitate academic performance. Thus, the results from this thesis imply that measures to improve socioemotional traits start with improving verbal ability by increasing the investment of Gf in such activities. In turn, students' Anxiety will decrease and Academic Self-Concept will increase. Although it can be challenging for the teachers to create a joyful reading environment that encourages the students to read more, such an environment will not only result in better academic achievement in secondary school, but also improve students' behavior in the classroom (e.g., increase students' Academic Self-Concept). In this way, it is likely that a class culture of verbal achievement (i.e., reading and writing) will develop, which engages students in the process of acquiring knowledge and understanding. Maybe such a strategy will reduce the levels of Anxiety that some students who struggle with schoolwork perceive, since the results show a weak, but positive, effect of Anxiety on academic achievement.

However, focusing on verbal achievement requires implementation of a strategy that consists of high reading standards, which challenge all students to meet the requirements. In addition, teachers should praise efforts and encourage students (including gifted students) to become interested in the material. Such a verbal achievement strategy should focus on offering support, confidence, and encouragement to assist students in overcoming boredom and distractions in the classroom. By also focusing on praising effort and learning, teachers might also provide gifted students with more challenging tasks. The negative relationship between Gc and perseverance might reflect a ceiling effect, as gifted students find the school tasks easy to accomplish and, therefore, they might invest too little effort into their school work. However, the diverging patterns that emerged in the prediction of perseverance in the research questions between Model 1 and Model 2 make it difficult to draw such conclusions. The same applies to the positive relationship between Gf and perseverance.

In addition, this thesis found positive relationships between SES, parental educational expectations, and cognitive abilities (i.e., Gf and Gc). One implication of the Investment Hypothesis, driven by socioeconomic status and parental educational expectations, is that the gap between good readers and poor readers widens over time. This means that good readers gain better knowledge in reading and verbal comprehension, while poorer readers struggle to achieve more. This phenomenon is also known as the *Matthew effect* or *accumulated advantage*. A consequence of the Matthew effect, which is in line with the Investment Hypothesis, is that a good reader with a large vocabulary is capable of reading more texts than his or her less skilled peers. Thus, he or she will accumulate a stronger vocabulary. This is another reason why teachers should focus on creating a joyful reading environment that encourages students to read more.

Nevertheless, factors that complicate a successful implementation of reading enhancement strategies are related to socioeconomic status and parental educational expectations. This thesis revealed significant direct and indirect effects on academic achievement and risk of unemployment, mostly mediated through the Investment Hypothesis. The findings show that the investment of Gf in Gc is related to socioeconomic status and parental educational expectations. Previous research (e.g., Grolnick, Friendly, & Bellas, 2009) has suggested that parents with higher educational expectations encourage reading at home, expose their child to new experiences, and initiate problem-solving

activities. This implies that parents play a key role in the child's school success, especially when parents have high educational expectations for their child. By displaying high educational expectations, parents demonstrate positive attitudes about education to their child. This thesis found both direct and indirect effects of parental educational expectations on academic achievement. This might suggest that what parents do and say at home can help children develop positive attitudes toward school, achieve, and build confidence in themselves as learners. Thus, when parents show their child that they value education and use it within their home environment, powerful models are created that contribute to the child's scholastic success.

Sociodemographic factors also have an impact on how schools are structured and, therefore, affect Gf and Gc, which both have been found to be predicted by both socioeconomic status and parental educational expectations. Subsequently, concentration of wealth or poverty is associated with residential segregation, as the rich send their children to certain schools and the poor send their children to other schools that are close to their residences. Another dimension to the residential segregation is ethnicity, which also increases the complexity in schools. In this way, socioeconomic status, parental educational expectations, and ethnicity are related to school processes that influence academic performance, as schools with a larger proportion of students with low socioeconomic status and ethnic background face challenges with structural and cultural components. A significantly higher risk of unemployment was found for students with lower grades, low SES, and non-native ethnic background, compared to students with high SES, higher grades, and Swedish parents. This result might reflect these structural challenges faced by schools with a higher proportion of low-SES students, as the institutions are not able to adequately meet students' needs.

An interesting finding in this thesis is the paradoxical role of Gc for the risk of unemployment. Further investigations are needed to examine why prior levels of Gc are associated with a higher risk of unemployment. One possible explanation is that the current study does not bring in higher education as a factor influencing unemployment and unemployment statistics. As was pointed out in Chapter 8, the resolution in the employment statistics is not particularly high and there may be a risk that students enrolled in higher education are classified as being unemployed. Given that students enrolled in higher education are likely to have a higher level of Gc than other persons in the

sample, this may at least partly explain the positive relation between Gc and unemployment.

12.5 Validity issues

This thesis found that socioemotional traits were influenced by cognitive abilities and that both predict academic achievement and unemployment. Thus, evidence is provided that socioemotional traits are malleable as a consequence of cognitive abilities and play an influential role in student success as measured by grades. Cognitive abilities were found to be the strongest determinants of academic achievement. Nevertheless, students' academic behaviors, such as doing his or her best even in boring subjects or not giving up when working on difficult school tasks, are, to some extent, associated with academic achievement. This might be an indication that teachers are taking socioemotional traits into account when grading, or that teachers affect these socioemotional traits in numerous ways. However, the precise mechanisms of how teachers relate to students' socioemotional traits or how they affect these traits are still unknown, and could not be answered in this thesis.

In Chapter 8 some fundamental aspects of validity were brought up, and in particular two main threats to the validity of measures were brought up, namely construct irrelevant variance and construct underrepresentation. Both these threats are likely to be present in the current study.

The threat of construct underrepresentation means that only certain aspects of a construct are covered by the measures. As has been observed previously, the Gc construct may be underrepresented in the current study, where it is narrowly defined by verbal ability tests. Gustafsson and Carlstedt (2006) suggested that broader measures of Gc may have higher predictive and construct validity compared to narrower measures of Gc. Theoretically, Gc represents accumulated knowledge and experiences, so a wider definition that also includes general knowledge, among other things, would have a more appropriate construct representation. However, due to data availability, a wider definition of Gc could not be tested.

The socioemotional constructs are typically measured by only two to three focus items, and they only capture some aspects of the personality factors, which are currently broadly accepted. These measures therefore suffer from considerable construct underrepresentation when taken to represent present-

day socioemotional constructs. However, given that the questionnaire items analyzed here were constructed long before the currently adopted conceptualizations of the socioemotional constructs had been developed the questionnaire data cannot be expected to be perfectly aligned with the current conceptualizations.

The measures also are affected by several souces of construct irrelevant variance. Given that most of the items only required a dichotomous response and that there were few items for each construct, random error was one source of construct irrelevant variance. However, because latent variable modeling of categorical variables was used the impact of the random error was minimized (see Chapter 8). The fact that the data was collected with printed questionnaires also imposed a certain level of reading requirements, the students may have interpreted the response options differently, and their motivation to respond carefully and truthfully may have varied. These are just a few examples of possible sources of construct irrelevant variance, and while they to a certain extent are reduced by the latent variable modeling techniques, the amount and consequences of these sources of error are generally unknown.

12.6 Limitations and Future Research

The present thesis has some advantages over most previous studies, but it also has some limitations. The strengths include that all endogenous variables were latent and not observed, compared to many other studies that do not utilize latent variables for the outcome variables such as grades. Instead, they use GPA, which, in many cases, is based on self-reported information.

Most investigations in the field of individual differences and educational psychology are based on self-reports, including the analyses in this thesis, which often leads to lower correlations than other rated personality assessments (Connelly & Ones, 2010). Although latent variable modeling is a technique that is used to summarize information from diverse sources (i.e., retrieve the overlapping variance from multiple items) and, thus, eliminate measurement errors, self-rated items are afflicted by several limitations. In many cases, respondents tend to over-rate themselves (Kenny & West, 2010), especially when they rate items that measure Conscientiousness due to motivational biases, which limits the accuracy of self-ratings (Vazire & Carlson, 2010). Thus, spurious variance is induced to personality ratings, which lowers the correlation

between the items (Ziegler & Buehner, 2009). Furthermore, self-ratings are also subjected to reference bias (Duckworth, & Yeager, 2015).

Given the contribution of personality traits to educational outcomes, these drawbacks using self-rated items as indicators suggest that additional sources of ratings could improve their accuracy. Thus, some researchers have proposed using teachers' ratings (e.g., Gill & Swann, 2004). Nevertheless, the idea to use various sources of information in the measurement of personality traits is not new. For example, Cattell (1971) proposed the use of Q-data (i.e., self-rating questionnaires), L-data (i.e., ratings given by peers and significant others), and T-data (i.e., data from experimental settings created in a lab). The application of experimental design is somewhat difficult to implement in a school setting from an ethical point of view. In addition, even if other-rated sources are used, such as teachers' or peers' ratings, there are several Conscientiousness-related behaviors, such as homework, that the teachers and peers cannot observe, thus, limiting the measurement of conscientiousness (Lubbers, Van Der Werf, Kuyper, & Hendriks, 2010). Thus, personality trait items are difficult to measure with a high level of accuracy.

Teachers have also been found to influence students' socioemotional traits. For example, Kane, Rockoff, and Staiger (2008) reported that highly conscientious teachers were better than less conscientious colleagues to persuade students to work harder and be more cooperative in order to achieve more. Unfortunately, the ETF database does not contain any information of teachers' traits in terms of socioemotional traits. This is another limitation.

However, a strength of the ETF database is that samples have been drawn with intervals of five or six years which have been administered the same or partly revised versions of the questionnaires. This makes it possible to make replication studies, and to investigate effects of changes in item formulations and formats.

12.7 Conclusions

The dynamic development of the relationships between cognitive and socioemotional traits between 3rd and 6th grade is driven by cognitive ability factors. Except for the autoregressive paths, cognitive traits (i.e., Gf and Gc) in 3rd grade influence subsequent levels of both cognitive and socioemotional traits in 6th grade. Hence, prior levels of socioemotional traits do not influence

subsequent levels of neither cognitive traits nor socioemotional traits. The pattern of relationships between cognitive and socioemotional traits between 3rd and 6th grade was replicated in the Gc trait complexes. However, the standardized factor loadings were low for several of the overlapping socioemotional items, due to data limitations. Future research should investigate the existence of a Gc trait complex by using items that measure perseverance, the ability to concentrate, and fear as latent variables with indicators that are measured at least on an ordinal scale.

In addition, both cognitive and socioemotional traits are related to academic achievement. Gc has the strongest direct effect on academic performance, followed by Gf. In addition, an indirect relation of Gf to academic achievement is mediated through Gc. Furthermore, grades are influenced by socioemotional traits, mostly Academic Self-Concept and perseverance. Anxiety is also positively (although weakly) related to academic achievement.

The influence of cognitive and socioemotional traits on academic achievement and risk of unemployment shows that almost all cognitive and socioemotional traits are captured by grades. Although Academic Self-Concept is a non-significant predictor of academic achievement, Gc has both a direct effect on the unemployment risk and an indirect effect via academic achievement on the unemployment risk. All other effects of socioemotional traits and Gf are related to the risk of unemployment via academic achievement. The strongest determinant of unemployment risk is academic achievement, which has a protective effect on the risk of unemployment.

Chapter 13. Swedish summary

13.1 Inledning

Under nästan ett sekel, har forskare försökt förstå, mäta och förklara framgång i livet. År 1973 drog Herrnstein och Jensen slutsatsen att skolprestationer, att komma in på arbetsmarknaden och löneutvecklingen beror på intelligens, som till stor del är ärftlig och oföränderligt. Bowles och Gintis (1976) bemötte Herrnsteins och Jensens slutsatser genom att hävda att både intelligens tillsammans med socio-emotionella drag, dvs. personlighetsdrag, påverkar framgång i livet. Denna logik ligger i linje med Edward Webb (1915) som hävdar att förmågor är viktiga, men ännu viktigare är vad vi faktiskt gör med dessa förmågor. Både kognitiv förmåga (t.ex. "vad en person kan göra") bidrar till förståelse och lärande, och personlighetsdrag (t.ex. "vad en person kommer att göra") underlättar eller hindrar lärande och utveckling (Chamorro-Premuzic & Furnham, 2003). Exempel på socioemotionella faktorer är: motivation, ihärdighet, självuppfattning, kreativitet, ängslan och social kompetens.

Trots att tidigare forskning hittat stöd för att dessa socioemtionella drag och kognitiva förmågor påverkar studieresultat och andra viktiga utfall, har den i mindre utsträckning studerat hur dessa personlighetsdrag och kognitiva förmågor påverkar varandra över tid. Moutafi et al. (2004) skriver att det är viktigt att göra en distinktion mellan flytande (Gf) och kristalliserad intelligens (Gc) för att förstå hur och varför socioemotionella egenskaper är relaterade till intelligens. Orsakssambandet mellan Gf och Gc intelligens stipuleras i Cattells Investmentteori. Dock har inte Gf-Gc-relationen systematiskt undersökts i relation till de socio-emotionella egenskaperna och hur dessa är relaterade till utfall senare i livet. Ett syfte med denna avhandling är därför att undersöka den roll som Gf, Gc, och socioemotionella drag har för skolframgång och risken att drabbas av arbetslöshet senare i livet.

13.2 Syften

Avhandlingen har tre huvudsyften eller frågeställningar. Det första är att undersöka longitudinella relationer mellan kognitiva och socioemotionella förmågor mellan åk 3 och åk 6. Det andra är att bestämma den relativa betydelsen av kognitiva och socioemotionella förmågor för skolprestationer

mätta med betyg i åk 9, och hur effekter av elevernas bakgrund på skolprestationer medieraras via sådana elevegenskaper. Det tredje huvudsyftet är att undersöka betydelsen av kognitiva och socioemotionella förmågor och skolprestationer för risken att drabbas av arbetslöshet i vuxen ålder.

13.3 Metod

13.3.1 Data

Dataunderlaget för att undersöka frågeställningarna utgörs av 1972 års longitudinella UGU-kohort (Utvärdering Genom Uppföljning). Samtliga UGU-kohorter bygger på 10-procentiga riksrepresentativa slumpmässiga urval. Den aktuella kohorten omfattar 9080 elever födda 1972. Undersökningarna av den första frågeställningen baseras på enkätdata från elever och på data från standardiserade kognitiva test insamlade år 1982 (årskurs 3) och 1985 (årskurs 6). Studierna av den andra frågeställningen baseras på enkätdata och på kognitiva testdata från elever insamlade år 1985 (årskurs 6). Vidare används information från föräldraenkäten, som administrerades år 1982, avseende om föräldrarna bor tillsammans eller skilda samt vilka utbildningsförväntningar de har på sina barn. Slutligen används registerdata om föräldrarnas socioekonomiska bakgrund, etnicitet, och elevernas könstillhörighet samt deras betyg i årskurs 9. Betygen i svenska, engelska och matematik används för att mäta skolprestation. Då lärarnas betygssättning i dessa ämnen har haft stöd av nationella prov är dessa betyg i högre grad jämförbara än övriga ämnesbetyg. Undersökningarna av den tredje frågeställningen baseras på samma data som den andra frågeställningen och dessutom på registerdata från SCB om förekomst av arbetslöshet mellan åren 1991 och 2009.

13.4 Analysmetod

Samtliga analyser vilar på strukturell ekvationsmodellering (SEM). SEM möjliggör skapandet av s.k. latenta variabler som baseras på samvariation mellan ett antal indikatorer. Latenta variabler kan ses som teoretiska fenomen som inte är direkt observerbara. Exempelvis har ängslan uppmätts genom indikatorerna (frågorna): ”*Är du rädd för att svara på frågor i skolan?*”, ”*Händer det att du är rädd för någon i skolan?*”, och ”*Oroar du dig ofta över sånt som händer i skolan?*”. Dessa tre

frågor representerar det teoretiska begreppet ängslan. Vidare tillåter SEM att man definierar relationer mellan variabler som kan både vara exogena (oberoende variabler)) och endogena (beroende och eventuellt även oberoende variabler)). Inom SEM-ramverket kan olika analystekniker användas. I denna avhandling har s.k. överlevnadsanalys använts för att estimera de kognitiva och socioemotionella förmågornas samt betygens effekter på risken för att bli arbetslös. Överlevnadsanalys estimerar risk och tid till någon given händelse (i detta fall, arbetslöshet). Genom att använda överlevnadsanalys inom SEM kan man se hur olika variabler påverkar risken för att bli arbetslöshet över tid. En subkategori till överlevnadsanalys är diskret överlevnadsanalys som modellerar diskreta förekomster av händelser, exempelvis när tiden är angiven i månader eller år. Denna teknik har använts för att estimera risken för och tiden till arbetslöshet mellan 1991 och 2009.

13.5 Resultat

13.5.1 Frågeställning 1

Syftet var att granska den dynamiska utvecklingen av kognitiva och socio-emotionella förmågor samt att undersöka förekomsten av ett eventuellt Gc-baserat komplex (dvs ett begrepp som omfattar såväl individens verbala förmåga som olika socioemotionella egenskaper). De kognitiva variablerna utgjordes av Gf och Gc. De socio-emotionella förmågorna bestod av ihärdighet (eng: Perseverance & procrastination refrainment), ängslan (eng: Anxiety) och skolmässig självuppfattning (Academic self-concept). En modell med relationer mellan de fem begreppen bestämda i årskurs 3 och i årskurs 6 estimerades.

Resultaten visade att inga socio-emotionella förmågor predicerade kognitiva förmågor. Utöver de autoregressiva effekterna (dvs att tidigare nivåer hos ett begrepp predicerar senare nivåer hos samma begrepp) kunde de socio-emotionella förmågorna inte predicera andra socio-emotionella variabler. Istället kunde Gf i årskurs 3 predicera Gc i årskurs 6, men Gc förmådde inte predicera Gf. Däremot visade resultaten att de socioemotionella förmågorna influeras av de kognitiva förmågorna. Gf i åk 3 var positivt relaterat till ihärdighet i åk 6. Gc i årskurs 3 hade ett positivt inflytande på skolmässig självuppfattning och negativt inflytande på ängslan.

Resultaten gav vidare svagt stöd för ett s.k. Gc-baserat komplex, som utgörs av verbal förmåga, läsförmåga, ihärdighet, koncentrationsförmåga och rädsla. Även om modellen med detta Gc-baserade komplex uppvisade bästa modellanpassningen, hade de överlappande indikatorerna svaga faktorladdningar.

13.5.2 Frågeställning 2

Huvudsyftet var att granska relationen mellan kognitiva och socio-emotionella förmågor å ena sidan och skolprestation i årskurs 9 mätt i form av betyg å andra sidan. De kognitiva variablerna utgjordes av Gf och Gc i årskurs 6. De socio-emotionella förmågorna bestod av ihärdighet, ängslan och skolmässig självuppfattning i årskurs 6. Den latenta variabeln, skolprestation, utgjordes av betyg i de tre ämnena svenska, engelska och matematik.

Gc i årskurs 6 hade den starkaste effekten på skolprestation, men även Gf hade en direkt relation till skolprestation. Vidare hade självuppfattning, ihärdighet och ängslan direkt påverkan på skolprestation i åk 9, vilket också gällde för bakgrundsvariablerna kön och SES.

Flera bakgrundsvariabler hade också indirekt påverkan på betyg i åk 9, genom samband med kognitiv förmåga och socioemotionella egenskaper. Både SES och föräldrarnas utbildningsförväntningar hade sålunda samband med Gf och självuppfattning, och Gc hade samband med kön och utbildningsförväntningar.

13.5.3 Frågeställning 3

I frågeställning 3 testades investmentteorin vid prediktion av arbetslöshetsrisk mellan 1991 och 2009 utifrån de kognitiva och socioemotionella förmågorna.

Resultaten visade att betygen medierar samtliga latenta variablers effekter, utom kristalliserad förmåga. Högre betyg sänker risken för att bli arbetslös mellan 1991 och 2009.

Stöd hittades för investmentteorin genom att den indirekta effekten mellan Gf och arbetslöshetsrisk var negativ, dvs. att kognitiv förmåga har en skyddande effekt mot arbetslöshet. Detta kan tolkas som att eleverna löser uppgifter av ökande svårighetsgrad i takt med att de avancerar i skolsystemet, vilket förutsätter vidare investering av Gf. I motsats till betyg, har Gc en direkt positiv

effekt på risken att bli arbetslös. Hela prediktionskraften hos Gc fångas således inte upp av betyg, utan en mindre del letar sig vidare och predicerar arbetslöshet. Den positiva effekten av Gc på risken att bli arbetslös kan troligtvis förklaras med en utelämnad variabel, nämligen val av studieprogram på postgymnasial nivå. Hypotesen är att individer som väljer kurser och program inom humaniora, konst och samhällsvetenskap löper större arbetslöshetsrisk än personer som studerar teknik, medicin eller ekonomi. Detta har dock inte kunnat testas i denna undersökning, utan lämnas till den fortsatta forskningen.

13.5.6 Slutsatser

Den dynamiska utvecklingen av kognitiva och socioemotionella färdigheter mellan årskurs 3 och årskurs 6 drivs av de kognitiva förmågorna. Utöver de autoregressiva relationerna, är det endast Gf och Gc i årskurs 3 som påverkar efterföljande nivåer av kognitiva och socioemotionella färdigheter i årskurs 6. De socioemotionella färdigheterna påverkar inte efterföljande nivåer av vare sig kognitiva färdigheter eller socioemotionella färdigheter. Dessa slutsatser reproduceras i det Gc läsfärdighetskomplex som testades. Dock är faktorladdningarna för de överlappande variablerna för dessa egenskapskomplex för låga för att kunna utgöra tydlig evidens för ett sådant läsfärdighetskomplex, troligtvis på grund av frågornas dikotoma svarsalternativ.

Vidare ingår både kognitiva och socioemotionella färdigheter i skolprestationer. Kristalliserad förmåga (Gc) har den starkaste direkta effekten på studieresultat följt av flytande intelligens (Gf). Dessutom föreligger en indirekt relation från Gf till skolprestation via Gc. Bland de socioemotionella färdigheterna påverkar akademisk självuppfattning och inhärdighet skolprestationen mest. Ängslan uppvisar också ett positivt om än svagt samband med akademisk prestation.

I analysen av de kognitiva och socioemotionella färdigheternas effekt på skolprestation och risken för arbetslöshet visar det sig att nästan alla kognitiva och socioemotionella färdigheter influerar betygen, och därför kan sägas vara inkapslade i betygen. Även om den akademiska självbilden är en icke-signifikant prediktor för skolprestationen, uppvisar Gc både en direkt effekt på risken för arbetslöshet och en indirekt effekt via betygen på arbetslöshetsrisken. Alla övriga effekter av socioemotionella färdigheter och Gf är relaterade till risken för arbetslöshet via skolprestationer. Den starkaste påverkansfaktorn på

arbetslöshetsrisken är skolprestation, som har en skyddande effekt på risken för arbetslöshet.

13.5.7 Praktiska implikationer

Resultaten i denna avhandling indikerar att skolan och föräldrar bör rikta in sig på att utveckla de kognitiva förmågorna. Utvecklandet av Gf är av särskild vikt, då denna är relaterad till Gc och möjligtvis till ihärdighet. Gc minskar i sin tur ängslan och höjer skolmässiga självuppfattningen. En elev som får bekräftat att han eller hon har gjort bra ifrån sig i skolan behöver inte oroa sig för saker och ting i skolan. Dessutom blir ett bra skolresultat ett kvitto på att eleven är duktig i skolan. Att säga till eleven att han eller hon är duktig i skolan, utan att så är fallet, kommer med all sannolikhet att vara icke-trovärdigt. Det kommer inte att leda till att en sådan elev blir mer motiverad och eller lägger mer tid på sina studier. Därför blir ett fokus på att utveckla de socio-emotionella förmågorna att uppmuntra eleverna att försöka anstränga sig mer, när de inte vet hur de skall göra, föga fruktbart. Istället handlar det om att utveckla elevernas Gf.

Resultaten pekar även på att både de kognitiva och socioemotionella förmågorna påverkar betygen i årskurs 9. Gynnsamma beteenden för skolresultaten utgörs, i denna avhandling, av skolmässig självuppfattning, ihärdighet och emotionell stabilitet (motsatsen till ängslan). Socioemotionella förmågor utgör sålunda en viktig resurs för både individens skolresultat och individens personaliga utveckling. Flertalet ekonomer, samhällsvetare och politiker har argumenterat för att skolan skall utveckla både de kognitiva och socioemotionella förmågorna i syfte att fostra individerna till goda samhällsmedborgare, vilket kan sammanfattas med Martin Luther Kings tankar: ”Intelligens plus karaktär utgör målet för den sanna utbildningen”. Kombinationen av intelligens och socioemotionella förmågor bidrar till att skapa förutsättningar för att lyckas i skolan och i arbetslivet. Resultaten i denna avhandling indikerar att de socioemotionella förmågorna spelar en indirekt roll för att reducera risken för att bli arbetslös i vuxen ålder. Arbetsgivare betonar ofta värdet av socioemotionella förmågor i platsannonserna. Kombinationen av intelligens och socioemotionella förmågor fångas upp av betygen, som i sin tur minskar risken för arbetslöshet. Arbetsgivare får således de socioemotionella förmågorna ”på köpet” när betyg används som urvalskriterium i anställningsprocesserna.

Kombinationen av kognitiva och socioemotionella förmågor skulle kunna tolkas i termer av att vara ”utbildad”. Att vara utbildad är i mångt och mycket förknippat med att man har teoretiska kunskaper och fakta från olika discipliner. Dessutom innebär uttrycket att vara ”utbildad” att individen har självkontroll och besitter sociala färdigheter, förmåga att tänka kritiskt samt att lösa problem – som möjliggör för individen att delta i samhällslivet och att lyckas på arbetsmarknaden.

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