The importance of personality, IQ and learning approaches

Predicting academic performance

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The importance of personality, IQ and learning approaches:

Predicting academic performance

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List of studies

This doctoral thesis is based on the following three studies, which will be referred to in the text by their Roman numerals:

Study I Rosander, P., Bäckström, M., & Stenberg, G. (2011). Personality traits and general intelligence as predictors of academic performance: A structural equation modeling approach. *Learning and Individual Differences, 21*, 590-596.[1]

Study II Rosander, P., & Bäckström, M. (2012). The unique contribution of learning approaches to academic performance, after controlling for IQ and personality: Are there gender differences? *Learning and Individual Differences, 22*, 820–826,[2]

Study III Rosander, P., & Bäckström, M. (2012). A longitudinal study of personality traits and intelligence as predictors of academic performance: The importance of Conscientiousness. Submitted manuscript.

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The thesis is dedicated to Alexander, Pontus and Philippa - never forget that you can do much more than you think you can and that you can be whatever you want to be!

Feci quod potui, faciant meliora potentes

Åhus October 2012

Pia Roander

Abstract

The aim of the present doctoral thesis was to examine to what extent personality traits and approaches to learning contribute to academic performance in upper secondary school (high school), after controlling for the well-known fact that general intelligence accounts for a large part of the variance. The general proposition of the thesis is that personality traits are stable dispositions and therefore predispose an individual to behave or act in a specific manner (Costa & McCrae, 1976). Additionally, another important determinant of academic performance is students' approaches to learning, the way someone studies and makes sense of a particular school subject (Biggs, 1999). **Study I** examined how personality traits, divided into facets, predict academic performance in different school subjects. The results from several SEM analyses showed that personality, specifically Conscientiousness, has a positive influence on academic performance. In addition, there was a negative relation between Extraversion and academic performance and a positive relation between Neuroticism and academic performance. There were also interesting findings on the facet levels for all traits. The major conclusion of this study is that personality traits, both on the factor level and on the facet level, are important to academic performance in general, but sometimes more specifically to different school subjects. In **Study II**, the aim was to investigate the unique contribution of learning approaches to academic performance. A second aim was to explore possible gender differences in learning approaches. It was found that learning approaches contributed uniquely to academic performance, over and above personality and general intelligence. Differences between girls and boys were found, both with respect to the use of learning approaches and the consequences of these learning approaches for performance results. Based on a longitudinal design, the aim of **Study III** was to explore to what extent personality traits predict academic performance. Conscientiousness, Extraversion and Neuroticism were found to predict overall academic performance. Results suggest that personality traits, as measured at the age of 16, can predict academic performance at the age of 19, and more specifically: the grades of conscientious students improved from age 16 to age 19. This study extends previous work by assessing the relationship between the Big Five and academic performance over a three-year period.

Introduction

For more than a century, personality theorists have attempted to identify and describe observable differences between individuals. Among these individual differences, intelligence and personality have received widespread attention in academic settings (Chamorro-Premuzic & Furnham, 2005).

Understanding what factors influence academic performance has important practical implications for learning and education (O´Connor & Paunonen, 2007).This knowledge can, for example, help identify students unlikely to maximize their potential in scholastic settings (Caprara, Vecchione, Alessandri, Gerbino & Barbaranelli, 2011). There are also other values in being able to predict academic performance: first; a large average of gross domestic product is spent on educational activities; second; many young people will stay in education for many years. The academic performance of students is highly valued, and thus any improvement in our understanding of such performance will have substantial implications (Poropat, 2009).

There has been a great deal of controversy concerning which individual differences can be used to predict a person's academic performance (Furnham & Monsen, 2009). Measures of intelligence are effective predictors of academic performance across educational settings (Chamorro-Premuzic & Furnham, 2005), and the development of IQ measures was prompted by the desire to predict individual differences in school performance (Mackintosh, 2011). However, several researchers have emphasized the need to include variables other than intelligence in the prediction of academic performance, suggesting that such performance involves factors separate from intellectual ability (Chamorro-Premuzic & Furnham, 2005). A person´s personality, for example, can influence how capable he/she is in processing and accumulating information (Furnham & Monsen, 2009), which, in turns, predicts how he/she will score on ability tests. Another important determinant of academic performance is students' approaches to learning, the relative emphasis they put on understanding concepts or reproducing facts, how they organize their learning environment, and the way they study and make sense of a particular school subject (Biggs, 1999).

The general aim of the present doctoral thesis was to investigate to what extent personality traits and approaches to learning contribute to academic performance, after controlling for intelligence. This is an important subject, as very few previous studies have included personality, learning approaches and intelligence measures

(Furnham & Monsen, 2009). In line with the growing acceptance of a broad factorial model of personality, the five-factor model (McCrae & Costa, 2003), consisting of the dimensions Openness to experience (broad-mindedness, imaginativeness), Conscientiousness (will to achieve, orderliness), Extraversion (activity and sociability), Neuroticism (emotional stability), and Agreeableness (friendliness), the general proposition of the thesis is that personality factors are stable dispositions and therefore predispose an individual to behave or act in a consistent way over time and situations. For example, attending class, doing one's homework, getting along with teachers and other students, and participating in discussions are all behaviors that could be expected to influence academic performance. The general idea is that personality makes these behaviors more or less likely. Individual differences in personality may therefore play an important role in academic performance (Chamorro-Premuzic & Furnham, 2005).

Furthermore, it is important to examine whether the use of personality traits facets, instead of the higher-order traits, may improve the prediction of academic performance (Chamorro-Premuzic & Furnham, 2003a). Examining specific personality trait facets has important exploratory advantages that may facilitate our understanding of the processes underlying the relation between personality and performance (Ones & Viswesvaran, 1996).

Another important contribution to the research field is the use of a Swedish upper secondary school sample, as the Swedish grading system is different from that of most other countries in that it uses criterion-based grades, set by the teacher. The grades also serve as important selection criteria for higher education in Sweden.

The thesis begins with a review of the literature on academic performance and personality traits, followed by a review of intelligence. Finally, approaches to learning will be examined. There will also be sections on how these constructs relate to each other and in what way and to which extent they are able to predict academic performance.

Academic performance

Although psychologists have rarely presented definitions of academic performance as a concept, it is generally defined in terms of grades (Chamorro-Premuzic & Furnham, 2005). Predicting performance depends on being able to assess it (Richardson, Bond & Abraham, 2012), and there are several ways to measure individual differences in academic performance (grades), these most commonly include written examinations designed to assess students' understanding and knowledge. Other methods may include oral examinations, dissertations, group work and continuous assessment (Chamorro-Premuzic & Furnham, 2005). Researchers studying academic

performance usually use grade point average, which is the mean grade from courses contributing to assessment of the final degree (Richardson, Bond & Abraham, 2012). Grade point average is an objective measure with good internal reliability and temporal stability (Bacon & Bean, 2006). The disadvantage of using grade point average, regarding its reliability and validity, arises as a result of grade inflation (Johnson, 2003). This is the tendency to provide higher grades for the same performance at different levels of study. Another disadvantage is that different schools, or institutions, use different grading systems (Didier, Kreiter, Buri & Solow, 2006).

Sweden has nine years of compulsory education, and three years of voluntary upper secondary education (high school). Although upper secondary education is not compulsory, about 90% of the population participates (Gustafsson, 2008). The present grading system in Sweden is based on criteria-referenced grades (Klapp Lekholm, 2011). The grading is based on teacher-designed tests, and school grades are assigned by teachers, primarily based on classroom assessments. The grading scale encompasses four levels: fail (IG), pass (G), pass with distinction (VG), and pass with special distinction (MVG). When the grades are used for selection purposes, they are converted into four numbers 0, 10, 15, and 20, respectively. In order to help teachers calibrate their grading against the criteria in the curriculum, national tests are used in three core subjects (English, Swedish and math). The national tests are centrally produced but are distributed, assessed, and marked by the teachers themselves; no external referees are involved in the process of assessing and grading the tests. However, in order to secure the validity and reliability of the tests, teachers are strongly recommended to cooperate in this process (Klapp Lekholm & Cliffordson, 2009). After conducting several studies, the National Agency for Education (2007b) argued that the national tests are useful instruments for investigating the equivalence of grades.

Another important difference between grades in Sweden compared to other countries is that grades are used as important selection criteria for higher education in Sweden. There are two main selection criteria: school-leaving grades from upper secondary school and results from the Swedish Scholastic Aptitude Test (SSAT). The SSAT tests general study skills. In addition to final school grades, the results from this test can be used when a selection of applicants to a program has to be made. When making such a selection, at least one-third of the places have to be allocated on the basis of final school grades at least one-third on the basis of results from the SSAT and no more than one-third on the basis of other criteria. The SSAT offers another possibility of admission for applicants who are qualified but whose school grades are not high enough. More and more programs are also using SSAT results to differentiate between applicants with equivalent school-leaving grades (Swedish National Agency for Higher Education, 2012).

Furnham and Monsen (2009) have investigated factors that predict academic performance by dividing grades into different school subjects, which allows more specific predictions. All of the studies in the present thesis used both grade point average and grades in different school subjects to explore the impact of personality on each school subject. This design helps us understand the factors underlying academic performance in relation to personality, and it may help teachers develop different teaching methods for different school subjects.

Studies (Brookhart, 1993; Cross & Frary, 1999) have shown that teachers´ evaluation of student performance may be related to students´ individual characteristics, and thus there may be elements of subjectivity in the grading process. In one study, Klapp Lekholm and Cliffordson (2009) showed that student characteristics influence grades, especially self-perception of competence and self-efficacy. However, the questionnaire used was constructed by the authors and has not been validated in other studies. In the present thesis, a well-validated personality inventory has been used to examine student characteristics that are related to grades.

Personality traits

The concept of personality arises from the spectrum of human individuality. People differ meaningfully in how they think, feel and act. The concept also rests on the observation that a given person often behaves consistently over time and across different situations. The study of personality traits is concerned with structural differences and similarities among individuals, and traits are used to describe and explain behavior, thus they are both internal (characteristics of an individual, rather than the situation or context) and causal (influence behavior) (Chamorro-Premuzic & Furnham, 2005).

Following the definition of McCrae and Costa (2003, p. 25), "dimensions of individual differences in tendencies to show consistent patterns of thoughts, feelings, and actions" tell us what traits look like and how we can recognize a trait when we see one. The trait trust, for example, is a dimension of individual differences in frequency of trust behaviors suggesting that people can be described by the degree to which they show this trait. Some people are very trusting, most are moderately trusting and few are very untrusting (or suspicious). All traits are found to varying degrees in all people; they are semi-stable, with distributions that approximate the normal curve. The more of a trait an individual has, the more likely he/she will be to show the behavior it predisposes (and thus, the more frequently we are likely to see it) (McCrae & Costa, 2003).

The starting point for the trait researcher is to identify the behaviors that define a particular trait (DeYoung, 2011). The second step is to test whether and how traits

relate to behavior and the final step is to development a satisfactory theory of personality traits (Matthews, Deary & Whiteman, 2009). To develop such taxonomy, one needs a comprehensive set of traits to be classified. The lexical hypothesis states that natural language provides a comprehensive pool of trait descriptors that can be used to determine the general factors underlying the covariation among many specific traits (Saucier & Goldberg, 2001).

A brief history of the trait perspective

Trait theorist Gordon Allport (1897-1967) went through the English dictionary and recorded all of the words that could be used to describe a person. The result was a long list of 17,953 words (Allport & Odbert, 1936). This group of words was later reduced to approximately 8,000 and then 4,500 (see Norman, 1967) based on elimination of ambiguous and unfamiliar words, as well as terms that refer to physical, rather than psychological, aspects.

The lexical hypothesis, which was to propose traits on the basis of words from everyday discourse, was soon replaced by a more systematic approach: the factor analytic approach. This technique is the most widely used for the simultaneous identification of multiple traits. The input to a factor analysis is a matrix representing the correlations between all traits that have been measured, e.g. by a questionnaire. The aim of factor analysis is to simplify the correlation matrix by identifying one or more underlying dimensions or factors that can account for most of the variation in individual item scores. Factors are latent variables defined by the individual items that correlate with them (Matthews, Deary & Whiteman, 2009). In other words, factors emerge from the covariation between item scores.

Raymond Cattell (1905-1998) gathered thousands of participants' ratings of themselves on numerous traits as well as ratings from people who knew the participants well. The approach was based on an exhaustive and systematic analysis of the English language, and it was assumed that every aspect of an individual´s personality can be described with existing words, the same idea as Allport proposed. When he factor analyzed this data, he identified 16 basic behavior clusters, or factors, and based on this, he developed a widely used personality test called the 16 Personality Factor Questionnaires (16PF) to measure individual differences on each of the dimensions (Cattell, 1965).

Other researcher favored a smaller number of personality traits. Hans J. Eysenck (1916-1997) suggested that normal personality differences can be represented using only two super factors. These factors are introversion-extraversion and stability-instability; they encompass more specific traits (such as restless, sociable, calm, moody and so on) that are combinations, or mixtures, of the two primary dimensions. The two basic dimensions are totally independent, meaning that the two dimensions can

be freely combined. Thus, an emotionally stable extravert is a lively, responsive, easy-going person who tends to be well adjusted. In contrast, a person who is an unstable extravert tends to be restless, changeable and impulsive. The stable introvert is calm, reliable and thoughtful, while the unstable introvert is reserved, rigid and anxious (Eysenck, 1967).

Later in his career, Eysenck introduced a third factor, psychoticism, which was proposed to describe the degree to which someone was aggressive, cold, egocentric, antisocial and tough-minded. He was also one of the first theorists to suggest a biological basis for the major personality traits by linking introversion-extraversion and stability-instability to differences in the normal arousal patterns of the brain (Eysenck, 1967). Eysenck believed that there is an optimal, or preferred, level of biological arousal in the brain, and he suggested that extreme introverts are chronically over-aroused; their brains are too electrically active, which is why they try to reduce the arousal and minimize stimulation to get down to their optimal arousal level. In contrast, extreme extraverts are chronically under-aroused, so they need frequent or powerful stimulation to achieve an optimal level of cortical arousal. The extraverts thus seek physical arousal and social contacts, while the introverts tend to avoid arousal. If introversion-extraversion reflects an individual's customary level of arousal, then the stability-instability factor represents the shifts in arousal. Unstable people's nervous systems show large and sudden shifts in arousal, whereas stable people's show smaller and more gradual shifts (Pickering & Gray, 1999). According to Eysenck (1967), the arousal patterns that underlie introversion-extraversion and stability-instability have a genetic origin. Evidence from twin studies (Loehlin, Willerman & Horn, 1988; Plomin, 1997) supports this view; identical twins are much more alike on these traits than are fraternal twins; about half of the variance among people can be attributed to hereditary factors. Eysenck believed that although personality is strongly influenced by life experiences, the way people respond to those experiences may be at least partly programmed by biological factors (Matthews, Deary & Whiteman, 2009). Other researchers (Thomas & Chess, 1977) combined both environmental and psychological factors when they discussed the consistency of personality traits. Using the term "goodness of fit", they argued that properties, expectations, and demands in the environment are consistent with a person´s own capacities, characteristics and style of behaving, which, in turn, are associated with optimal development. Wachs (1994) proposed that goodness of fit might contribute to increased consistency in the transition from childhood temperaments to adult personality traits. He argued that if children's temperament matches the environment, this might engender stabilizing reactions from their environments, which, in turn, would elicit a more consistent transition from temperament to personality. However, the view that genes are an underlying mechanism of personality trait consistency is one of a handful of different views, such as the personality-environment view.

The Big Five

The Big Five factor model (Norman, 1963; Digman, 1990; Goldberg, 1981; Costa & McCrae, 1985; 1992) is the personality system most widely used by trait theorists (Chamorro-Premuzic & Furnham, 2005). Because of the extensive longitudinal and cross-cultural evidence in support of the five higher orders personality traits, this model has dominated the research on personality in recent years. The Big Five personality framework originated, like Cattell´s 16PF, from the lexical hypothesis. As explained, the lexical hypothesis refers to the assumption that the major dimensions of behavior can be derived from the words that exist in our language to describe a person (Chamorro-Premuzic & Furnham, 2005).

The Big Five model was derived from a re-analysis of Cattell's 16PF. In 1961, Tupes and Cristal (1961/1992) conducted a series of studies using Cattell's scale and found only five factors. Norman (1963) suggested, after replicating the five factors in his own studies, that the five factors constituted an adequate taxonomy of personality traits. Goldberg (1981, 1982) started the project from scratch, going back to the dictionary and forming his own sets of synonyms and replicating the five factors again. At the same time, McCrae and Costa (1985, 1987) began to re-examine the system and found striking parallels with the taxonomy of Norman (1963) and Goldberg (1981, 1982).

The five-factor model consists of five higher order personality traits (or factors) – namely: Neuroticism, Extraversion, Openness to experience, Agreeableness and Conscientiousness. In McCrae and Costa's model, each of these traits has six facets, which reflect specific sides or aspects of the broader domain (super-traits).

Neuroticism

Neuroticism can be described as the tendency to experience negative emotions, such as anxiety, depression and anger (Busato, Prins, Elshout & Hamaker, 2000). People high in neuroticism experience these emotions more often as opposed to the typically calm, relaxed and stable (low Neuroticism) personalities (Chamorro-Premuzic & Furnham, 2005). The primary facets of Neuroticism are anxiety, angry hostility, depression, self-consciousness, impulsiveness and vulnerability (McCrae & Costa, 2003).

Anxiety and angry hostility, the first two facets of Neuroticism, are the dispositional forms of two fundamental emotional states: fear and anger. Everyone experiences these emotions from time to time, but the intensity and frequency with which they are felt varies from person to person. Individuals high in the trait of anxiety are prone to worry; they dwell on what might go wrong. Hostile people show a proneness to experience anger; they tend to be irritable and ill-tempered and may prove hard to get along with (McCrae & Costa, 2003).

The facets depression and self-consciousness share the different emotions sorrow and shame. Depression, as a trait, is the predisposition to experience sadness, hopelessness and loneliness; depressed people have often feelings of guilt and lower self-worth. People high in self-consciousness are, on the other hand, more prone to the emotion of shame or embarrassment and are sensitive to ridicule and teasing because they often feel inferior to others (McCrae & Costa, 2003).

Two of the facets of Neuroticism, namely impulsiveness and vulnerability, are more often manifest in behavior than in emotional states. Impulsiveness is the tendency to give in to temptations and get overwhelmed by desires. Because of the lack of control, impulsive individuals tend to overeat and overspend, to drink and smoke, gamble and sometimes use drugs. The inability to deal adequately with stress is essential for the facet vulnerability. Vulnerable people tend to panic in emergencies and to become dependent on others for help (McCrae & Costa, 2003).

Extraversion

Extraversion concerns differences in preference for social interaction and lively activity (McCrae & Costa, 2003). Introverts (individuals low on Extraversion) are characterized by being quiet, withdrawn and having 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 can be subdivided into three interpersonal and three temperamental traits. Warmth, or attachment, refers to a friendly, intimately involved style of personal interaction; cold individuals, by contrast, are more likely to be formal and impersonal with weak attachments to other people. The facet gregariousness refers to a willing to be with other people and warmth and gregariousness sometimes are referred to as sociability. Assertiveness, the third facet of Extraversion, reflects natural leaders, easily taking charge and making up their own minds and readily expressing their feelings and desires (McCrae & Costa, 2003).

McCrae and Costa called the three facets activity, excitement seeking and positive emotions temperamental. These facets describe differences in the extent to which people keep busy, act vigorously and are energetic and forceful.

Openness to experience

Openness to experience represents the tendency to involve oneself in intellectual activities and experience new sensations and ideas (Busato et al., 2000). The naming of this factor has been more controversial, and thus it has also been referred to as Creativity, Intellect or Culture (Goldberg, 1994; Saucier, 1994).

Costa and McCrae (1992) included six different areas (facets) in their version of this factor: fantasy, aesthetics, feelings, actions, ideas and values. Openness to fantasy

refers to a vivid imagination and the tendency to have daydreams; in relation to aesthetics it is seen in sensitivity to art and beauty. Aesthetic experience is experience for its own sake. Openness to actions is the opposite of rigidity; open people are willing to try new things, like new dishes, see a new movie, or travel to a foreign country. Openness to ideas and values are other facets of the domain. Open people are curious and value knowledge, maybe because they are willing to think of different possibilities and to empathize with others in different circumstances.

People high on Openness to experience tend to be dreamy, imaginative, inventive and liberal in their thoughts and opinions (Costa & McCrae, 1992); poets and artists may be regarded as typical examples of high Openness scorers (McCrae & Costa, 1997).

Agreeableness

Agreeableness (also known as Sociability) refers to friendly, considerate and modest behavior (Chamorro-Premuzic & Furnham, 2005). The facets of Agreeableness are: trust, straightforwardness, altruism, compliance, modesty and tender-mindedness. People scoring high on Agreeableness can thus be described as caring, friendly, warm and tolerant (Costa & McCrae, 1992).

According to McCrae and Costa (2003), age change in the facet trust is of particular interest because it reflects what Erikson (1950) claimed about psychosocial development. Those who do not develop trust can never really advance toward industry, identity and intimacy.

The selflessness of agreeable people is seen in their desire to help others, as depicted in the facet called altruism (McCrae & Costa, 2003). Agreeable people, who defer to others, rather than aggressively pushing for their own ends, reflect the facet compliance. Agreeable people also are humble, showing modesty in their assessment of their own abilities. In contrast, low scores on this facet might be considered to reflect narcissism.

Conscientiousness

Conscientiousness is associated with responsibility and persistence (Busato et al., 2000). Conscientious individuals are best identified in terms of their efficiency, organization, determination, and productivity. The factor includes the facets competence, order, dutifulness, achievement striving, self-discipline and deliberation.

Part of the success of conscientious people is a result of their ability to organize and be orderly, which makes them efficient in work. They also have a strong sense of dutifulness, which in some respects makes them inhibited and causes them to scrupulously follow their moral precepts. They are high in achievement striving, pursuing excellence in everything they do, and they are high in self-discipline, which is necessary if they are to accomplish their goals. Finally, they are characterized by deliberation, making plans in advance and thinking before acting (McCrae & Costa,

2003). Conscientiousness is also most closely linked to the will to achieve (Digman, 1989).

Stability and change in personality traits

It was long thought that the personality was set in childhood and adolescence, and then fully developed by the age of 30 (McCrae & Costa, 1994). More recent studies have suggested that mean-level developmental change of personality traits in midlife and old age is still possible (Branje, Van Lieshout & Gerris, 2007). However, to draw conclusions about the consistency of traits, one must distinguish among the various forms of trait consistency (Roberts & DelVecchio, 2000). Intra-individual differences in consistency focus on whether one individual remains the same over time and is most commonly operationalized by examining the correlates of difference scores or growth curves of estimates of change. Examination of the relative salience of attributes within an individual over time is referred to as ipsative stability, best exemplified by Block´s (1971) research using the Q-sort technique (Roberts & DelVecchio, 2000). In his study from 1971, Block identified five male and six female patterns of ipsative change. For example, he looked at one group of men for whom talkativeness and rebelliousness became more salient in their personalities from adolescence to young adulthood. The two most common definitions of trait consistency are mean-level consistency and rank-order consistency, where mean-level consistency reflects whether groups of people increase or decrease in trait dimensions over time. Mean-level consistency reflects generalizable patterns of personality development that apply to most people. Rank-order consistency, on the other hand, refers to the relative placement of an individual within a group, most commonly assessed through test-retest correlations (Roberts, Walton & Viechtbauer, 2006). However, it should be noted that the existence of, for example, rank-order consistency does not rule out the possibility of other types of change such as intra-individual or mean-level change. Each approach to consistency addresses a different question and these questions are not always statistically or conceptually related (Roberts & DelVecchio, 2000).

The results of a meta-analysis of longitudinal studies (Roberts, Walton & Viehctbauer, 2006), covering 92 studies of the life course from age 10 to 101, showed that the mean-level change in Conscientiousness and social dominance (a facet of Extraversion) significantly increase, as well as emotional stability (people score lower on Neuroticism as they get older). In contrast, people increase on social vitality (another facet of Extraversion) and Openness to experience in adolescence, but then decrease on both of these domains when they get older. Agreeableness changed only in old age. Clearly, personality traits continue to change in adulthood (Roberts & Mroczek, 2008).

Most of the mean-level changes occur between the ages of 20 and 40, which highlights the notion that young adulthood appears to be the most important period for studying personality development (Roberts & Mroczek, 2008). McCrae and Costa (1994) suggested that personality trait development is governed by genetic factors rather than environmental influences. Genetic factors define propensities to grow in specific directions at specific ages during the life course. According to Roberts, Walton and Viechtbauer (2006), there are very few data to support this position. The few longitudinal studies of twins show that childhood personality change appears to be largely genetic, but that during adulthood genetics have only a small influence over personality change (Plomin & Nesselroade, 1990). McGue, Bacon and Lykken (1993), showed that the largest estimate of the heritability of personality trait change is around 30%, with average being much lower. This indicates that environmental factors play a larger role in personality trait change in adulthood than do genetic factors, in line with Kogan (1990), who highlighted a model emphasizing the interaction between traits and environment, building on Levinson´s (1978) interactional model. The model focuses on the building of life structure, which represents the basic pattern of a person's life and reflects the interplay between self-driven goals and social and age-graded norms. Baltes, Lindenberger and Staudinger (1998) have more recently elaborated on the life span development approach, including adaption as the primary focus and the dialectic between consistency and change over the life time. In this perspective, people are viewed as open systems; they exhibit both continuity and change in personality throughout life. As people grow older, they become better adapted through social experience; they become less impulsive, more norm-adherent and more skilled in social interaction.

Between the age of 12 and 18, the population used in the present thesis, cross-sectional studies have revealed inconsistent results, some studies reporting that mean levels of Emotional Stability (the opposite side of Neuroticism) decrease, but only for girls, and that mean level of Extraversion, Agreeableness and Conscientiousness do not change (McCrae et al., 2002). Other studies have found Agreeableness and Conscientiousness to decrease (Allik, Laidra, Realo & Pullman, 2004). Openness was found to increase both cross-sectionally and longitudinally (Allik et al., 2004; McCrae et al., 2002). This increase in Openness in adolescence may indicate that adolescents increase in their appreciation of creative and intellectual expressions, which may be related to identity development and exploration of different roles. Another possible explanation for this change may be the construction of items measuring Openness, which may be better suited to an adult population ("I like going to art museums"; "I avoid philosophical discussions"). This was confirmed in a study by De Fruyt, Mervielde, Hoekstra and Rolland (2000) with an adolescent sample using the NEO-PI-R (see section "Measuring personality traits" below, for a description of the NEO-PI-R). The adolescent sample in their study reported more problems with the Openness items. Branje, VanLieshout and Gerris (2007) found gender differences in

personality development in their cross-sectional study. Girls increased more in Openness, as well as in Conscientiousness and Agreeableness. These differences may be related to girl's earlier pubertal development which, in turn, may be related to higher social expectations regarding education and work as well as domestic chores, because girls may look more mature and therefore elicit greater expectations from others than boys do.

Measuring personality traits

As describe below (see section on Intelligence), the origin of trait theory can be traced back to the development of the IQ testing movement. From the perspective of trait theory, variation in personality is viewed as continuous: a specific personality trait will vary in strength along a continuum from low to high.

Most forms of personality assessment consist of self-report inventories comprising a series of items to which the individuals respond according to how they view themselves. Some advantages of self-report inventories are that they are quick and easy to administer to both groups and individuals. Other advantages are that scoring is objective and the response is obtained directly from the person being assessed. There are, of course, also limitations; the respondents may try to present themselves in the best possible light or respond in line with what they think is expected or desired (Rust & Golombok, 1999).

It is beyond the scope of this thesis to investigate all extant personality measurement instruments (for a guide to the state of five-factor model assessment, and variations on the theme, see De Raad & Perugini, 2002, in their edited book Big Five Assessment). Nevertheless, some of the most popular tests are mentioned below:

The leading instrument used to assess the traits of the five-factor model is the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1985, 1992). It consists of 240 items and is a measure of the five-factor model with six facet scales, used to assess specific aspects of each of the factors Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness. The items are phrased in the first person for self-reports (e.g., "I really like most people I meet"). Respondents read each item and rate (from 1 to 5) if they strongly disagree, disagree, don't know or are neutral, agree, or strongly agree with the statement. Sample items from the NEO-PI-R are (N): I have frequent mood swings, (E): I don´t find it easy to take charge of a situation (reverse scored), (O): I enjoy trying new and foreign foods, (A): Most people I know like me, and (C): I keep my belongings neat and clean. The responses are then summed to yield the five basic domain scores and the six facets of each domain (McCrae & Costa, 2003). The NEO Five-Factor Inventory (Costa & McCrae, 1992) is a shortened version of the NEO-PI-R and comprises 60 self-report items, 12 items for each of the personality domains.

Cattell´s (1965) ambitious project with grouping Allport and Odbert´s (1936) list of trait names resulted in sixteen dimensions, which are measured by the Sixteen Personality Factor Questionnaire (16PF: Cattell, Eber & Tatsuoka, 1970). The 16PF has been extensively used in research and applied settings for several decades (Mathews, Deary & Whiteman, 2009). However, this version of the 16PF has been criticized on psychometric grounds because of the low internal consistency of some of the scales. The 16PF5 version of the 16PF, with 185 items (Cattell & Mead, 2008; Conn & Rieke, 1994), features improved internal consistency and has good predictive validity, but doubts still remain as to its construct validity (Mathews, Deary & Whiteman, 2009).

According to the personality theory of Eysenck (1967, 1997), there are three broad personality factors (neuroticism, extraversion-introversion, and psychoticism). These factors are assessed using a self-report questionnaire, which has evolved through several different versions, reviewed by Furnham, Eysenck and Saflofske (2008), and culminating in the Eysenck Personality Questionnaire-Revised (EPQ-R: Eysenck & Eysenck, 1991). The questionnaire also contains a "lie scale" intended to measure subjects´ tendencies to "fake good".

The California Psychological Inventory (CPI; Gough, 1987; Gough & Bradley, 2002) is another popular questionnaire used in industry that assesses twenty traits. However, development of the CPI made no reference to factor analysis (Matthews, Deary & Whiteman, 2009). Instead, items were chosen on the basis of their ability to discriminate criterion groups. According to Kline (1993), this method has the serious disadvantage that scales may not correspond to those obtained by factor analysis and, in the absence of systematic experimental studies, construct validity is lacking.

Paper and pencil questionnaires are the most widely used measures, although computerized self-report techniques are increasing in popularity (Rust & Golombok, 1999). Collecting and scoring questionnaires via the Web is more efficient than doing these things by hand, because Web-based research allows one to tap into much larger and more diverse participant pools (Goldberg et al., 2006). However, most test publishers disallow the use of their copyrighted inventories on the Web, leading to the development of personality items in the public domain, such as the International Personality Item Pool (IPIP) where researchers can freely use the items (Goldberg et al., 2006). The items selected for the IPIP are proxies of the items from commercial scales. To validate the scales, correlations have been estimated with the original scale. The mean correlation between the 30 facet scales of the NEO-PI-R (Costa & McCrae, 1992) and the corresponding IPIP scales was .73 (Goldberg, 1999).

Big five measures, initially developed for adults, are often used to describe differences in younger age groups. Examples of studies using this strategy are De Fruyt, Mervielde, Hoekstra, and Rolland (2000) and McCrae et al. (2002). Other studies adapted the phrasing of personality items for younger age groups, for example the

junior version of Eysenck's Personality Questionnaire measure (EPQ-J; Eysenck, 1963; Eysenck, Makaremi & Barrett, 1994), or the Hierarchical Personality Inventory for Children (HiPIC; Mervielde & De Fruyt, 1999). The HiPIC was originally constructed to assess traits of children aged 6 to 12 years. It includes 5 first- and 18 second-order traits that show clear resemblance to the adult Big Five. The inventory includes 144 items that represent the descriptive content of parental descriptions of children. All items refer to a particular overt behavior. Given the limited vocabulary of children, HiPIC ratings are usually provided by parents or teachers well acquainted with the child. In a study by De Fruyt et al. (2000), the HiPIC was given as self-reports, together with the NEO PI-R, to an adolescent sample (M=13.6 years, SD=1.1 years) to investigate the convergent and discriminant validity of both measures. The results showed that the adult NEO-PI-R factor structure proved to be highly replicable in the sample of adolescents, with all facet scales primarily loading on the expected factors. The same results were found for the NEO-FFI with a sample of gifted adolescents (Parker, 1997, 1998).

Some criticism of the Big Five and other perspectives on personality traits

Many psychologists are now convinced that the best representation of trait structure is provided by the five-factor model (Digman, 1990), but there are, of course, dissenting views.

Regarding Openness to Experience, there is some disagreement about its content and replicability. Different researchers have variously labeled Openness as culture, intellect, imagination, openness to experience, and even fluid intelligence and tender-mindedness (see Brand & Egan, 1989; De Raad, 1998). One way to resolve these differences has been to look across cultures and across languages. Traits that are universally found in different languages and cultures have been regarded as more important than those lacking such cross-cultural universality (Matthews, Deary & Whiteman, 2009).

In one study based on a sample from Turkey, a factor best described at openness emerged (Somer & Goldberg, 1999), while a different Dutch study found a factor marked by progressiveness at one end and conservativeness at the other (De Raad, di Blas & Perugini, 1998). In Germany, Ostendorf (1990) found a factor representing intelligence, talents and abilities, and in Italy, Caprara and Perugini (1994) described the factor as conventionality. In summary, although the other traits (Neuroticism, Extraversion, Agreeableness and Conscientiousness) are highly replicable across cultures and languages, there is uncertainty about the content, naming and replicability of Openness to Experience.

Perhaps some traits are more relevant to some cultures than to others – such that conventionally is more suitable in some cultures and intellect in others. More

extensive cross-cultural work is needed (Saucier, Hampson, Goldberg & Lewis, 2000). Perugini and Di Blas (2002) came up with an interesting hypothesis about emic and etic lexical approaches to personality structure. An emic approach means that the research progresses by using native descriptors found in each language, while an etic approach imports (via translations) structures embedded in personality questionnaires from another language, usually English. By using a combination of etic and emic methods in an Italian setting, they suggested that etic rather than emic methods have replicated the Big five model in different cultures.

Critics of the five-factor model argue that it leaves out important aspects of personality, and one important question is whether the five-factor model provides a comprehensive description of personality. There is evidence that the five-factor model has proven to be more robust and replicable than any other taxonomy of personality, and four of the factors have proven to be highly replicable across researchers, data sources, item formats, samples, languages and cultures. It has also been found to be the major structure underlying many existing personality inventories. On the other hand, there is an ongoing quest for factors beyond the Big Five and a search for a sixth replicable factor (Ashton & Lee, 2008; Ashton, Lee & Goldberg, 2004).

For example, Almagor, Tellegen and Waller (1995) presented evidence for seven factors, instead of five. They suggested the addition of two factors: positive and negative evaluation (outstanding versus ordinary and awful versus decent). McCrae and Costa (1995) found the two valence dimensions to be related to the Big Five personality factors, but concluded that they are related to self-appraisal and social evaluation, but do not constitute core personality traits.

Goldberg and Saucier (1995) discovered that factors such as religiosity and spirituality sometimes emerge as separate factors, although these factors account for less variance than do those of the Big Five. Paunonen and Jackson (2000) identified 10 personality traits that appear to fall outside the five-factor model: Conventionality, Seductiveness, Manipulativeness, Thriftiness, Humorousness, Integrity, Femininity, Religiosity, Risk-taking and Egotism. Other researchers (Lee, Ogunfowora & Ashton, 2005), however, have confirmed that these traits are not highly correlated with the Big Five and that they instead highlight many interesting facets of personality at a more specific level.

Most of the suggestions for replicable factors, such as honesty, negative valence, religiousness, Machiavellianism, conventionality, seductiveness, thriftiness, egotism, integrity, and so on, are disputed (Saucier & Goldberg, 1998; Paunonen & Jackson, 2000; Ashton & Lee, 2002). Among the traits that should be added to the five-factor model, honesty has strong advocates (Lee & Ashton, 2006). They suggest that the basic model should be adjusted to include this factor. This model, called the HEXACO, includes honesty-humility, emotional stability, extraversion, agreeableness, conscientiousness and openness. The honesty-humility factor was

added because the Agreeableness facets straightforwardness and modesty were poorly correlated with the other facets of this dimension. The honesty-humility factor, it was further argued, can substantially account for variance in several of the above-mentioned traits not contained in the five-factor model (Lee, Ogunfowora & Ashton, 2005). However, the separateness of Agreeableness and honesty-humility within the HEXACO has been questioned. In one study, the results showed that these two factors correlated, r=0.49 (Lee & Ashton, 2006).

Saucier (2003) argued for the use of personality-descriptive nouns rather than adjectives to find personality factors beyond the Big Five. He discovered eight factors within the domain of personality nouns such as Joker (e.g., clown, goof, comedian), Jock (e.g., sportsman, tough, machine), Babe (e.g., beauty, darling, doll), Philosopher (e.g., genius, artist, individualist). However, he also concluded that type nouns have different content emphases, which were revealed by results from a study of personality nouns in the Italian language showing a somewhat different organization with factors such as Honesty, Humility and Cleverness (Di Blas, 2005).

The five-factor model has also drawn more general theoretical critics, such as Block (1995), who argue that the five factors, although useful for laypersons in everyday life, fail to capture the underlying casual personality processes. He suggested that if someone describes another as high on neuroticism, it may be useful in social communication but it does not capture the underlying psychological processes involved in such things as feeling guilty, worrying over worst-case scenarios and so on. Goldberg and Saucier (1995) respond to Block (1995) by suggesting that the Big Five taxonomy has been proposed merely as a framework for the phenotypic attributes of personality that have become encoded within the natural language and makes no claims about the underlying personality processes. Block (1995) also criticized the variables that were included in the factor analysis resulting in the five factor model. He suggested that the variables could have been selected to contain different subsets of redundant descriptors, which then cluster together to define the five factors. Goldberg and Saucier (1995), on the other hand, pointed out that discovery of five personality factors emerged from data sets where no prestructuring or selection has taken place.

We might conclude that trait psychology is in a healthy state, with signs of growing agreement on the structure of personality. However, there still remains some conflict between partisans of the various perspectives, and perhaps the most problematic issue is the state of Openness (Matthews, Deary & Whiteman, 2009).

Intelligence

Following Gottfredson (2000, p. 81) "Intelligence is the general ability to reason, plan, solve problems, think abstractly, learn quickly, and learn from experience". This definition highlights the notion that intelligence represents the ability to solve problems by thinking (DeYoung, 2011). Intelligence is a theoretical construct, referring to observable behavior (Chamorro-Premuzic & Furnham, 2005), and is currently defined, assessed, and studied on at least three different levels: psychometric, physiological and social (Davidson & Kemp, 2011; Eysenck, 1988; Flynn, 2007). The psychometric approach is used here. It focuses on individual differences in performance in relation to mental ability. The physiological approach typically employs advanced technology to examine indices of intelligence in the brain to enable assessment of the relationships between brain activity and mental ability. The social approach uses performance on "real-world" tasks to study intellectual skills in context (Davidson & Kemp, 2011).

The history of intelligence testing

The history of intelligence testing began with Sir Francis Galton (1822-1911). By studying the family trees of eminent families, he showed that eminence and genius seem to occur within certain families. This convinced him that eminent people had inherited mental constitutions that made them more fit for thinking than their lesser counterparts were. Modern intelligence testing began in the twentieth century, when the French psychologist Alfred Binet (1857-1911) developed a test by asking experienced teachers what sort of problems children of different age groups can solve. Based on the answers from the teachers, he then constructed a standardized test to measure children's reasoning ability and their use of judgment. The result of the test was a score he called the child's mental age. For instance, if a 5-year-old child could solve problems at the level of the average 7-year-old, the child would be said to have a mental age of 7. The concept of mental age was later expanded by William Stern (1871-1938) to provide a relative score for people of different chronological ages. Stern's intelligence quotient (IQ) was the ratio of mental age to chronological age, multiplied by 100. Thus, a child who performs at exactly his or her age level has an IQ of 100. In my previous example, the child with a mental age of 7 and a chronological age of 5 would have an IQ of 140. In the 1960´s, these normative differences were standardized through a measure called the standard deviation, which is a comparative indicator of a person's score with regard to the general population (Mackintosh, 2011; Chamorro-Premuzic & Furnham, 2005).

The work of Alfred Binet inspired Lewis Terman (1877-1956) to revise Binet's test for use in the US, and this revised test became widely accepted in North America and

known as the Standford-Binet Intelligence Test. Two decades after Terman introduced the American version of Binet's test, psychologist David Wechsler (1886-1981) developed a major competitor to the Stanford-Binet. The aim of this new test was to measure both verbal and non-verbal intellectual skills. Today, the Wechsler tests, the WAIS III and WAIS IV, are the most popular individually administered intelligence tests (Mackintosh, 2011; Chamorro-Premuzic & Furnham, 2005).

The term IQ is still in use, even if it is no longer referred to as mental age, as described above in the section "The history of intelligence testing". Instead, a new way of arriving at IQ scores has been devised; scores are derived by comparing a person´s performance on a test to norms based on the performance of a representative group of people in the same age range. The typical standard deviation is set at 15 with a mean of 100. The difference between a person´s score and the average score of the age group, the SD units, determines the person´s IQ.

The first group test of mental ability, the Army´s Group Examination (also known as the Army Alpha), was used in the selection and classification of Army personnel during the First World War, and one of its innovations was the response format. The success of the Army Alpha spawned the rapid development of other paper-and-pencil tests of cognitive ability. Some of these tests, such as the Wonderlic Personnel Test (Wonderlic, 1992), attempt to obtain a general estimate of cognitive ability (Urbina, 2011).

Psychometric intelligence

The psychometric approach to intelligence attempts to map the structure of the intellect and to measure the abilities that underlie individual differences in performance (Chamorro-Premuzic & Furnham, 2005). The term psychometric refers to the statistical study of psychological tests. One question that arises from this perspective is how many mental abilities there are. Are there one or a few, or perhaps a dozen? To answer these questions, researchers administer diverse measures of mental abilities and then correlate them with one another. If one test is highly correlated with another, then performance on these tests probably reflects the same mental ability. By using the statistical technique of factor analysis, introduced by Spearman (1863-1945), it is possible to reduce a large number of measures to a smaller numbers of factors. Each factor contains all the variables that correlate highly with one another, and at the same time, less highly, or not at all, with variables from other factors. Spearman observed that grades in different school subjects were all positively correlated, but not perfectly. He found the same to be true for different types of Stanford-Binet test items, such as arithmetic reasoning problems and the ability to solve puzzles. He therefore concluded that intellectual performance is determined partly by a g-factor, or general intelligence.

The g-factor model was soon challenged by Thurstone (1887-1955), who claimed that even if there are correlations between scores on different mental tasks, these correlations are far from perfect. He therefore concluded that mental performance depends not on a general factor, but rather on several distinct abilities. However, Spearman's findings had impact on one of the most influential theories of intelligence until this date, namely the theory of crystallized and fluid intelligence (Cattell, 1971; Horn, 1985). Spearman's general intelligence was broken down into two distinct but related subtypes of g (with a correlation of about .50). Crystallized intelligence (Gc) is the ability to acquire, retain, organize and conceptualize information, rather than information processing, which is represented by fluid intelligence (Gf). Broadly speaking, Gc is the ability to apply previously acquired knowledge to new problems, while Gf is the ability to deal with problem-solving when personal experience does not provide a solution (Mackintosh, 2011; Willis, Dumont, & Kaufman, 2011). Gf involves high performance with novel information, and it has been suggested to be dependent on differences in the effectiveness of the central nervous system. Gc, on the other hand, is dependent on differences in education and other forms of acculturation. Cattell (1941) proposed that Gf derives from genetic and biological differences, while Gc primarily reflects environmental influences (such as education and socioeconomic status).

Today the model is sometimes referred to as the extended Gf-Gc theory, because other broad, second-order factors joined Gf and Gc at the top level (Stratum II) of its hierarchical structure (Horn & Blankson, 2005). Besides the nine Stratum II factors (e.g., Quantitative Knowledge, Speed of Thinking Abilities, and Abilities of Long-term Memory Storage), there are over 80 first-order factors (Stratum I). These intercorrelated factors represent specialized abilities that are strongly associated with the broad, second-order abilities (Davidson & Kemp, 2011). From a developmental perspective, the extended Gf-Gc theory has been useful in explaining and predicting intellectual change, especially in adulthood (Horn, 1994). Horn, Donaldson and Engstrom (1981) showed that when individuals are around age 20, Gf tends to reach its peak and then subsequently begins its slow decline. They argued that this is due to the accumulation of injuries to the central nervous system. Gc, on the other hand, is less dependent on the general effectiveness of the nervous system, and therefore it can improve during childhood and increase or remain stable throughout adulthood (Horn & Blankson, 2005).

Carroll´s (1993) three-stratum theory views the structure of intelligence as a pyramid with Stratum III at the top, which consists solely of the conceptual equivalent of Spearman´s g-factor. Stratum II, the middle of the pyramid, represents eight broad abilities that are differentially influenced by g. These eight factors are similar to the second-order factors in the Gf-Gc theory. Stratum I, the base of the pyramid, consists of 69 specialized abilities, such as quantitative reasoning and spelling. Each factor at Stratum I is highly related to at least one of the eight broader abilities in Stratum II.

The three-stratum theory has been empirically examined in light of age differentiation (Bickley, Keith & Wolfe, 1995), supporting Carroll´s (1993) claim that the structure of mental abilities does not vary with age.

Today, many studies refer to The Cattell-Horn-Carroll (CHC) Theory, which is an integration of the Gf-Gc theoryand three-stratum theories (McGrew, 2005). The CHC captures the similarities between Cattell and Horn´s Gf-Gc theory and Carroll´s three-stratum model, while reconciling the discrepancies. There are four main differences between the theories: (1) the three-stratum model strongly endorses the g-factor, but the extended Gf-Gc does not include it; (2) the three-stratum theory does not have a distinct factor for quantitative knowledge, whereas the Gf-Gc theory does; (3) the three-stratum theory incorporates reading and writing ability under Gc; and (4) the three-stratum model combines short- and long-term memory into one general factor, whereas they are separate second-order factors in the Gf-Gc theory (Davidson & Kemp, 2011). The ways in which CHC theory handles these differences has changed since its conception in 1997 (McGrew, 1997), and the most recent version has three strata (McGrew, 2009). Stratum III consists solely of a g-factor, although it is emphasized that this factor may only have an indirect effect on performance because it is mediated by some of the broad and narrow abilities in the other two strata. Stratum II is viewed as the most relevant level, now consisting of 16 broad, second-order abilities. These are Crystallized intelligence (Gc), Fluid intelligence (Gf), Quantitative reasoning (Gq), Reading and writing ability (Grw), Short-term memory (Gsm), Long-term storage and retrival (Glr), Visual processing (Gv), Auditory processing (Ga), and Processing speed (Gs). The number of narrow factors at Stratum I have increased accordingly, and to date there are over 70. Even if CHC is relatively new, and revisions are expected and encouraged (McGrew, 2009), it has already generated a great deal of research in a variety of fields (Davidson & Kemp, 2011).

However, after reviewing 20 years of factor analytic research on intelligence from a CHC perspective, Keith and Reynolds (2010) concluded that Gc remains an elusive construct, and that researchers often talk past each other when discussing Gc, referring to crystallized intelligence, academic achievement or verbal ability. Kan, Keivit, Dolan and van der Maas (2011) investigated Gc in relation to Cattell´s (1987) investment theory. When educational differences were taken into account, Gc and verbal comprehension, on the one hand, and Gf and g, on the other, were distinct. Their conclusion was that crystallized intelligence is not a capacity, i.e. an underlying variable, and that Gf was a predictor of Gc, as was verbal comprehension. According to Cattell (1987), Gf and verbal comprehension are not the only predictors of Gc; exposure to information through education is another. But as Keith and Reynolds (2010) argue, CHC theory appears to be a valid foundation on which to build the next generation of intelligence tests, though questions about the theory certainly remain.

Relationships between Big Five and intelligence

Personality and intelligence have often been viewed as distinct domains with only a low degree of overlap. However, research on both personality and intelligence suggests the possibility that intelligence could be integrated with larger models of personality (DeYoung, 2011). Pytlik Zillig, Hemenover and Dienstbier (2002) argued that the discrimination between cognitive and noncognitive traits, where intelligence is considered cognitive and personality noncognitive, fails because almost all traits have cognitive attributes, though these are more prominent in some traits than others. In their study of common Big Five questionnaires, items describing cognitive traits were found in all five domains, with Openness containing the most such items and Extraversion and Neuroticism the fewest. Even for traits that might be considered relatively less cognitive, there are examples of cognitive attributes. Neuroticism, for example, is associated with compulsive thinking about possible threats (Nolan, Roberts & Gotlib, 1998), and Agreeableness is associated with understanding and considering the mental states of others (Nettle & Liddle, 2008).

Another type of relationship between personality and intelligence is revealed in intelligence testing. Personality may influence performance on intelligence tests, through its effects on attentional and memory functions (Ackerman & Heggestad, 1997). Anxiety, for example, may depress test scores by distracting attention from the task at hand (Matthews, Deary & Whiteman, 2009).

Several studies of associations between intelligence and personality have been published (Ackerman, 2009; Chamorro-Premuzic & Furnham, 2003a; Zeidner & Matthews, 2000), but only one of these is a meta-analysis (Ackerman & Heggestad, 1997). This meta-analysis reported a correlation of .33 between intelligence (g) and Openness to experience. Other interpretations of the correlation are that Openness to experience may be regarded as a self-report measure of ability, because the scale often include words such as intellectual, erudite, and clever (DeYoung, 2011; Chamorro-Premuzic & Furnham, 2005), or that Openness could be a consequence, rather than a cause, of higher intelligence. In the latter case, high intellectual ability would to some extent cause the development of a highly open personality, but support for this interpretation is poor (Ackerman & Rolfhus, 1999). Another option would be if more intelligent individuals engage in more activities, which would lead to high intellectual competence and vice versa (Goff & Ackerman, 1992).

Extraversion revealed a small, but significant, positive correlation (r = .08) in Ackerman and Heggestad's (1997) meta-analysis. An updated meta-analysis for Extraversion (Wolf & Ackerman, 2005), including 50 new studies, found a similar effect (r = .05). This weak relationship between Extraversion and intelligence can be interpreted in terms of Extraversion's positive correlation with Openness to experience rather than a real association with intelligence specifically (DeYoung, 2011).

For Neuroticism, Ackerman and Heggestad (1997) reported a modest significant negative correlation with intelligence (r = -.15). According to Zeidner (1995), the negative relationship between intelligence and Neuroticism may depend on the facets anxiety, angry, hostility and depression, all of which impair intellectual functioning in a variety of contexts. Ackerman and Heggestad (1997) also reported a correlation of r = -.33 between general intelligence and self-report measures of test anxiety, suggesting that test anxiety serves as a mediator of the relationship between Neuroticism and intelligence. These findings imply that Neuroticism is more related to intelligence test performance than to intelligence per se. Furnham and Thomas (2004) suggested that Neuroticism may also be associated with lower self-estimated intelligence because persons with high neuroticism have lower self-esteem.

Earlier studies (Ackerman & Heggestad, 1997) seem to indicate that Agreeableness and Conscientiousness are only weakly related to intelligence, but more recent studies have observed that Conscientiousness and intelligence are negatively correlated (Moutafi, Furnham & Crump, 2003). This result was confirmed in a large-scale sample (N=4859), where Conscientiousness was significantly negatively correlated with measures of numerical, verbal, abstract and general intelligence (Moutafi, Furnham & Paltiel, 2005). The authors explained this negative relationship in terms of compensation; higher Conscientiousness might be compensatory for those with lower intelligence. People who are low in intelligence may use orderliness as a strategy for dealing with complex situations. They may also tend to work harder to accomplish tasks that could be performed more quickly or easily by someone more intelligent. Conscientiousness and intelligence are the best predictors of performance, both in work and academic settings (Poropat, 2009). Thus, increasing one might well compensate for a deficiency in the other (DeYoung, 2011).

De Young (2011) pointed out the need for future research to examine what genetic and neurobiological mechanisms are involved in the association between intelligence and personality traits. We know relatively little about how the biological systems underlying intelligence are related to the biological systems underlying personality traits.

Personality and intelligence as predictors of academic performance

Intelligence and academic performance

Already in the 1940s, Harris (1940) claimed that the most essential determinants of academic success were intelligence and motivation. Today, few would disagree about the importance of these factors or about the fact that intelligence test scores predict academic success (e.g., Ackerman & Heggestad, 1997; Busato et al., 2000).

The relationship between intelligence and academic success is usually explained by the ability to learn more efficiently, which, in turn, leads to successful problem-solving across a variety of areas (Furnham & Chamorro-Premuzic, 2004). Mayer (2011) argued that the relationship between intelligence and academic achievement is reciprocal. First, intelligence (the ability to learn) helps in acquiring knowledge (the outcome of learning). Second, knowledge (the achievement) improves the ability to learn (intelligence). This reciprocity is apparent in the definition of Gc, the cognitive ability that depends on specific knowledge (Carroll, 1993). Gc is important for education because it can increase through appropriate opportunities for learning (Mayer, 2011). Taken together, intelligence enables learning, and achievement enables intelligence, which in turn, can explain the Flynn effect (Flynn, 1998). The Flynn effect refers to findings showing that IQ scores rose throughout the 20th century at a rate of about five points per decade in each of the 20 industrialized countries for which data are available. Martinez (2000) interpreted these findings as showing that increased access to education serves not only to increase knowledge (what is learned), but also to improve the ability to learn (intelligence). Ceci, Barnett and Kanaya (2003) interpreted the Flynn effect as evidence that intelligence and experience interact to produce improvement in students' knowledge. They argued that general ability may predispose a learner to seek certain experiences, which results in specialized knowledge that, in turn, enables the learner to use his or her general ability to learn even more effectively in that domain, leading to more specialized knowledge and so on.

Research by Eriksson (2003) also showed that deliberate practice can greatly enhance task performance. When a learner continually devotes considerable time and effort to practicing tasks that are challenging (and somewhat beyond the learner´s current level of performance), deliberate practice occurs. In a Swedish sample (N=48 269), Cliffordson and Gustafsson (2008) examined the effects of age and schooling on different aspects of intellectual performance, taking track of study into account. The

results showed that both age and schooling increase performance, but the effects of schooling were considerably stronger than the effects of age. Given that individuals are both selected and self-selected into different educational programs, Ceci (1991) claimed that is is necessary to control for initial performance differences. Several such studies have been carried out, all of them showing fairly strong effects of schooling on intellectual level, amounting to around 2.0 – 2.5 IQ points for each additional year of academic schooling (Cliffordson & Gustafsson, 2008). However, gains in intelligence as an effect of schooling raise a number of questions. First, as experimental methods cannot be used for practical and ethical reasons, the causal effect of schooling is not easy to determine. Second, differences in intellectual interest may be related to changes in IQ (Brody, 1992). Third, there is a difficulty associated with interpreting a change in IQ points as an effect of schooling, because it may in fact reflect a change in test performance rather than a real change in intelligence (Ceci, 1991). Ceci (1991) discussed the possibility that schooling may influence IQ because the experience of being in school alters individuals´ cognitive processes in a fundamental manner.

In any case, cognitive ability plays a significant role in predicting academic success (Deary, Strand, Smith, & Fernandes, 2006; Chamorro-Premuzic & Furnham, 2006), but a large proportion of the variance is still unaccounted for (Chamorro-Premuzic & Furnham, 2005). There is a considerable amount of research suggesting that the relationship between general intelligence and academic performance may often be weaker than expected (Singh & Varma, 1995; Metha & Kumar, 1985), especially at higher levels of formal education (Chamorro-Premuzic & Furnham, 2005). Some researchers have reported that in higher levels of education (college), the predictive power of psychometric intelligence declines (Ackerman, 1994). In elementary school, Jensen (1980) reported correlations ranging from r = .60 to r = .70 between psychometric intelligence and academic performance, declining to r = .50 in secondary school further to r = .40 in college. Hunter (1986) argued that measures of general intelligence have only been found to be modest predictors of academic success for adults. This leads to the assumption that non-cognitive factors, such as personality, play a more important role as individuals grow older and progress through the formal educational system (Ackerman & Heggestad, 1997; O´Connor & Paunonen, 2007; Chamorro-Premuzic & Furnham, 2008). Another possible explanation for the declining correlation between academic performance and intelligence at higher education levels is the restricted range in intelligent scores. In tertiary education, student selection procedures reduce variation in intelligence scores, especially at selective institutions (Furnham, Chamorro-Premuzic & McDougall, 2002). As a consequence, factors other than intelligence may be better predictors of academic performance, factors such as personality traits.

Personality traits and academic performance

Most measures of personality were not explicitly designed to predict academic performance (Ackerman & Heggestad, 1997), in contrast to the field of intelligence, where many intelligence tests were specifically constructed to predict such performance (Brown & French, 1979). There is, however, a good theoretical basis for the ability of the Big Five to predict academic performance (Poropat, 2009), e.g. the lexical hypothesis suggesting that most of the differences between people are recorded in language (Allport & Odbert, 1936). Saucier and Goldberg (1996) suggested the idea that there is an evolutionary advantage to being able to identify individual differences among people and that natural languages are therefore developed in a way that aids this identification. The more valued a feature of personality is, the more descriptors for that feature will be found in natural language (Poropat, 2009). Therefore, if the lexical hypothesis is correct, dimensions of the Big Five should be related to behaviors and outcomes that are important, such as performance at work, mortality, divorce and other socially important outcomes. The substantial investments in education by societies and individuals, which demonstrate the high value placed on education performance, may therefore explain why there are associations between personality traits, as defined the Five-Factor Model of personality (Poropat, 2009), and academic performance.

Of the Big Five factors, Conscientiousness is undoubtedly the strongest personality predictor of academic success (see Poropat, 2009, for a review). This trait covers many facets important in academic settings, such as organizational ability, perseverance, hard work and motivation. Conscientious people are rational, informed and generally think of themselves as being high in competence (McCrae & Costa, 2003). It therefore seems logical that students high on Conscientiousness also perform better in academic settings (O´Connor & Paunonen, 2007). Another explanation has been that Conscientiousness is conceptually related to motivation to succeed (Busato et al., 2000; Anderson & Keith, 1997; Furnham, 1995), which is of considerable importance with regard to academic performance. Campbell (1990) suggested that motivation can be understood as the choice to expend effort, the level of effort, and persisting at that level of effort (see also Chamorro-Premuzic & Furnham, 2003a, b).

In a recent meta-analysis of the five-factor model of personality and academic performance, with a cumulative sample size of over 70,000, Poropat (2009) found that Conscientiousness was the strongest predictor of academic performance, both on the tertiary level (college) but also in secondary education (high school). Poropat also concluded that Conscientiousness and intelligence have a similar magnitude of correlation to academic performance, and he therefore emphasized the need for future researchers to seriously consider the role of Conscientiousness in academic settings. In the meta-analysis by Trappmann, Hell, Hirn, and Schuler (2007), which included 58 studies, Conscientiousness showed the strongest validity for academic achievement as

measured by college grades. They showed that 7.2 percent of the variance in the criterion measure could be explained by Conscientiousness.

According to Chamorro-Premuzic and Furnham (2003a, b), it is important to examine whether the use of facets can improve on the prediction of academic performance achieved when using super-traits alone. The results from one of their studies showed that the Conscientiousness facets dutifulness and achievement-striving as well as self-discipline correlated significantly with exam scores. The facet self-discipline was associated with academic performance in O`Connor and Paunonen's (2007) meta-analysis, with correlations from r=.18 to r=.46. Other studies (De Fruyt & Mervielde, 1996; Gray & Watson, 2002) have found positive associations between all six facets and academic performance, but the strength of the relations tends to vary across facets, suggesting that some of the facets are more important than others for predicting academic performance.

Openness to experience as a predictor of academic success has produced mixed results (O´Connor & Paunonen, 2007). Some studies have identified a positive association between Openness to experience and post-secondary academic performance (e.g., Dollinger & Orf, 1991; Rothstein, Paunonen, Rush, & King, 1994), while others have found no significant relationship between Openness and academic performance (Goff & Ackerman, 1992; Busato et al., 2000, Chamorro-Premuzic & Furnham, 2003a, b), even if De Raad and Schouwenburg (1996) stated that Openness, given its association with being intelligent, resourceful and foresighted, appears to reflect the ideal student. The lack of relationship between Openness and academic performance can be explained by the nature of academic settings; people low on Openness to experience are characterized by being down to earth and practical, which may be beneficial to academic performance. Openness to experience may therefore be associated with higher intelligence, but not with academic performance (Chamorro-Premuzic & Furnham, 2003b). However, if the academic settings involve artistic, imaginative and creative intervention, it is possible that Openness to experience may have a positive effect on academic performance (Chamorro-Premuzic & Furnham, 2003a, b). O´Connor and Paunonen (2007) discussed the possibility that one or more unknown moderator variables may be responsible for determining whether Openness exerts a positive or null influence on academic performance, owing to the variation found in Openness in many studies.

Like Openness to experience, Extraversion has produced mixed results as a predictor of academic performance (O´Connor & Paunonen, 2007). Several studies have reported negative associations between Extraversion and academic performance (Furnham, Chamorro-Premuzic & McDougall, 2002; Goff & Ackerman, 1992; Busato et al., 2000). Only a few studies have reported positive associations (Rothstein et al., 1994), while most report no association between Extraversion and academic performance (Paunonen & Ashton, 2001). At the facet level, activity and gregariousness were negatively related to grades in Chamorro-Premuzic and

Furnham's (2003b) study, supporting the assumption that introverts spend more time studying (Eysenck, 1992). Age also seems to act as a moderator in explaining the relationship between Extraversion and academic performance; Extraversion predicts higher grades in elementary school, but lower grades in high-school (Bratko, Chamorro-Premuzic, & Saks, 2006; Wolf & Ackerman, 2005). According to De Raad and Schouwenburg (1996), students who are high on Extraversion will perform better academically because of their higher energy levels, along with their positive attitude (which in turn leads to a desire to learn). On the other hand, students who are high on Extraversion would be more likely to socialize and engage in activities other than studying (Eysenck, 1992), which can explain the declining correlation between Extraversion and academic performance after the age of 14 (Wolf & Ackerman, 2005)

Neuroticism often shows negative correlations with academic performance (Poropat, 2009; Chamorro-Premuzic & Furnham, 2003a), which can be explained by the association with anxiety (Zeidner & Matthews, 2000). Individuals high on Neuroticism tend to focus on their emotional state, and such a focus may interfere with attention to academic tasks and thereby reduce performance (De Raad & Schouwenburg, 1996). On the other hand, there is evidence that the relationship between Emotional Stability (the opposite of Neuroticism) and academic performance becomes more positive among older students, at least in primary education (De Raad & Schouwenberg, 1996), and then declines again at the secondary level (Poropat, 2009), which can be explained by the upward restriction of the range of intelligence of students. Students low on Emotional Stability perform worse on stressful tests of intelligence (Dobson, 2000), while students with higher intelligence have more capacity for managing emotional responses (Perkins & Corr, 2006). Upward restriction of the range of intelligence in students may mean that only the more intelligent students with low levels of Emotional Stability are retained in formal education, and they may have learned strategies for managing their anxiety so that it does not affect their academic performance (Poropat, 2009). Poropat further discussed the notion that the advantage of having higher levels of Emotional Stability will decline if older students with low Emotional Stability generally find tests, examinations and other activities progressively less stressful.

In one of the rare longitudinal studies, Chamorro-Premuzic and Furnham (2003a) found that Conscientiousness and Neuroticism were the strongest predictors of academic performance (positively and negatively, respectably). They argued that personality measures might be a better predictor of academic performance than students' oral and written skills as well as written production. They did not, however, control for general intelligence.

Agreeableness has been related to academic performance in some studies (Poropat, 2009), but is more often not related to overall academic performance (O´Connor & Paunonen, 2007). Poropat (2009) discussed the declining correlation between

Agreeableness and academic performance as students proceed through their academic career with changes in the relationship with the teacher/s. The measure of academic performance is less associated with factors regarding student-teacher and teacher-parent relationships at the second and tertiary level than at the primary level. Students in primary education have a much closer relation with their teachers than they do in secondary school, and at tertiary level teachers often have relatively distant relationships with students. This line of thought is corroborated by the findings from Laidra, Pullman and Allik (2007), as well as O`Connor and Paunonen (2007), who showed that Agreeableness predicts academic performance in school children but not in adolescents.

In one rare study where academic performance was measured by dividing grades into school subjects (Furnham & Monsen, 2009), the results showed that intelligence was the most important factor for science subjects. Conscientious students who were phlegmatic (stable introverts) did best in science subjects. For English language and literature, the results were similar. Neuroticism did not act as a significant predictor in their study, but there were different predictors if the school subjects were compulsory (in this case English language, English literature, math and science) or elective (in this case French, history, religion, geography and German language). Extraversion acts as a significant negative predictor for all compulsory tests, which suggests that extraverts are more successful when they are more interested in their studies or feel a sense of greater autonomy and freedom.

Approaches to learning

Another determinant of academic performance is approaches to learning (Chamorro-Premuzic & Furnham, 2009). Students' approaches to learning were initially examined by Marton and Säljö (1976). By studying how students perceived a particular reading task and then went about learning it, they came up with the idea of approaches to learning, the conceptual framework now known as "student approaches to learning" theory (Biggs, 1987a, b; 1993; Entwistle & Waterston, 1988). Learning outcomes varied as a result of learners´ intention and a student´s approach to learning refers to his/her preferences for employing particular processes and to the cognitive processes adopted during the learning tasks (Biggs, 2001). According to Entwistle (1988), approaches to learning are both context dependent and student dependent; students develop habitual ways of approaching a study task, and they adjust to the situational demands, as they perceive them. A student may adopt a surface, or a deep, approach to satisfy the specific task in question, but generally, individuals exhibit a tendency to take either a predominantly deep approach or a predominantly surface approach to learning (Marton & Säljö, 1976).

Deep learners enjoy taking an active orientation to the learning task, which is characterized by a search for meaning, a focus on the content as a whole and a willingness to see the interrelationship between different parts. A deep approach is based on interest in the subject matter of the task; the strategy is to maximize understanding and the intention is to engage in the task properly, on its own terms. A surface approach, on the other hand, is characterized by extrinsic motivation, a focus on the elements rather than the task as a whole, and a desire to complete the task as quickly as possible with the minimum of effort needed to meet requirements, which leads to a strategy of acquiring knowledge with a minimal emphasis on understanding (Biggs, 1987b; Biggs, Kember & Leung, 2001; Entwistle & McCune, 2004).

Kember, Biggs and Leung (2004) suggested a multidimensional hierarchical model of learning approaches based on the same concepts of a deep and a surface approach to learning. In their model, as shown in Figure 1, the top level consists of the learning approaches: deep and surface. The next level adds the motive and strategy for each approach. At the lowest level, there are four different variants of motive and strategy for each approach: "intrinsic interest" and "commitment to work" (deep motive), "relating ideas" and "understanding" (deep strategy), "fear of failure" and "aim of qualification" (surface motive), "minimizing scope of study" and "memorization" (surface strategy).

Measuring approaches to learning

The Learning Process Questionnaire (R-LPQ-2F; Kember, Biggs & Leung, 2004) is the most widely used instrument for measuring learning approaches (Zeegers, 2001; Gijbel, Van de Watering, Dochy & Van den Bossche, 2005). It was derived from two different questionnaires: the Study Process Questionnaire (SPQ; Biggs 1987a), for use at tertiary levels (e.g., college) and its school-level companion Learning Process Questionnaires (LPQ; Biggs 1987b). The R-LPQ-2F was developed specifically for use in secondary schools and is relatively brief and simple. It comprises 22 items (see Appendix), and respondents answer on a 5-point Likert scale ranging from "Always or almost always true of me" to "Never or only rarely true of me". The instrument measures deep and surface approaches to learning with items combined to represent the four sub-scales, described as deep motive, deep strategy, surface motive and surface strategy (see Figure 1). A third approach, the achieving, or strategic, approach, is characterized by a highly organized approach to study and high achievement motivation (Watkins, 1982). In the revised two-factor Study Process Questionnarie (R-SPQ-2F: Biggs, Kember & Leung, 2001), only deep and surface approaches are assessed, as these are the indicators which are most pertinent to its intended use by teachers in their classrooms. These two main factors do have clearly identified motive and strategy sub-components, as the R-LPQ-2F (Kember, Biggs & Leung, 2004), which may be of interest to researchers.

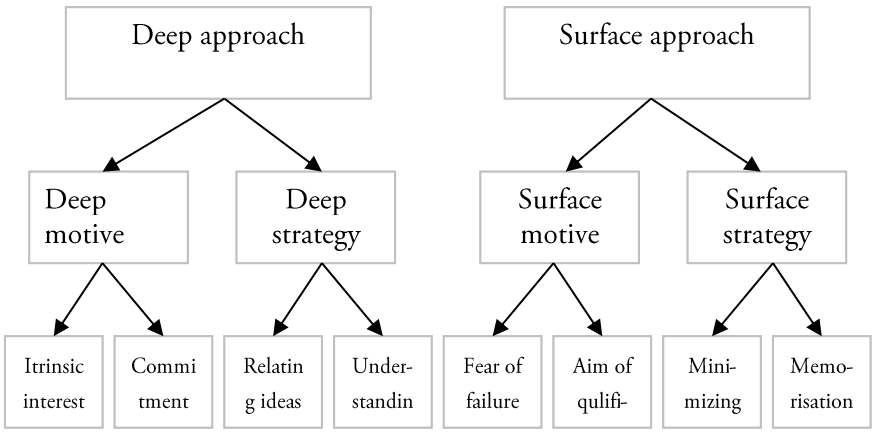

Figure 1. Hierarchical factor structure approaches to learning, according to Kember, Biggs & Leung (2004).

Relationships between approaches to learning and the Big Five

There is an on-going debate in the literature as to the possible overlaps between approaches to learning and personality traits (Chamorro-Premuzic, Furnham, & Lewis, 2007; Zang, 2003). Some researchers consider approaches to learning as partially stable and coherent personal attributes rather than as a fully situational determined strategic construct (Swanberg & Martinsen, 2010; Diseth, 2003; Duff, Boyle, Dunleavy & Ferguson, 2004). Chamorro-Premuzic and Furnham (2009) discussed the practical, as well as the theoretical, importance of examining the possible psychometric overlap between approaches to learning and personality traits. Interventions aimed at influencing student´s approaches to learning would benefit from knowing to what extent stable dispositions (e.g. personality traits) may "compete" with situational factors (e.g. approaches to learning). Knowledge of the possible overlap between approaches to learning and personality traits would also benefit researchers and practitioners wishing to predict various educational outcomes, such as academic performance or test anxiety.

Regarding correlations between approaches to learning and personality traits, in a study by Zhang (2003), Openness, as characterized by open-mindedness and active imagination, had a strong positive relationship with the deep approach. Chamorro-

Premuzic and Furnham (2009) discussed the notion that the positive association between Openness and deep approaches to learning may reflect the intrinsic motivation and intellectual profile of both open and deep learners. Another empirical relationship is that between Neuroticism and a surface approach; this relationship is supported theoretically, because both reflect negative emotionality and maladaptive coping responses (Diseth, 2003). Zhang (2003) discussed this relationship, suggesting that individuals high on Neuroticism avoid taking the risk of making mistakes because they are emotionally unstable and suffer from low self-esteem. Owing to the conceptual and empirical overlap between learning approaches and personality traits, it is important to show that both learning approaches and personality uniquely contribute to the prediction of academic performance (Chamorro-Premuzic & Furnham, 2008).

Relationships between learning approaches and intelligence

The relation between approaches to learning and intelligence is far from conclusive. McKenna (1984) argued that there are no theoretical relationships between intelligence and learning style (e.g. the way we process information), because intelligence is concerned with the level of achievement, while style focuses on how to achieve. Diseth (2002) found no relationships between intelligence and learning approaches, except for a small negative relation between surface approach and crystallized intelligence. Chamorro-Premuzic and Furnham (2008) reported a positive relation between deep approach and intelligence, while Furnham, Monsen and Ahmetoglu (2009) found that the deep approaches to learning mediated the effects of IQ on academic performance. They suggested that IQ led to higher academic performance because individuals with a higher IQ employed a deep learning approach.

Learning approaches as predictors of academic performance

In terms of the relationship between learning approaches and academic performance, the typical findings are positive correlations between academic performance and deep approach, and negative correlations between a surface approach and academic performance (Entwistle & Ramsden, 1983; Busato, Prins, Elshout & Hamaker, 1998; Busato et al., 2000; Diseth, 2003). According to Entwistle, Tait and McCune (2000), a deep approach is more likely to be related to academic performance in the later years in university degree courses, while a surface approach may be beneficial for undergraduate students, depending on what the assessment procedure directly rewards: conceptual understanding or factual knowledge. These population-specific differences can depend on changing learning approaches based on students' intention

in learning or the perceived situational demands (Diseth, 2003). Despite expectations that the deep approach facilitates high-quality learning, some studies indicate that a deep approach does not necessarily correlate with higher grades (Busato et al., 2000; Diseth, 2003; Entwistle, Tait & McCune, 2000).

Diseth (2003) compared the relationship between academic performance and approaches to learning in two different samples and found that a surface approach was negatively related to academic performance among undergraduate psychology students, whereas a deep approach was positively related to academic performance among philosophical students. He explained this difference in the relationship in terms of difference in study motivation of the two groups. The latter group was taking courses that were both compulsory and a prerequisite for further education and the examination procedure demanded understanding. The negative relationship between the surface approach and academic performance among undergraduate psychology students was in line with previous findings and was also in line with the theoretical assumption that the surface approach impairs performance.

Gender differences

Female students receive higher grades and graduate from university at a higher rate than male students do, both in Sweden (National Agency for Education, 2005) and in other industrialized countries (Furnham, Monsen & Ahmetoglu, 2009; Buchmann & DiPrete, 2006). Findings also support the idea that female students have more positive attitudes toward their academic work (Kelly & Smail, 1986; McCall, 1994). In Sweden, girls have better grades in all school subjects by the end of the compulsory school (except for sports, where boys outperform girls). Differences in grades are smallest in mathematics, physics, and technology and largest in Swedish language, art, home economics and religion (National Agency for Education, 2005).

Female students also attend to schoolwork and homework more seriously and diligently than do male students (Halpern, 1992), and arrive at school better equipped for school activities (Murphy, 2000). One hypothesis concerning these gender differences is differences in personality, although Costa, Terracciano and McCrae (2001) have not offered any guidance as to whether there are gender differences in the FFM (Five Factor Model). However, results from their study show that, although the magnitude of gender differences varies, the direction is the same for all of the 26 cultures studied; women scored higher on Neuroticism, Agreeableness, and openness to feelings (a facet of Openness), and men scored higher on assertiveness (a facet of Extraversion). Other studies have shown that men tend to score slightly higher on the facet achievement striving, while women score slightly higher on self-control (both facets of Conscientiousness). These differences in

personality might possibly help account for gender differences in grades (Hicks, Johnson, Iacono & McGue, 2008).

Until recently there has been little systematic investigation into gender differences in approaches to learning (Wilson, Smart & Watson, 1996), even if there is evidence showing that men report poorer study habits than women and also report enjoying reading less (Noel-Levitz, 2007), until recently there has been little systematic investigation into eventual gender differences in approaches to learning (Wilson, Smart & Watson, 1996). Although the aim of the studies by Arteche, Chamorro-Premuzic, Ackerman and Furnham (2009) and Chamorro-Premuzic and Furnham (2009) was not to explore gender differences in learning approaches, neither of the studies reported significant gender differences in this regard. Other studies have found significant gender differences; male students scored significantly higher than female students on surface approach (Biggs, 1987b), and on the sub-factor surface strategy (Watkins & Hattie, 1981), and females scored higher than males on the sub-factors deep motive and deep strategy (Watkins & Hattie, 1981). Other studies have shown that women score higher than men on "fear of failure", a sub-factor of the surface motive (Clarke, 1986; Miller, Finley & McKinley, 1990; Watkins & Hattie, 1985), as well as on "relating ideas" a sub-factor of the deep strategy (Watkins & Hattie, 1985). All of the studies mentioned above used university samples.

Marrs and Sigler (2011) found that women tend to use a deep approach to a higher degree than men do at university, and they discussed this finding in terms of gender socialization, claiming that different socialization experiences cause men and women (boys and girls) to endorse different values. For example, female and male students differ in the extent to which they prepare for exams as well as in how they value achieved grades. The proportion of female students attending university has increased during recent years, thus increasing the importance of examining gender differences in learning approaches at an earlier stage, e.g. in upper secondary school. Moreover, when students reach the university level, they are a much more selected group compared to upper secondary level students. Their grades and interests have already determined their acceptance into different university programs and courses, and it is highly likely that this selection interacts with learning approaches. Thus, it is more probable that differences in learning strategies will be found at the lower level of education

Concluding remarks and aims of the present thesis

Extending prior work on what factors predict academic performance, the general purpose of the present thesis was to investigate to what extent personality and learning approaches predict academic performance. Intelligence has often been an

important and stable predictor of academic performance, and it has sometimes been found to be the most significant predictor (Chamorro-Premuzic & Furnham, 2005). However, in other reports its relation to academic performance has been weaker than expected, leading researchers to examine the predictive validity of other constructs for explaining the unique variance in academic performance. In any case, intelligence has been included in all studies presented in the present thesis to control for its influence on the prediction of academic performance of personality and learning approaches.

Most of the research on academic performance has been cross-sectional. Thus one goal of the present research was to use a longitudinal design (Study III) to explore the predictive validity of personality to academic performance. The longitudinal design also allowed the investigation of possible personality trait changes and how they might affect academic performance over time. All of the reports in the thesis aimed to investigate academic performance in more specific areas (e.g. different school subjects) and not just overall academic performance (GPA), which also provided knowledge on which specific factors best predict different areas of study. By investigating personality traits at the facet level, Study I also aimed to explore which level best predicts academic performance, the higher trait-level or the facet-level.

Given the fact that intelligence and personality account for a large amount of variance in academic performance, the aim of Study II was to investigate whether learning approaches contribute to the unique variance in academic performance. Another aim of Study II was to explore possible gender differences, as there is evidence in the literature that girls outperform boys, but that they also report higher levels of anxiety. Finally, by using a sample of upper secondary school students in all three studies, instead of a college sample, the results from the present thesis extend the findings from previous research.

Methodological background

The participants in the three studies included in this thesis originate from the same schools, and some measures have been used in all three studies. Therefore, a general methods description is in order before summarizing each of the three individual studies.

Participants

The participants consisted of upper secondary school students from two schools in southern Sweden. All participants were enrolled in university preparatory programs. Data were collected on three occasions, the first in autumn 2008, and included participants in 1st form, at age 16 (M=16.01, SD=.23). Study I consisted of 315 participants, 157 males and 158 females who were either enrolled in the social science program (8 classes), the natural science program (4 classes), or The International Baccalaureate program (IB; one class).

Study II was based on two sub-samples; the first collected in the spring of 2009 included 182 students, 72 males and 158 females, in their last semester of the 3rd form (M=19.06, SD=.36). They were enrolled in the social science program (9 classes in this sample) or the natural science program (2 classes). The second sample was a sub-sample from Study I and included 294 students, 120 males and 174 females. These data were collected in spring 2011 when the students were in their last semester of the 3rd form.

Study III was a longitudinal study based on the same N students who were included as the second sample of Study II, in other words, the first and second wave of data collection using a sub-sample of students from Study I.

Measurements

General Intelligence was measured using the Swedish version of Wonderlic Personnel Test (WPT) (Wonderlic, 1992). This 50-item test measures general intelligence and is administered in 12 min. The score is calculated as the number of correct answers given in the allotted time. Scores can range from 0 to 50, with a population mean of

22 and a population standard deviation of 7 (norms based on 118,549 Americans) (Wonderlic, 2002). The means and standard deviations found in this thesis were as follows: Study 1 (M=23.90, SD=6.00), Study II (M=24.24, SD=6.19) and Study III, second wave (M=27.80. SD=6.86). Items include word and number comparisons, disarranged sentences, serial analysis of geometric figures and story problems that require logical solutions. Studies have reported good validity and reliability (ranging from .82 to .94, Geisinger, 2001), and the test correlates very highly (from r = .75 to r = .92) with the WAIS-R (Dodrill, 1983; Dodrill, & Warner, 1988; Wonderlic, 2002).

The inventory used for measuring personality was a Swedish version of the 120-item short form of the IPIP-NEO-PI inventory (Goldberg, 1999). This inventory measures the personality scales Neuroticism, Extraversion, Openness to Experience, Conscientiousness and Agreeableness, using 24 items for each scale. Each scale has 6 subscales or facets. The answer format was a Likert scale with five rating levels from 1 (not at all accurate) to 5 (very accurate). There is a rapidly growing body of literature (Goldberg et al., 2006) reporting studies that have included IPIP scales instead of commercial inventories, such as NEO-PI-R (Costa & McCrae, 1992). The mean correlation between the 30 facet scales of NEO-PI-R and the corresponding IPIP scales has been estimated at .73 (.94 after correcting for attenuation due to unreliability – Goldberg, 1999).

Academic performance was measured by the participants' school-leaving certificate after completion of compulsory school (for participants in the 1st form), or the final grades in upper secondary school (for participants in the 3rd form). These grades are public documents in Sweden and were reported by the participating schools. Each grade can take one of four categorical values: 0 (fail), 10 (pass), 15 (pass with distinction) and 20 (pass with special distinction). Grades were split up into different topics, based on the content of each subject.

Approaches to learning were measured by the Swedish version of the Revised Learning Process Questionnaire (R-LPQ-2F; Kember, Biggs & Leung, 2004). This 20-item questionnaire was used to assess two main approaches to learning: a deep approach (a real understanding of what has been learned) and a surface approach (a reproduction of what has been taught to meet the minimum requirement). The answer format was a scale with five ratings from 1 (this item is never or only rarely true of me) to 5 (this item is always or almost always true of me). The translation to Swedish was led by the author and was based on the process of back translation; first, two independent persons translated the English version into Swedish, and then this version was back translated from Swedish into English by two persons. Finally, the original and the back-translated versions were compared to look for disagreements. Persons fluent in both English and Swedish carried out all translations. Only a few items had to be changed owing to mistakes during the process.

Procedure

The measures were administered to groups of students in classroom settings, one class at a time. The researcher and one assistant were present, and in some cases the students´ teacher. All participants were given the same information about the aim of the study and instructions about how to complete the measures. The subjects were also informed that their informed consent was needed, and that they could quit the study at any time without giving a reason. They were also assured of confidentiality in the storage and processing of the collected data. All of the measures were in paper-and-pencil form. They first completed the Wonderlic measure, and then they continued with the other measure/s. There were no time limits for any of the tasks, except for the Wonderlic. The students were told not to talk with each other during the test session. There was time to ask questions before the test session began. The test sessions lasted approximately one hour.

Summary of the empirical studies

Study I

Background and aims

Understanding individual differences in scholastic achievement has long been a concern of educational psychologists. Knowledge of factors affecting academic success has implications for learning and education. Many studies have therefore attempted to identify the determinants of academic success in order to develop curricula and improve academic achievement (O'Connor & Paunonen, 2007). Research has established that cognitive ability is one important determinant of academic performance, but studies have also shown that factors other than intelligence are useful predictors of academic performance; one of these factors is personality (Busato et al., 1998, 2000;; Chamorro-Premuzic, & Furnham, 2003a; b). Research by Chamorro-Premuzic and Furnham (2003a; b), Chamorro-Premuzic and Arteche (2008) as well as Furnham and Monsen (2009) have highlighted our understanding of which factors predict academic achievement. They have pointed out the need for future research to look at academic achievement in relation to specific subjects, not simply in relation to overall achievement. In addition, they have instigated research in which personality factors are analyzed at the level of facets, or primary traits, as a promising alternative to using super-traits. Inspired by the above research, the main aim of the first study in the present thesis was to explore the degree to which personality and general intelligence predict the academic performance of upper secondary school students in Sweden. Personality was measured both an a global factor level and a lower level using facets, and academic performance was also measured on a global level and on a lower level using grades of more specific school subjects. In addition to the expectation of positive results for general intelligence and Conscientiousness, we also expect that Extraversion, Openness and Neuroticism will predict academic performance (after controlling for general intelligence and Conscientiousness). At the facet level, the hypotheses were that the Conscientiousness facets dutifulness, achievement striving and self-discipline would be positively related to academic performance, and that the Extraversion facets activity, gregariousness, and excitement seeking would be negatively associated with academic performance.

For Openness, we expected the facets openness to ideas and openness to values to be positively related to academic performance. No specific hypotheses were made for Agreeableness or the other facets of the other traits, or the facets in relation to different subjects. Instead, the study aimed to determine which other facets could predict academic performance at both the higher level, as well as lower levels. Differences between boys and girls were expected regarding level of academic performance.

Method

A total of 315 upper secondary school students attending their first year of a university preparatory program participated in the study. General intelligence was measured using the 50-item Wonderlic Personnel Test (Wonderlic, 1992), personality traits were measured using a Swedish version of the 120-item short form of the IPIP-NEO-PI test (Goldberg, 1999), and academic performance was measured by the participants' school leaving certificate after completing compulsory school. Grades were divided into different school subjects.

By using structural equation modeling, a basic exploratory path model was constructed. In the basic model, only Conscientiousness and general intelligence were included as independent variables. Thereafter the other personality factors were added one at a time to investigate whether they contributed additively to the basic model. Academic performance was modeled as a hierarchical factor with total academic performance as a latent variable at the highest level; the different kinds of academic performance were defined as latent variables on a lower level, with the grades from all school subjects as observed variables.

Main findings and conclusions

Of the Big Five personality variables, Conscientiousness, as well as the facet achievement-striving, had a clear effect on total academic performance. It seems likely and logical that hard-working and achievement-oriented students will perform better on typical academic tasks than will those who do not have these traits (Poropat, 2009). There were also relationships between Conscientiousness and the school subjects involving practical topics (music, home and consumer studies, crafts and art). These topics are more often evaluated based on the quality of performance than on the basis of theoretical knowledge. It seems reasonable that these topics would be predicted by Conscientiousness. As expected, Extraversion had a negative relationship to academic performance. There were no significant relations at the facet levels, supporting only the high level Extraversion factor as a predictor of grades. On the other hand, on a lower level, there were positive relationships between Extraversion

and the school subject social science and sports, both of which seem logical; extroverts are favored because they dare to speak out and to discuss the subject. In sports, teamwork is sometimes needed, and this may be the reason why extraverts outperform introverts.

The study did not support a relationship between Openness and academic performance, but there were positive relationships to the school subjects language and practical topics, supporting the importance of this level. These results can be interpreted in relation to the nature of the trait Openness: being curious, but also having the ability to imagine things in an intellectual way, may facilitate the performance of practical tasks (Chamorro-Premuzic & Furnham, 2003a; b). There were also relationships between some of the facets of Openness and the low-level school subjects. A positive path from the facet artistic to the school subject art and a negative path from the facet intellect to art indicated that these low-level traits seem to suppress each other.

Neuroticism had small, but significant, positive associations with academic performance. On a lower level, there were positive relations between Neuroticism and the school subject language and practical topics and an average negative relation with sports.

There were also structural differences between boys and girls; the relation between Conscientiousness and IQ was positive for girls and negative for boys. Earlier studies (Moutafi, Furnham & Crump, 2003) have suggested that the relation between IQ and Conscientiousness is negative, yet the present study only finds support for this in boys. Other studies have rather suggested that IQ and Conscientiousness are not related to each other. The present study may help explain why conflicting results have been found concerning this relation.

The major conclusion of this study is that personality traits, particularly Conscientiousness, may facilitate academic performance, and that lower-level traits may facilitate particular subjects. A likely explanation for these relations is that personality has an impact on the motivation to study a specific subject. New knowledge about the relationship between personality traits and study grades could inspire teachers to develop new methods adapted to the specific personality styles of students (Poropat, 2009).

Study II

Background and aims

The general aim of this study was to investigate the unique contribution of learning approaches to academic performance, given the well-documented predictors of personality and intelligence. A second aim was to explore possible gender differences in learning approaches. Among college students, females, as compared to males, tend to have a more positive attitude toward academic work (Mathews, 1991), while men are less academically engaged than woman, which impacts the quality of the educational experience (Sax, 2008). The question is whether these differences are also evident among students in upper secondary school and whether learning approaches are related to general academic performance as well as to more specific school subjects, e.g. math, language, natural science and social science.

Learning approaches have been categorized into two general strategies: deep and surface (Biggs, 1999). A surface approach to learning is founded on a motive that is extrinsic to the purpose of the task and driven by a desire to complete the task as quickly as possible, with the minimum effort needed to meet requirements. This reflects a strategy of acquiring knowledge with a minimal emphasis on understanding and is based on rote learning of details and facts for later recall. In contrast, a deep approach to learning reflects an interest in the concept underlying the topic being studied and an emphasis of understanding (Biggs, 2001; Biggs, Kember & Leung, 2001). The approaches to learning model have a hierarchical structure including the lower-level elements of both strategy and motive for the deep and the surface approach. In addition, the strategy and motive elements are themselves multidimensional (Kember, Biggs & Leung, 2004), see Figure 1. In university settings, the typical findings have shown positive relations between deep approach and academic performance at the graduate level, while a surface approach may be beneficial for undergraduate students.

Regarding gender differences in approaches to learning, some studies have found significant differences, e.g. male students scored significantly higher than female students on surface approach (Biggs, 1987b), and on the sub-factor surface strategy (Watkins & Hattie, 1981). Females scored higher than males on the sub-factors deep motive and deep strategy (Watkins & Hattie, 1981). Other studies have shown that women score higher than men on "fear of failure", a sub-factor of surface motive (Clarke, 1986; Miller, Finley & McKinley, 1990; Watkins & Hattie, 1985), as well as on "relating ideas", a sub-factor of deep strategy (Watkins & Hattie, 1985).

The general hypothesis of this study was that learning approaches contribute uniquely to academic performance after controlling for IQ and personality traits. The first

hypothesis was that academic performance would be related to learning approaches, such that the deep approaches (deep motive and deep strategy) would be positively related to academic performance, while the surface approaches (surface motive and surface strategy) would be negatively related to academic performance. The second hypothesis was that there would be a relation between IQ and learning approaches, and between personality and learning approaches. More specifically, we hypothesized that IQ would be related to the deep approaches, Neuroticism to the surface approaches and Extraversion and Conscientiousness to both the deep approaches and to the sub-factor surface strategy. No specific hypothesis was made concerning possible gender differences, due to the lack of research on this subject, but we expected to find differences among boys and girls in how learning approaches were related to academic performance.

Just as in Study I, this study divided academic performance into different school subjects to explore whether there were specific relations between learning approaches and academic performance in different school subjects.

Method

A total of 476 upper secondary school students from Sweden participated in this cross-sectional study. All participants were attending university preparatory programs. General intelligence was measured using the Personnel Test (Wonderlic, 1992; Wonderlic & Associates, 2002). The short form of the IPIP-NEO-PI test (Goldberg, 1999a) was used to measure personality. A Swedish version of the 20-item Revised Learning Process Questionnaire (R-LPQ-2F, Kember, Biggs & Leung, 2004) was used to measure learning approaches: deep approach and surface approach. Academic performance was measured by the participants' school leaving certificate after completion of compulsory school (for participants in their 1st form) and final grades in upper secondary school (for participant in their 3rd form)..

Main findings and conclusions

The hypotheses were tested by using a combination of hierarchical and stepwise regression analyses, separate for girls and boys, with academic performance as the dependent variable and with IQ, the facets of personality traits and learning approaches as independent variables. Different analyses were carried out for the different school subjects. The results showed that learning approaches uniquely accounted for 6 % and 16 % of the variance in general academic performance for girls and boys, respectively. This finding supports the idea that learning approaches do contribute to academic performance, even after controlling for personality and general intelligence.

There were also differences between girls and boys with respect to how much they valued different learning approaches. Girls who rated high on the surface motive generally had higher academic performance; this was especially true of the school subjects English language, Swedish language and math. The fact that surface motive involves the subscales "fear of failure" and "aim of qualification" suggests that girls with higher grades are anxious about getting low grades and what implications these low grades will have. Perhaps such motives drive girls more than boys to perform well in school. On the other hand, boys who valued the sub-factor deep motive showed better academic performance, although this relation was not significant for girls. Among girls there were in fact negative relations between deep motive and the school subjects math and social science. For Swedish language, this negative association can be explained by the impact of Conscientiousness for the girls; the facets achievement and cautiousness had a positive impact on this grade. Girls with a higher degree of achievement and cautiousness got higher grades in Swedish language even if they did not use a deep motive, as the boys did; this suggests that pragmatic girls do well and that boys who in their learning approaches are more intrinsically motivated to fully understand get better grades in Swedish language. Another more speculative possibility is that girls use these learning approaches especially during math and social science studies. Thus, even if they prefer a deeper understanding of the material, this approach has not led to high grades in the past; so instead, some girls use other strategies to get good grades in these subjects.

The relations between personality traits and learning approaches were very interesting. The positive relation between Neuroticism and the sub-factors surface motive and surface strategy for girls support Diseth's (2003) idea that Neuroticism and surface approach both reflect negative emotionality and maladaptive coping. As discussed above, the sub-factor surface motive was a predictor of academic performance for girls, but not for boys, indicating that there are differences regarding how girls and boys behave in relation to this motive. Schools are sometimes accused of using a teaching style that fosters a surface approach to learning (Smith & Miller, 2005), e.g. with exams that foremost include detail knowledge. There were positive associations between Conscientiousness and deep approach for both girls and boys, as well as between Openness to experience and deep approach. These results indicate that students who score themselves high on Conscientiousness and Openness also prefer a deep understanding.

Taken together, the results from this study improved our knowledge of what factors predict academic performance, and showed that learning approaches are independent of personality. In addition, interesting patterns of results were revealed in relation to specific school subjects, patterns that may have practical implications for teachers in different subjects.

Study III

Background and aims

By using a longitudinal design, the main aim of the final study in the thesis was to examine the predictive validity of personality traits in relation to academic performance (after controlling for the well-known fact that intelligence accounts for a fair amount of the variance) and, at the same time, to explore whether personality becomes more important for academic performance in upper secondary school than it was in elementary school. Besides, earlier findings have indicated that Conscientiousness sometimes accounts for the same amount of variance as intelligence does (Poropat, 2009). It has been shown that the relationship between personality factors and academic performance rises and falls depending on whether sample stem from primary or from secondary education (Poropat, 2009). As students proceed through their academic career (Laidra, Pullman and Allik, 2007), we see, for example, a declining correlation between Agreeableness and academic performance, and an increasing correlation between Neuroticism and academic performance (Poropat, 2009). In addition, Extraversion seems to predict higher grades in elementary school but lower grades in high school (Bratko, Chamorro-Premuzic, & Saks, 2006; Wolf & Ackerman, 2005).

The first hypothesis was that personality traits at Time 1 (age 16) would predict academic performance, after controlling for general intelligence, at Time 2 (age 19), and more specifically: Conscientiousness in a positive direction, Extraversion in a negative direction (after controlling for Conscientiousness) and Neuroticism (after controlling for Conscientiousness) in a negative direction. The second hypothesis was that the change in personality traits from Time 1 to Time 2 will have an influence on academic performance owing to the transition to upper secondary school from elementary school (where the measure of academic performance comes from at Time 1). More specifically: we expect that an increase in Conscientiousness and Openness to experience, and a decrease in Neuroticism and Extraversion, from age 16 to age 19, will improve academic performance,

Method

Swedish students (*N*=197) from upper secondary schools and attending university preparatory programs participated in the longitudinal study. Data were collected twice: Time 1 – when participants had just started their first year, and Time 2, the last semester of their third year. The inventory used in this study was the same as for Study I. Academic performance was measured by the participants' school leaving

certificate after completion of compulsory school (Time 1) and the participants' final grades in upper secondary school (Time 2).

Main findings and conclusions

The hypotheses were tested using structural equation modeling. The first step was to estimate a basic model consisting of general intelligence and Conscientiousness at Time 1 as independent variables, and academic performance at Time 2 as the dependent variable. The other personality factors from Time 1 were then added one at a time to investigate their separate contributions to the model (first hypothesis). For the second hypothesis, SEM-models were constructed using two latent variables, one representing academic performance in general (both Time 1 and Time 2) and the other representing the change from Time 1 to Time 2. The same kinds of latent variables were used for the personality factors.

As expected, Conscientiousness was demonstrated to be the strongest single predictor of academic performance, predicting performance both simultaneously and over time. Conscientiousness at age 16 predicted academic performance at age 19, thus it would seem that self-ratings at age 16 contained unique information on personality that was not captured by the self-ratings at age 19 related to specific aspects of academic performance graded in secondary school. The results also suggest that an increase in the level of Conscientiousness from age 16 to age 19 was related to an increase in the level of academic performance at age 19. There were also differences in the correlations between personality and academic performance from Time 1 to Time 2 (these results are not included in the manuscript, due to space restriction in the chosen journal). More specifically; there was a stronger correlation between Conscientiousness and academic performance and between altruism, a facet of Agreeableness, and academic performance, indicating that this facet is more beneficial to academic performance in senior high school than in elementary school. This is surprising, because the student-teacher relationship changes from elementary school to senior high school, where it is more distant in nature. One suggestion based on this result is that teachers' ratings of students' degree of altruism are important for grades but not for factual knowledge. Nevertheless, through ratings of norms and values, another goal of the Swedish school system, is evaluated and included in students' grades (National Agency of Education, 2011).

Extraversion at Time 1 had a negative relation to academic performance at Time 2, which is in line with previous findings (Bratko, Chamorro-Premuzic, & Saks, 2006; Wolf & Ackerman, 2005). This supports the idea that introverts perform better than extraverts, who may prefer to be more engaged in social networking (Eysenck, 1992).

Contrary to the hypothesis, there was a positive, instead of negative, relationship between Neuroticism at Time 1 and academic performance at Time 2. This result can

be difficult to interpret, but one suggestion is that the anxiety and vulnerability component of Neuroticism is important for academic performance in terms of a fear of failure. The selection criterion for college studies in Sweden is based on grades from upper secondary school, so for those students who wish to pursue a further academic career, the final grades are very important. Further research is needed to confirm this possibility.

The fact that a student's personality, as measured by age 16, predicted academic performance at age 19 is interesting at both a theoretical and an applied level. From a theoretical perspective, it supports the view that personality is related to academic performance and at the same time that traits are rather stable over time (McCrae & Costa, 1994). From an applied point of view, the results from this study emphasize the importance of personality measures for predicting academic performance, together with earlier academic performance and cognitive ability. Another potential application is the use of personality measures in student guidance and development.

Summary of results, discussion, and conclusions

The primary aim of the present thesis was to examine the hypothesis that personality traits predict academic performance, after controlling for intelligence. Personality and intelligence are two well-established domains in the research on individual differences, and the concepts and measures can be used not only in scientific research, but also in applied, real-world settings (Chamorro-Premuzic & Furnham, 2005). The results from three separate studies demonstrate, that intelligence and personality traits, specifically Conscientiousness, do in fact predict academic performance. This was shown to be the case both simultaneously (Study I, II and III), and over time (Study III). By using facet-level analysis, it was possible to obtain more precise information about predictor-criterion association.

Another aim was to explore whether learning approaches contribute uniquely after controlling for personality and general intelligence. Just such a contribution was supported in Study II. Moreover, gender differences were found, and they will be discussed in light of the other factors. The results from all three studies presented here showed that general intelligence and, secondly, Conscientiousness was the strongest predictors of academic performance. However, level of intelligence was not found to be predictive of whether an individual is likely to perform, leading us to a discussion of the importance of personality.

Furthermore, the relationship between general intelligence and personality traits was also in line with previous findings (Ackerman & Heggestad, 1997). Openness to experience correlated with general intelligence in all three studies. However, Openness to experience did not reveal any notable relationship to academic performance, indicating that Openness may be a consequence, rather than a cause, of higher intelligence (Ackerman & Rolfhus, 1999), or that individual high on Openness will engage in more activities, leading to higher intellectual competence (Goff & Ackerman, 1992).

The importance of Conscientiousness

Within the Big Five, Conscientiousness captures individual differences in "socially prescribed impulse control that facilitates task- and goal-directed behavior, such as thinking before acting, delaying gratification, following norms and rules, and planning, organizing, and prioritizing tasks" (John, Naumann & Soto, 2008, p. 120). Conscientiousness is associated with persistence, self-discipline, and achievement-striving, and is the trait most consistently associated with academic performance in previous research (Busato et al., 2000; Chamorro-Premuzic & Furnham, 2005; Poropat, 2009), which is in line with the present findings. This relationship has often been interpreted as motivation-based; conscientious students are thought to be more motivated and therefore perform well, as compared to less conscientious students (Chamorro-Premuzic & Furnham, 2005). Behaviors underlying some facets of Conscientiousness are often assumed to have a relationship to academic performance; it seems likely and logical that well-organized, hard-working and achievement-oriented students will perform better on typical academic tasks than will those who do not have these traits (O`Connor & Paunonen, 2007). At the facet-level, results from Study I and Study III confirm the importance of the facets self-discipline, self-efficacy and achievement striving as being the best predictors of academic performance. The facet self-discipline has previously been found to be positively associated with numbers of hours spent on homework and negatively associated with absences from school (Duckworth & Seligman, 2005), supporting results indicating that order predicts academic performance (Corker, Oswald & Donnellan, 2012). Striving for achievement is closely linked to effortful strategies, e.g. Elliot and McGregor (2011) showed that students with mastery goals strive to learn and develop competence. Results from Study III showed that the facet self-efficacy becomes more important for academic performance when students reach the upper secondary school level. This finding is interesting and needs further research. One possible explanation is that self-efficacy has a positive influence on motivation and performance because it increases individuals' perceived ability to regulate their own studying and learning activities as well as their perceived ability to successfully master specific academic subjects and curricular areas (e.g., mathematics) (Caprara et al., 2011).

The predictive validity of Conscientiousness was demonstrated in Study III using longitudinal data. The result showed that Conscientiousness at age 16 predicts academic performance at age 19. The results from Study III also suggest that a relatively higher level of Conscientiousness will lead to an increase in academic performance and that students improve their academic performance if they are conscientious at both age 16 and age 19. This can be interpreted in terms of the characteristics of Conscientiousness as well as classroom behavior. The teachers may consider students´ cooperation in the classroom in relation to academic effort (not

only results), which seems to be more important in senior high school than in elementary school.

Moreover, when academic performance was divided into school subjects (Study I), there was a relationship between Conscientiousness and the school subject practical topics. These topics are more often evaluated based on the quality of performances (e.g. music) than on the basis of theoretical knowledge. It seems reasonable that these topics would be predicted by Conscientiousness, as they require classroom attention and commitment.

Taken together, the present results suggest that Conscientiousness, in general, and the facets self-discipline, achievement striving and self-efficacy, in particular, contribute to the ability to make plans, to regulate behavior in accordance with one's purposes, to make the necessary effort, and to persevere in homework and exam preparation, all of which promote success in achieving higher academic grades.

By controlling for general intelligence, the thesis also supports the evidence of both the incremental as well as the predictive validity of Conscientiousness in relation to academic performance. Compared to Conscientiousness, the other major traits such as Extraversion, Neuroticism, Openness to Experience and Agreeableness have been shown to have less consistent associations with academic performance.

Besides Conscientiousness

Results from the present thesis (Study I and Study III) confirmed the negative association between Extraversion and academic performance (e.g., Furnham, Chamorro-Premuzic & McDougall, 2003; Goff & Ackerman, 1992; Busato et al., 2000), This gives some supports to the idea that extroverts perform more poorly than introverts do, owing to extroverts' higher engagement in social networking and introverts' spending more time studying (Eysenck, 1992). The findings of Study III also supported the predictive validity of this relation; students who rated themselves as introverts at age 16 did get higher grades at age 19. At the facet level, the activity and gregariousness facets of Extraversion were negatively related to grades in Chamorro-Premuzic and Furnham's (2003b) study. This was not the case in Study I, where none of the facets revealed any unique relationships to academic performance, indicating that the findings rather support the high-level Extraversion factor as a predictor of academic performance, instead of the lower-level traits.

The present research did not support the relation between Openness to experience and academic performance (Study I and Study III). When academic performance was divided into different school subjects (Study I), one study revealed a positive relation between Openness and practical topics. The school subject practical topics in Study I

involves both music, home and consumer studies, art and crafts, all of which require a degree of Openness. The result can be understood in relation to the nature of the trait Openness: perhaps experiencing new sensations and ideas but also liking creativity (Busato et al., 2000) facilitates the performance of practical tasks. According to McCrae and Costa (2003), people high on Openness tend to be dreamy, imaginative, inventive and non-conservative in their thoughts and opinions, and poets and artists may be regarded as typical examples of high Openness scorers. On the facet level, there was, for example, a positive relationship between the facet artistic and the school subject art, and a negative relationship between the facet intellect and art.

Agreeableness has no relationship to academic performance in the present research (Study I and Study III), which is in line with previous findings (O´Connor & Paunonen, 2007). In Study III, the correlation between the altruism facet of Agreeableness and academic performance increased from Time 1 to Time 2 (age 16 to age 19), indicating that this facet is beneficial to academic performance to a higher degree in upper secondary school than in elementary school. This is surprising, because the student-teacher relationship changes from elementary school to upper secondary school, where it is more distant. One possible explanation for this result is that the teachers' grades are somewhat influenced by the degree of altruism they see in their students, in other words, nice students get somewhat better grades. Another explanation is that the increasing relationship between altruism and academic performance is mediated by gender.

There was a positive, instead of negative, relationship between Neuroticism and academic performance in Study I and Study III. This result is difficult to interpret, especially because it is contrary to the hypothesis, but one suggestion is that the anxiety and vulnerability component of Neuroticism may be beneficial for academic performance in upper secondary school because these facets are related to fear of failure. In Study II, there was a positive relation between the learning approaches sub-factor fear of failure and academic performance for girls (see discussion for this result in the section "Gender differences" below). The selection criterion for college studies in Sweden is based on grades from upper secondary school, so for those students who wish to pursue a further academic career, the final grades are very important. Further research is needed to investigate this hypothesis, but the present findings suggest that fear of failure is an important factor, at least for some subjects, which was one of the issues addressed in Study II.

Besides personality, the importance of learning approaches

Chamorro-Premuzic and Furnham (2008) pointed out the need for research showing that effects of learning approaches on academic performance are independent of personality. The findings from Study II support this: after controlling for general intelligence and personality, learning approaches contributed uniquely to academic performance in general, as well as to performance in different school subjects. When learning approaches were divided into sub-factors, the results from Study II showed that there were negative relations between academic performance and the use of the surface strategy, a sub-factor of the surface approach, clearly supporting previous findings (Entwistle & Ramsden, 1983; Busato et al., 1998; Busato et al., 2000; Diseth, 2003). This suggests that "minimizing the scope of study" and "memorization" (sub-factors of surface strategy) seems to result in lower grades. The results from Study II also showed interesting gender differences for the different sub-scales of learning approaches in relation to different school subjects.

Gender differences

In line with previous research, (Furnham, Monsen & Ahmetoglu, 2009; Buchmann & DiPrete, 2006), girls had higher average grades than boys did in all three studies presented here. Previous research has shown that women score higher in some facets of Conscientiousness (Hicks et al., 2008), which was supported in this thesis (Study I and Study II) for the facets orderliness, dutifulness, cautiousness and achievement strivings. Differences in these facets may provide an interesting explanation for why girls have higher grades than boys do in Sweden at present and also support Halpern's (1992) claim that girls attend to schoolwork and homework more seriously and diligently than boys do.

There was also a structural gender difference found in Study I; Conscientiousness had a positive correlation with IQ among girls, but a negative correlation among boys. It seems that boys with higher intellectual capacity do not like to see themselves as Conscientious, but the reason for this difference from girls is indeed difficult to interpret at present. One possible explanation for the negative correlation among boys is that they compensate low IQ with higher Conscientiousness or vice versa. In competitive settings, boys with lower IQ may compensate by being more organized, responsible, and intrinsically motivated. This suggests that Conscientiousness can increase as a function of low intellectual ability. Conversely, very bright individuals do not need to develop systematic and dutiful work habits, because their high intellectual ability is enough for them to excel in the real world (Moutafi, Furham & Crump, 2003; Moutafi, Furnham & Paltiel, 2005).

Fear of failure is one of the sub-components of approaches to learning (Kember, Biggs & Leung, 2004) that has been empirically and theoretically associated with Neuroticism; both reflect maladaptive coping responses and negative emotionality (Diseth, 2003). Zhang (2003) discussed this relationship, suggesting that individuals high on Neuroticism avoid taking the risk of making mistakes because they are emotionally unstable and suffer from low self-esteem. The typical findings are that Neuroticism and a surface approach to learning do not correlate with academic performance (Entwistle & Ramsden, 1983; Busato et al., 1998, 2000; Diseth, 2003). The results from Study II were therefore somewhat surprising, in that they showed a positive relation, among girls, between the sub-factor surface motive and academic performance. This relation was also valid for the school subjects English language, Swedish language and math. Surface motive involves the sub-factors "fear of failure" and "aim of qualification", indicating that such motives partly explain why some girls have high grades. Furthermore, the findings from Study II support the discussion above about the positive relationship between Neuroticism and academic performance among upper secondary school student in Sweden (Study I and III). The positive correlations found between Neuroticism and the sub-factors surface motive and surface strategy for girls in Study II strongly support Diseth's (2003) idea that Neuroticism and surface approach both reflect negative emotionality and maladaptive coping. The results suggest that some form of anxiety may motivate these girls to study. According to Ruthig et al. (2008), students who attribute academic failure to lack of effort instead of lack of ability will experience higher motivation. Such students will probably experience higher perceived control over academic outcomes and remain committed to avoiding future failure.

Furthermore, there were gender differences for the sub-factor deep motive. Among girls there were negative relations between deep motive and the school subject math, Swedish language as well as social science. For Swedish language, this negative association can be explained by the impact of Conscientiousness for the girls; the facets achievement and cautiousness had a positive impact on this grade. Girls with a higher degree of achievement and cautiousness got higher grades in Swedish language even if they did not use a deep motive. For boys, on the other hand, there was a positive relation between Swedish language and deep motive. This suggests that pragmatic girls do well and that boys, who in their learning approaches are more intrinsically motivated to fully understand, get better grades in Swedish language. This finding supports Entwtistle, Tait and McCune (2000), who claimed that the deep approach is more meaningful in later years at university. Another more speculative possibility is that girls use surface motive to a higher degree during math and social science studies. Thus, even if they prefer a deeper understanding of the material, this approach has not led to high grades in the past, so instead girls use other strategies to get good grades.

Moreover, another finding from Study II was the gender differences regarding the relationship between learning approaches and general intelligence as well as the relation between learning approaches and personality. Although the relations between general intelligence and learning approaches were not significant in general, there were interesting gender differences related to the sub-factors; for girls, there were positive relations between general intelligence and both the sub-factor deep strategy and the sub-factor surface motive, while there was a negative relation to the sub-factor surface strategy. For boys, on the other hand, there were negative relations between general intelligence and the sub-factors deep motive and surface strategy. These gender differences may be difficult to interpret owing to the paucity of earlier research, but one possible explanation is that students with a higher IQ understand that studying is more than just learning for a test and memorizing facts. Instead, girls with a higher IQ wish to relate the things they have learned to other knowledge and want a deeper understanding, while boys with a higher IQ are more interested in the subject being studied and want to spend extra time thinking about different questions. This can be compared to the result in Study I, showing that Conscientiousness had a positive correlation with IQ among girls and a negative correlation among boys.

Personality change in adolescence and its relation to academic performance

Even if the main aim of the thesis was not to investigate mean level changes in personality during adolescence, the longitudinal design in Study III provides opportunities for studying this, and such changes can help explain the differences in correlations between personality and academic performance between Time 1 and Time 2 (Study III). The mean-level differences for the traits Extraversion, Openness to experience and Conscientiousness increased significantly from age 16 to age 19. In contrast, Neuroticism decreased from age 16 to age 19. At the facet level, each personality trait from Time 1 to Time 2 had significantly changed for the facets assertiveness (E), artistic interest (O), imagination (O) and intellect (O); the participants scored themselves higher at age 19 than age 16 for those facets. In contrast, they scored themselves significantly lower on the facets self-discipline (C), anger (N) and activity level (E) at age 19 than age 16. The increase in Openness to Experience is consistent with Allik et al. (2004) and can be interpreted as meaning that adolescents become increasingly appreciative of creative and intellectual expressions, which may be related to identity development and exploration of different roles. However, further longitudinal research is needed to explain how possible personality differences are related to academic performance and whether

there are potential gender differences that may affect academic performance, as discussed by Branje, Van Lieshout and Gerris (2007).

Practical implications

One important question is how we can translate theory and research into practical recommendations for teachers. There are no simple, quick solutions. However, it is possible to discern a few clear patterns that can at least serve as a rough compass in everyday life and to give guidance on how to best create a good environment for the development of, for example, motivation.

First, the fact that a student's personality, as measured by age 16, can predict academic performance at age 19 (Study III) is interesting at both a theoretical and an applied level. From a theoretical perspective, it supports the view that personality traits are rather stable over time (McCrae & Costa, 1994). From an applied point of view, it emphasizes the importance of personality measures for predicting academic performance, together with earlier academic performance and cognitive ability.

Second, another potential application is the use of personality measures for student guidance and development. Students who score low on Conscientiousness could benefit from support and interventions. If we understand the factors underlying academic success, we may be able to help students who need to develop certain essential skills. One intervention for students low in Conscientiousness would be to provide structure and reinforcement to complete all their homework or to increase the amount of time they spend preparing for exams. Locke and Latham (2002) argued that goal attainment is enhanced when difficult and specific goal levels are assigned, instead of vague do-your-best strategies, because the former focuses and directs attention and allows for better feedback and self-monitoring. Corker, Oswald and Donnellan (2012) discussed interventions for those low in Conscientiousness and argued that more research is needed to determine whether or not interventions work well. One clue to determining the targets of interventions designed to promote success may be to examine in detail how conscientious people naturally behave. Taken together, if teachers succeed in getting students low in Conscientiousness to create a self-theory that includes the importance of effort, and to perceive failure as a natural phenomenon, then they (teachers) can likely create a platform for motivation and development. From this perspective, academic performance is something the student themselves can influence and have control over.

Third, schools are sometimes accused of using a teaching style that fosters a surface approach to learning (Smith & Miller, 2005), e.g. with exams that foremost include detail knowledge. The gender differences found in Study II suggest that girls are more successful in adapting to such signals from teachers. Another suggestion is that girls

and boys differ in how they value various tasks based on their expectations of success, and that girls tend to avoid taking the risk of making mistakes. This would imply that it may be beneficial to use differential teaching strategies for girls and boys (Wilson, Smart & Watson, 1996).

Fourth, interventions for girls with high fear of failure are important, even if these girls do get higher grades. A recent study (Berger & Freund, 2012) has shown that fear of failure predicts a negative change in affective well-being over time. Low affective well-being, in turn, impaired structured goal pursuit over time. People whose self-esteem is defined by achievements are compelled to invest a great deal of effort in their work. This strong involvement is likely to lead to stress and lower affective well-being. Another study showed evidence that fear of failure predicts anxiety and hopelessness (Pekrun, Ellun & Maier, 2009). One way of helping these girls is to focus their attention on the process of exam preparation and teach them how to focus on the study subject rather than on the outcome of the exam. Another way, suggested by Autin and Croizet (2012), may be to emphasize that failure is a natural phenomenon that can even provide new and necessary opportunities to learn things: "By being obsessed with success, students are afraid to fail, so they are reluctant to take difficult steps to master new material. Acknowledging that difficulty is a crucial part of learning could stop a vicious circle in which difficulty creates feelings of incompetence that in turn disrupt learning" (American Psychological Association, 2012).

Although individualized interventions for both genders are of value, it is also important to realize that there is enormous within-group variation in learning and study strategies. Future research is needed to clarify which interventions are most effective, and the conclusion must be that one-size-fits-all programs cannot equip all students in ways that help facilitate their academic performance.

Limitations and future implications of the studies

Taken together, the current research revealed some interesting and potentially useful findings on factors that predict academic performance. Nevertheless, the present research also suffers from limitations in its methodology and research design. There is a need for further research to extend and explore the current findings, which might include:

1) Replicating the results in other cultural contexts and investigating students from other populations, e.g. upper secondary school students in more practical programs (nursing, construction and so on). The samples used in this research were quite homogenous, in that they were limited to an upper secondary school population (highly ranked).

It is possible that different communities and different countries may have different teaching traditions, although they have a similar written policy. On the other hand, many of the results are in line with results from other parts of the world, which supports the validity of the present findings.

2) The present research used a within-group design in which the same students were followed over several years to discover whether their present personality and learning approaches could predict academic performance in later years. The longitudinal design in Study III used two-wave panel data, instead of multiwave data, which would allow for more effective testing of interindividual differences.

3) Another important direction for future research is to use different measures of personality and learning approaches, e.g. observations and teacher or peer ratings, not only self-reports, which have limitations given the problems of social desirability and positive self-presentation (Trapmann, Hell, Hirn & Schuler, 2007). A method that would minimize these biases may increase the validity, for example peer ratings or a lie scale.

4) The inventory used to measure intelligence in the present research was a general measure of cognitive ability thought to capture the g-factor. Ziegler et al. (2010) suggested that every study investigating the impact of specific traits should control for intelligence by using broad measures that differentiate between verbal, numerical and figural reasoning ability, which may lead to better predictions.

5) The effect of teaching is not measured here, and therefore we cannot account for the student-teacher interaction and its possible effect on academic performance. The results from the research suggest that the Big Five personality variables, particularly Conscientiousness, may facilitate academic performance, and that lower-level traits may facilitate particular subjects. A likely explanation for these relations is that personality has an impact on the motivation to study a specific subject. This may, in turn, have an effect on the learning style employed. Investigating the mediators between personality and high grades is an important task for future research.

6) Furthermore, the gender differences found in Study II require some further investigation. One possibility would be to include a measure of self-esteem and believed self-efficacy to investigate potential differences and their effect on academic performance.

Conclusions

These limitations notwithstanding, the present thesis contributes to the research field by showing interesting relationships to academic performance at the facet level for all five traits, after controlling for general intelligence. Looking at academic performance (grades) in relation to different subjects and exploring the impact of personality on each subject also contribute to current research as well as to the development of teaching methods in the schools. The current results provide broad evidence for the importance of self-discipline, achievement striving and self-efficacy in explaining the association between Conscientiousness and academic performance.

On a general level, the thesis contributes to the extant research literature in four ways. First, it extends prior research on personality traits as important predictors of academic performance, both at a higher level and at the facet level. The results from the longitudinal study might also enhance our understanding of stability and change in personality traits over time and how these changes affect academic performance. Second, the results improve our understanding of how different school subjects require different learning approaches and that different personality traits may benefit or impair academic performance in different school subjects. Third, the sample used here included senior high school students, a population that so far has not received a great deal of interest, compared to college students. Fourth, the results of the thesis could have important practical implications. If educators and school institutions have knowledge of what factors predict academic performance, they can offer help to students whose personality may negatively affect their performance. Maximizing the academic success of young people is of paramount importance for both the individual student as for the society.

Appendix

Items in "The Learning Process Questionnaire" (R-LPQ-2F; Kember, Biggs & Leung, 2004).

Deep approach

Deep motive

Intrinsic interest

I find that at times studying makes me feel really happy and satisfied.

I feel that nearly any topic can be highly interesting once I get into it.

I work hard at my studies because I find the material interesting.

Commitment to work

I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.

I come to most classes with questions in mind that I want answering.

I find I am continually going over my school work in my mind at times like when I am on the bus, walking, or lying in bed, and so on.

I like to do enough work on a topic so that I can form my own conclusions before I am satisfied.

Deep strategy

Relating ideas

I try to relate what I have learned in one subject to what I learn in other subjects.

I like constructing theories to fit odd things together.

Understanding

I try to relate new material, as I am reading it, to what I already know on that topic.

When I read a textbook, I try to understand what the author means.

Surface approach

Surface motive

Fear of failure

I am discouraged by a poor mark on a test and worry about how I will do on the next test.

Even when I have studied hard for a test, I worry that I may not be able to do well in it.

Aim for qualification

Whether I like it or not, I can see that doing well in school is a good way to get a well-paid job.

I intend to get my A Levels because I feel that I will then be able to get a better job.

Surface strategy

Minimizing scope of study

I see no point in learning material which is not likely to be in the examination.

As long as I feel I am doing enough to pass, I devote as little time to studying as I can. There are many more interesting things to do.

I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.

I find it is not helpful to study topics in depth. You don't really need to know much in order to get by in most topics.

Memorization

I learn some things by rote, going over and over them until I know them by heart.

I find the best way to pass examinations is to try to remember answers to likely questions.

I find I can get by in most assessment by memorizing key sections rather than trying to understand them.

Summary in Swedish/svensk sammanfattning

Betydelsen av personlighet, IQ och inlärningsstilar: Att predicera studieframgång

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Personlighetspsykologer har i mer än ett århundrade försökt att identifiera och beskriva observerbara skillnader mellan individer. Bland dessa individuella skillnader har intelligens och personlighet fått stor uppmärksamhet inom skolvärlden (Chamorro-Premuzic & Furnham, 2005), liksom elevers förhållningssätt till sitt lärande (Biggs, 1999). Kunskapen om vilka faktorer som påverkar studieresultat har viktiga praktiska konsekvenser för lärande och utbildning (O'Connor & Paunonen, 2007). Det finns också andra värden i att kunna förutsäga studieresultat: för det första, en stor genomsnittlig del av bruttonationalprodukten går till utbildningsåtgärder, för det andra, många unga människor kommer att utbilda sig under många år. En tredje faktor är att studieresultat värderas högt så alla steg i att förstå studieresultat kommer att få betydande konsekvenser (Poropat, 2009).

Det övergripande syftet med denna avhandling var att undersöka i vilken utsträckning personlighetsdrag och förhållningssätt till lärande bidrar till akademisk prestation, efter kontroll för intelligens. I linje med den ökande acceptansen av en bred faktoriell modell av personligheten, Fem-faktor modellen (Costa & McCrae, 1976), som innehåller dimensionerna Öppenhet, Samvetsgrannhet, Extraversion Neuroticism och Samstämmighet, är grundantagandet i denna avhandling att dessa är relativt stabila egenskaper och därmed kan predisponera en individ att bete eller agera på ett specifikt sätt.

Huvudsyftet med Studie I var att undersöka om personlighetsegenskaper på facettnivå bättre predicerar skolframgång än själva faktorerna. Genom att dela upp betygen på respektive ämne visade resultatet av flera SEM-analyser att Samvetsgrannhet, både på faktor-nivå och på facett-nivå, predicerar skolframgång. För de andra faktorerna

visade resultatet på en negativ relation mellan Extraversion och skolframgång och på en positiv relation mellan Neuroticism och skolframgång. På facett-nivå fanns flera intressanta fynd, liksom på relationen till de olika skolämnena. Det fanns också intressanta fynd som visade på strukturella skillnader mellan könen; relationen mellan Samvetsgrannhet och IQ var positiv för flickor medan den var negativ för pojkar. Den största slutsatsen från den här studien var att personlighetsegenskaper, både på faktor-nivå och på facett-nivå, inverkar på akademisk prestation i olika ämnen vilket kan inspirera lärare till att tillämpa nya metoder som är anpassade till elevers specifika personlighetstyper.

I Studie II undersöktes i vilken grad inlärningsstilar bidrar till skolframgång, efter kontroll av personlighet och intelligens. Eventuella könsskillnader avseende inlärningsstilar undersöktes också. Genom att använda en kombination av hierarkiska och stegvisa regressionsanalyser, separata för flickor och pojkar, samt uppdelade på skolbetyg, visade resultatet att inlärningsstilar svarade för 6 % av variansen i akademisk prestation för flickor och 16 % för pojkar. Resultatet visade också på stora variationer mellan könen och vilken inlärningsstil som föredras för respektive ämne. Sammantaget visar resultatet från studien att inlärningsstilar är oberoende av personlighet och bidrar till att predicera akademisk framgång.

Genom att använda en longitudinell design i Studie III, möjliggjordes syftet att undersöka den prediktiva validiteten av personlighet på akademisk framgång. Som väntat var Samvetsgrannhet den största enskilda prediktorn över tid vilket kan förklaras av innebörden i egenskapen, såsom ordningsam, uthållig, organiserad och målinriktad, vilka alla är kända för att ha en betydande roll i elevers studievanor och den ansträngning de lägger på sina studie (Costa & McCrae, 1992). En av slutsatserna av studien är att Samvetsgrannhet, Extraversion och Neuroticism vid 16 års ålder predicerar akademisk framgång vid 19 års ålder. Ytterligare fynd som gjordes är att en relativ ökning av Samvetsgrannhet från 16 till 19 år också ger en relativ ökning av akademisk prestation vid 19 år. Resultaten som presenteras i denna avhandling har såväl teoretiska som praktiska implikationer.

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