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Predicting the future – A quantitative study of predicting grade point average from psychological and cognitive factors at the university

Master's thesis in Psychology; Learning, behaviour, brain and environment

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Preface

The topic of this master thesis is a result of my counsellor Hermundur Sigmundsson's inspirational talks about the effects of passion and Grit in high achievers in a variety of domains. As a part of my specialisation in my master program, I was interested in investigating the effects of Grit as this was a new and existing concept, where research had resulted in somewhat ambiguous findings from different parts of the world. I wanted to compare the predictive value of Grit to two other concepts that already had a lot of scientific fundament in predicting outcomes; cognitive ability and personality. Hermundur Sigmundsson suggested to include passion as a construct that might separate high achievers from the others.

The data collection, the theoretical foundation of the thesis and data analysis were performed by me, with guidance and discussions provided by Hermundur Sigmundsson.

I want to give my appreciation to Assessio Norge AS, and especially Christoffer Gundhus for providing me with the cognitive ability test Adaptive Matrigma. I also want to thank Adrian Dybfest Eriksen for good advice in the somewhat chaotic, fun and exciting process in writing a master thesis in these extraordinary times. I also want to thank my family for all their support and for at times giving me space to discuss my frustrations. Last, but not least I want to thank my counsellor Hermundur Sigmundsson for inspirational and open-minded discussions about the different concepts, as well as being patient during my many streams of thought.

Abstract

The purpose of this thesis is to investigate the predictive value of different variables related to academic achievement, as well as improve our understanding of the psychological and cognitive characteristics found in high achieving students in Trondheim, Norway. The predictive value of the different variables; First year grade point average (GPA), Grit, Passion, Cognitive ability and Personality traits was investigated by multiple regression to predict last semester grade point average (GPA last semester). A one- way ANOVA was used to review the difference between the levels of last semester GPA in mean score of the included variables. The results showed a significant model with all the included variables. Only first year GPA, Grit and the personality traits Conscientiousness and Agreeableness showed a unique contribution in predicting last semester GPA. The study indicates that previous performance in the form of first year GPA is the best predictor, followed by Grit and the personality traits Conscientiousness and Agreeableness. Conscientiousness and first year GPA seem to have a positive effect of the mean level in last semester GPA, while Grit and Agreeableness showed an inverse effect on the mean level in last semester GPA. The results from the ANOVA showed no significant difference between the various levels in last semester GPA. This would seem to imply that further research is needed on a random sample to find more conclusive results.

Keyword: Grit, Passion, Personality, General mental ability, Educational performance

Sammendrag

Formålet med denne masteroppgaven er å undersøke den prediktive verdien av ulike variabler relatert til akademisk prestasjon, samt bedre vår forståelse av psykologiske og kognitive karakteristika funnet hos studenter i Trondheim (Norge) som presterer på et høyt nivå. Den prediktive verdien av de ulike variablene; gjennomsnittskaracter første året, grit, lidenskap, kognitiv evne og personlighetstrekk, ble undersøkt ved bruk av multippel regresjon for å predikere forrige semesters gjennomsnittskaracter. En enveis ANOVA ble brukt for å undersøke forskjellen mellom nivåene i gjennomsnittskaracter i gjennomsnittlig skåren av de inkluderte variablene. Resultatene viser en signifikant modell hvor alle variablene er inkludert. Bare gjennomsnittskaracter fra første året, grit og personlighets trekkene planmessighet og medmenneskelighet viser et unikt bidrag til å kunne predikere forrige semesters gjennomsnittskaracter. Studien viser at tidligere akademiske prestasjoner i form av gjennomsnittskaracter første året viser den beste prediktive verdien, etterfulgt av grit, planmessighet og medmenneskelighet. Planmessighet og gjennomsnittskaracter fra første året synes å ha en positiv effekt på gjennomsnittsnivået i forrige semesters gjennomsnittskaracterer, samtidig som grit og medmenneskelighet viser en negativ effekt på gjennomsnittsnivået i forrige semesters gjennomsnittskaracter. Resultatet fra ANOVA viser ingen signifikant forskjell mellom de ulike nivåene i forrige semesters gjennomsnittskaracterer. Resultatene synes derfor å indikere at videre forskning er nødvendig på et randomisert utvalg for å finne mer konkrete resultater.

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Introduction

Higher education has for quite some time been a high priority for the Norwegian Government. To facilitate that everyone has the opportunity to get a university degree, the Government has made available loans and grants for the student population, so that economy or socio-economic factors do not prevent anyone from obtaining such a degree (Regjeringen.no, 2020). From 2009 – 2019 there has been a 25.9 % increase in the number of students (Statistisk sentralbyrå (SSB), 2020), as well as an increase in the number of applications to the different universities (Samordnaopptak, 2018, 2020). This has resulted in a significantly greater competition to get enrolled at a university. The enrolment is primarily determined by the high school grade point average, or GPA (first diploma). It is therefore reasonable to argue that this could lead to a lot of pressure and motivation to get as high grades as possible at the high school level. According to a rapport from 2010 made by Statistics Norway (SSB), only 65,7% of the students enrolled at the universities in Norway finished their degree within a period of 8 years (SSB, 2019). As low grades are often associated with a higher probability of students dropping out or having to redo exams and thereby delaying their plan for completing the degree, it is important to improve our understanding of the complexity of psychological and cognitive factors that affect high GPA scores.

For a long time, high intelligence has been understood as a necessary fundament for the ability to learn. Personality, and especially the big five models, are perhaps one of the most researched constructs to explain how individual differences in behaviour can predict academic performance (O'Connor & Paunonen, 2007). More recently, scientists have investigated the role of Grit and Passion and their relationship to a variety of successful outcomes (Duckworth et al, 2007; Sigmundsson, 2020a; Vallerand; 2010). However, no studies have been found that compare Grit, Passion, Cognitive ability and Personality in conjunction with GPA. It is therefore of great interest to investigate which of these factors have the best predictive value for students and their academic success at the university.

Theory

The psychology of achievement and success

The perspective of positive psychology has for a long time focused on the factors of achievement and success. The psychology behind success and mastery has been studied in a variety of fields such as music, sports, work and academia. As the goals would be different depending on the field of interest and the complexity of the goals or tasks, researchers have tended to focus on a limited number of theories that seem relevant to the specific domain one wish to succeed in.

In military psychology, the term “hardiness” presented by Suzanne Kobasa has been used to predict the best military performance (Kelly, Matthews & Bartone, 2014), while in sports and competition settings we find that the term “mental toughness” is much used to characterize successful athletes (Weineberg, 2010). In addition to hardiness and mental toughness, resilience has also been used to characterize why some individuals succeed and others fail. Highly resilient people tend to continue to strive despite setbacks and other negative outcomes or situations (Hosseini & Besharat, 2010). In classical music researchers tend to focus more on personality features such as self-discipline and deliberate practice to attain a certain mastery (Ericsson & Charness, 1994; Ericsson, Prietula & Cokely, 2007). When dealing with occupational performance, recruiters focus to a higher degree on personality traits as well as intelligence. In sports and music, the factor of high passion has also been suggested as a fundamental characteristic for high achieving individuals (Sigmundsson, 2020a, 2020b). Grit, one of the more recent theories, has been shown to predict achievements in a variety of contexts (Duckworth et al., 2007).

As there might be some underlying factors in high achieving individuals, we will investigate Grit and Passion related to education and learning on the basis of this belief.

Grit

The question of why some people succeed when others fail has been of particular interest to scientist Angela Duckworth and colleagues (2007), who suggest the non- cognitive trait “Grit” to predict success and high achievement in different domains. Grit is defined as “perseverance and passion for long term goals” (Duckworth et al., 2007, s. 1087), and emphasize working “steady towards a specific goal, maintaining effort and interest over several years despite setbacks and challenges” (Duckworth et al., 2007, p. 1088). In her research she claims that Grit can predict the ranking in a spelling bee competition

(Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011), educational attainment, retention in military academy and grade point average (GPA) for Ivy league students (Duckworth, Peterson, Matthews & Kelly, 2007). Research also claim that Grit can predict marital status among men, as well as retention in the Army Special Operation Forces, high school and sales jobs (Eskreis-Winkler, Duckworth, Shulman & Beal, 2014). The variety of contexts where Grit plays a part is the foundation of the argument that Grit might be a domain general trait that explains the individual differences in achieving success.

As the popularity about the construct has grown so has the amount of research made, especially as Duckworth and her colleagues argue that Grit is a better predictor in academic success than any other well-known predictors, such as Cognitive ability (Duckworth et al, 2007). Even though Duckworth et al. (2007, 2011) claim that Grit can predict academic success, other researchers have found more ambiguous results, especially when it comes to predicting high GPA (Credé, 2018; Jachimowicz, Wihler, Bailey & Galinsky, 2018; Chang, 2014; Cross, 2013; Hogan, 2013). Another critique found in Grit research is how it correlates significantly with other psychological factors such as self-control $r = .6$ (Duckworth et al., 2007). The difference between them emphasizes that Grit relates to perseverance over several years, while self-control can be understood as a shorter period capacity that helps one resist temptation (Duckworth & Gross, 2014). In the meta-study by Credé, Tynan & Harms (2017) they argue that Grit could possibly be a result of the “Jangle fallacy”, as several studies have shown a high correlation between Grit and Conscientiousness. Even if there is some merit in the argument of the Jangle fallacy, the fact that other well-known predictors of success highly correlate with Grit, such as self-discipline and conscientiousness, demonstrates that Grit can be found to have a good predictive value in itself.

Based on Duckworth’s et al (2007) findings it is suggested that neither of the two facet of Grit; Perseverance of effort or Consistency of interest is more predictive that the other, and that the total score of the two results in the best value. Researchers have found that the Grit facet Perseverance of effort do show a somewhat better correlation with GPA than any of the other Grit scores (Credé et al., 2017), suggesting that perseverance and the ability not to give up despite of setbacks (Question 2,4,7,8 in the Grit – S scale, see appendix A) are more influential regarding how to succeed in higher education.

The importance of perseverance in high achievers is not a new concept in the field of psychology. Csikszentmihalyi, Abuhamdeh & Nakamura (2014) refer to perseverance as a psychic energy (p. 163) and could therefore be seen as a tool to be able to get through the workload that is required at a university. However, in their study of motivation and creativity

they also suggest that persistence in a specific task is not enough by itself (p. 164). Jachimowicz and colleagues (2018) argue that the construct of Grit neglects passion theoretically and empirically and conclude that perseverance alone cannot predict achievement sufficiently, passion is also needed.

Passion and achievement

Passion is a well-known construct which has been used to explain the drive and motivation in people for a very long time. This construct was first recognized by early philosophers such as Plato (427-348 BC) and Spinoza (1632 - 1677) who focused on how passion need to be “tamed” as they believed it resulted in the loss of control and reason (Vallerand, 2015). The contemporary association people have towards passion is perhaps related to the more positive description presented by philosophers such as Descartes (1596-1650). In his book, “*Les passions de l’âme*” he argues that passion can be good for people as long as it is controlled by reason (Vallerand et al, 2015, p. 18). Robert J. Vallerand is a well-known researcher in the field of motivation and passion and defines passion as “a strong inclination towards an activity that people like, that they find important and in which they invest time and energy” (2003, p. 756). Vallerand and colleagues (2003) propose a theory of a dualistic passion model, containing Obsessive and Harmonious passion. He believes that both types of passion can be present in a person, and that it is possible to convey one type of passion into the other (2015). The distinction between the two lies in the experience and way of internalization into one’s identity. Obsessive passion would be an internal pressure to engage in a specific activity, while Harmonious passion is based on a positive task engagement that an individual freely chooses to engage in. Vallerand also claims in his study that passion is related to how the activity that people enjoy are incorporated into one’s identity and exemplifies this by someone being a musician and not just playing music (Vallerand, 2010; 2003). Another difference between the two types of passion emphasizes the individual’s experience of conflict between a passionate activity and regular everyday activities such as work (Vallerand, 2010). Vallerand uses the theory of Self-determination, as presented by Deci & Ryan (2000), to explain how an individual can satisfy his or her psychological need for autonomy, competence and relatedness, and is the reason why people engage in certain activities. Jachimowicz, Wihler, Bailey & Galinsky (2018) describe Passion as “a strong feeling towards a personal important value/preference that motivates intention and behaviour to express that value/preference” (p. 9981). Vallerand and Jachimowicz

descriptions of passion both relate to a specific direction in behaviour towards an activity or value.

Hegel (1783- 1842) describes passion as a source of high energy directed to a specific path or object that is necessary for accomplishment (Vallerand, 2015, p.21). This is also supported by research on expertise made by Ericsson and Charness, as passion is a necessity to maintain interest and perseverance (1994) and relates to achievement by affecting the amount of deliberate practise (Vallerand et al., 2007). Previous literature associate passion to mastery achievement in music (Bonneville-Roussy, Lavigne & Vallerand, 2011) and in different areas of sports (Li, 2010), such as football (Sigmundsson, Clemente & Loftesnes, 2020b) and basketball (Vallerand et al., 2008). The majority of passion literature emphasize passion as a key component to characterize the highest achievers in specific domains (Sigmundsson, 2020a). Less research has been made on the relationship between passion attainment and academic achievement.

Passion in education.

To understand how passion is important in an educational setting, it is necessary to focus on what passion is and what a passionate experience could result in. First and foremost, Passion, or at least harmonious passion towards an activity, is linked to hedonic and eudemonic well- being (Philippe, Vallerand, & Lavigne, 2009). Vallerand and colleagues (2007) found, that passion is an important factor to predict GPA for psychology students at university, as “Passion can fuel motivation and give meaning in everyday life” (Vallerand et al., 2003, p. 756). Martínez, Floyd and Erichsen (2011) found a link between passion and academic productivity, as Passion related to cognitive adaptations where the experience of engaging in a passionate activity could result in an enhanced concentration and mindful attention (Vallerand et al., 2010). Based on research there seems to be a mediation effect between passion and deliberate practise which affect achievement. According to Vallerand (2010) both types of passion result in deliberate practice. It is believed that harmonious passion in relation to a specific activity is due to the experience of flow (Vallerand et al., 2003). In the book *Flow and the Foundation of positive psychology* (Csikszentmihalyi, Abuhamdeh & Nakamura, 2014) flow is characterised by “people report when they are completely involved in something to the point of forgetting time, fatigue, and everything else but the activity itself” (p. 15). The state of flow will occur as a result of a balance between skills and challenge (Csikszentmihalyi et al., 2014). The theory of flow indicates that there is a possibility of passionate experience at a specific point in time and not only for a specific

activity, if there is a balance for the student between skills and challenge. Another interesting finding from passion research is how one can be passionate for a specific cause (Vallerand, 2010). Vallerand (2010) shows how passion, or internal motivation for a specific societal cause, also can affect performance. For instance, in an academic perspective, a medicine student could be motivated to find a cure for cancer as he or she has a family member with the disease, or a psychology student is inspired to better understand mental health as it is a serious problem in the community.

Csikszentmihalyi et al., (2014) reported that American teenagers had a greater interest or experience of flow in their after-school activities than in their schoolwork (p. 190). This is consistent with the findings of Fredricks, Alfred and Eccles (2010) where non- academic activities had more characteristics of passion than academic work. Scientists have suggested that there might be a lack of passion in today's school setting and that the environment appears to undermine passion. Oliver and Venville (2011) study suggest that even in the same academic field, such as science, the students' report of passion were higher if it was in a context other than school. The lack of choice and autonomy might result in low passion (Ruiz- Alfonso, 2016), and could be the reason why it has not been associated with predicting academic achievement in earlier studies.

The contribution of personality traits in academic success

Personality is defined as "individual differences in characteristic patterns of thinking, feeling and behaving" (American psychological association (APA), 2020b). These individual differences found in personality makes it a good foundation for investigating and predicting success in a variety of contexts, as well as to understand the needs and motivational characteristics related to the different personality domains. Since the start of personality research, the different theories and measurements have been extensive. Regarding the measurement of personality there are several suggestions as to how this should be done based on different approaches and theoretical background. Perhaps one of the most used personality measurements is related to the original work done by Costa and McCrae in the form of the Five-factor model (1992). It is, however, important to understand that the work of Costa and McCrae is not supposed to give a theoretical perspective, but as a taxonomy of the different personality domains. The trait perspective does however consist of some assumptions regarding the human nature. These assumptions focus on how personality is an object for science and that people differs from one another and are capable of understanding themselves and others, along with the argument that people act in response to internal reactions (McCrae

& Costa, 2008, p. 161-162). Costa and McCrae (1985) presented the Big five measurement, also known as NEO- PI, where personality could be broken down to a score of different dimensions or traits, each containing their separate facet. The NEO- PI-R consists of five personality domains; neuroticism, extraversion, openness to experience, conscientiousness and agreeableness (McCrae & Costa, 1987). These five traits have been linked to Murray's classification of need and can help in our understanding of the tendencies found in the different traits (Costa & McCrae, 1988). Researchers have found that these personality traits are very stable over time and across situations (Terracciano, McCrae & Costa, 2010). Costa and McCrae (1992) explain this stability as "basic tendencies" that refers to the abstract underlying potential in a person. They explain the changes in personality "characteristic adaptations", which reflect the interaction between basic tendencies and the environmental demand accumulated over time (John & Srivastava, 1999). Science has also found a genetic factor regarding individual variations in the five personality domains that ranges from 51-59 %, based on twin studies (Loehlin, McCrae, Costa & John, 1998). The genetic stability in personality has made it optimal for research settings when predicting certain outcomes.

The NEO-PI-R measurement has shown to consistently predict different outcomes, such as job- performance and academic achievement (John & Srivastava, 1999). As the NEO-PI-R measurement consists of 240 different questions and is quite time consuming to complete, Costa and McCrae made an abbreviated version NEO-FFI that consists of 60 items (Costa and McCrae, 1985). Still, the demand from scientists for an even shorter version has been the origin of most of the short versions of the Big five measurements; BFI by John, Donahue and Kentle in 1991 (John & Srivastava, 1999; Benet-Martínes & John, 1998; Rammstedt & John, 2007). Several meta-studies have been done regarding how personality traits based on the Big Five- approach can have a predictive value in different contexts (Poropan, 2009; O'Connor & Paunonen, 2007), including academic success. The difference in the findings seems to be explained by how the different traits would vary as a result of the context itself or what the predicted object of success consists of.

Conscientiousness.

The trait dimension of conscientiousness includes; competence, order, dutifulness, achievement striving, self-discipline and deliberation (Costa & McCrae, 1992). The level of a person's ability to self-control can facilitate task and goal-directed behaviour (Costa and McCrae, 1992 in John, Naumann & Soto, 2008). This can be explained by the underlying characteristics that found in conscientiousness; delaying gratification, following norms and

rules, planning, organizing and prioritizing tasks (John, Naumann & Soto, 2008, p. 25). Conscientiousness has been linked to several positive habits and outcomes that would be beneficial to a person's health (John, Naumann & Soto, 2008; Hampson, Andrews, Barckley, Lichtenstein & Lee, 2000). Whereas a low measure of conscientiousness is linked to risky behaviour, such as substance abuse, poor diet and exercise habits (Bogg & Roberts, 2004; Hampson, Arew, Barckley, Linchenstein & Lee, 2000). In the study by John & Srivastava (1999) they argue that on a general level conscientiousness is the best predictor of success, but that there might be differences when looking at specific areas. Conscientiousness has also repeatedly been found to positively predict academic performance in university students (Downey, Lomas, Billings, Hansen & Stough, 2014; Furnham, Chamorro-Premuzic & McDougall, 2003; Poropat, 2009; O'Connor & Paunonen, 2007). This link between conscientiousness and academic performance can be associated with the facet of achievement striving, as their foundation is high motivation and achievement learning (Von Stumm & Furnham, 2012). Mehl, Gosling & Pennebaker (2006) found that students high in conscientiousness had a higher tendency to spend more time in the classroom or on campus. As higher-level education often includes a great amount of literature, it would be reasonable to assume that to go through it all might be less demanding for students who show high levels of conscientiousness. When the facet includes competence, order, dutifulness, achievement striving, self-discipline and deliberation (Costa and McCrae, 1992), such an individual would normally do well in the academic setting.

Extraversion.

Extraversion is often described as an energetic approach towards the social and material world and are often associated with sociability, activity, assertiveness and positive emotionality (John, Naumann & Soto, 2008, p. 25). People high in extraversion often have more available social support and close relationships, which can be important factors in coping with difficult situations and challenges (John, Naumann & Soto, 2008; Halamandaris & Power, 1999) and can be helpful in an academic context with its high pressure and great workload. Mehl, Gosling & Pennebaker (2006) claim that students with a high score on extraversion had a greater tendency to engage in conversation and to spend more time with others. It seems that extraversion show a greater need for interpersonal relationships, as extroverts have a more of social contact, while introverts may be more inclined to be alone and study by themselves (John, Naumann & Soto, 2008). This, combined with the characteristic of extraversion as excitement seeking (Costa & McCrae, 1992), might explain

why some students high in extroversion show a negative association with different academic outcomes (O'Connor & Paunonen, 2007), as well as a negative predictive value related to high GPA (Bauer & Liang, 2003; Furnham Chamoro- Premuzic & McDougall, 2003). However, Rothstein et al. (1994) explain how there might be a positive link between extraversion and academic performance when reviewing classroom participation, indicating that extroverts might perform better in an academic evaluation that is more suited to their need for interpersonal connections. These findings, however, are not conclusive and meta-studies have found the personal trait to vary both regarding significant associations and in the direction of the association between extraversion and academic performance (O'Connor & Paunonen, 2007).

Neuroticism.

Neuroticism is considered as the contrast to emotional stability (John, Naumann & Soto, 2008, p. 25) and is related to high stress and anxiety (Bauer & Lian, 2003). Overall adjustment to university was found to correlate negatively with neuroticism, as well as a high correlation regarding the feeling of loneliness (Halamanaris & Power, 1999). High levels of stress and anxiety show a confounding effect on the brain's ability to process new information and for neural connections to be made (Edelman, 1993; Kleim & Jones, 2008). It is therefore understandable that researchers have found a negative association between neuroticism and academic achievement. Based on the findings of O'Connor and Paunonen (2007) neuroticism was found to show little or negative association towards performance at the university level. An interesting finding in the research of neuroticism and a possible explanation of the non-significant association, is that there seems to be a difference between generations in the score of neuroticism, with a general increase in the score from 1994 - 2009 (Twenge & Foster, 2010). Tweng and Foster (2010) have argued that this increase might be an effect of the increase in individualism found in USA. A general increase in a the neuroticism score could potentially reduce the variation found in the sample making it a poor variable to use for predicting purposes.

Openness to experience.

The trait openness to experience describes the depth, originality and complexity of the individual's mental and experiential life (John, Naumann & Soto, 2008, p. 25). The contrast to openness to experience is known as close-mindedness. The trait seems to positively predict success in more creative work (Barrick, Mount & Gupta, 2003; Larson, Rottinghau & Borgen,

2002) and have also been associated with the total number of years of completed education (Goldberg, Sweeney, Merenda & Hughes, 1998). This might be a result of people high on openness to experience show a higher curiosity towards objects of intellectual origin (Costa & McCrae, 1992). Some research has found a positive relationship between the trait and academic achievement (Farsides & Woodfield, 2003), but seems to vary depending on the personality measurement used and the specific object of academic achievement (O'Connor & Paunonen, 2007). However, openness to experience might have a greater predictive value at the lower educational levels (John, Caspi, Robins, Moffitt & Stouthamer-Loeber, 1994).

The trait has also been associated with general intelligence and domain-specific knowledge (Ackerman & Heggestad, 1997; Ackerman & Rolfhus, 1999). The explanation for this seems to rely on a possible moderator in the form of intelligence or ability. It has been argued that more intelligent individuals are better capable of understanding difficult information and processing new experiences, which in turn facilitates open-minded attitudes and expands knowledge (Moutafi, Furnham & Crump, 2006). When using the PRF and NEO measurements, openness to experience has been found to correlate with intelligence, from small to high correlations (Holland, Dollinger, Holland & Macdonald, 1995; Costa and McCrae, 1992). According to O'Connor and Paunonen (2007) and Poropat (2009), openness to experience and academic performance have an estimated correlation of between .06 and .13. Studies reporting low phenotypic associations of openness and intellectual accomplishments typically measure openness as a higher-order factor and do not sample its facets. Therefore, the apparent lack of empirical evidence for associations of openness and academic performance may be due to a methodological problem. There could be one or more unknown moderator variables that are responsible for the determination of whether the trait shows a positive or a negative influence on academic performance (O'Connor & Paunonen, 2007).

Agreeableness.

Agreeableness includes traits such as altruism, tender, trust and modesty (John, Naumann & Soto, 2008, p. 25). The construct seems to be the variable that varies the most in its correlation to academic performance. Research has shown significant negative and positive correlations, but the majority of findings show a non-significant correlation with academic performance (O'Connor & Paunonen, 2007). Agreeableness have been linked to good cooperation skills (Ross, Rausch & Canada, 2003) and show a mediating effect on GPA as a result of high seminar attendance (Farsides & Woodfield, 2003). Low levels of agreeableness seem to negatively predict work performance in groups, possibly due to an increased tendency

of hostility towards others. The ambiguity found in these studies could be related to different levels of teacher/ professor interaction or of general assistance provided by others. As people tend to prefer interaction with other individuals that show high levels of agreeableness (Peterson et al., 2003), this could result in a higher interaction between teacher and student. Getting more assistance and involvement from their teachers could help steer the students learning process in a more positive direction (Sigmundsson, 2020; Ericsson & Charness, 1994). The amount of interaction between student and teacher seems to decrease at the higher educational levels compared to at the lower ones. However, low levels of agreeableness can also be beneficial in certain situations, such as in discussions about increasing the individual's salary (Heineck, 2011). As the study at the university level demands a certain amount of critical thinking and discussion, it is not unreasonable to argue that agreeableness can show a negative association to academic performance.

The altruistic association that is found in agreeableness might explain its tendency towards charity as well as to helping others (Costa and McCrae, 1988). Altruism might also show negative associations with different aspect of success as an altruistic behaviour might be related to spending a significant amount of time helping others to achieve their goals.

Cognitive ability- the foundation of learning

Cognitive ability is defined by the American psychological association (APA) as “the skills involved in performing the task associated with perception, learning, memory, understanding, awareness, reasoning, judgment, intuition and language” (2020a). A universal definition of cognitive ability or intelligence is still not agreed upon by the scientific world (Neisser et al., 1996). Arthur Jensen referred to the arbitrariness in the definition, or the lack of a general consensus of intelligence, as “The trouble with intelligence” (1998, p. 45). One of the reasons for non-consensus relates to the disagreement regarding multiple types of intelligence (Thurstone, 1938 in Neisser et al., 1996, p. 78) versus only one underlying factor of intelligence (Spearman, 1927 in Neisser et al., 1996, p. 78). Spearman is known as the pioneer for factor analysis as well as his work on correlation (Jensen, 1998). With the implementation of these techniques, he claimed to have found an underlying factor of intelligence that he named the General factor, also known as the G- factor (Neisser et al., 1996; Jensen, 1998). The G-factor has been described by Spearman as mental energy (Jensen, 1998, p. 18 - 19) and a generalized abstract reasoning ability (Gustafsson, 1984), or an index measure of neural processing speed (Reed & Jensen, 1992).

Since Sir Francis Galton first started his work on “human capacity” a 100 years ago, where he tried to measure simple sensory and motor signals, there has been a great development in our understanding of intelligence (Neisser et al., 1996), which perhaps is one of the most studied factors in psychology. According to Linda Gottfredson (1997), intelligence “...involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience”(p.13). Neisser et al. (1996), claims intelligence will show individual differences “to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome an obstacle by taking thoughts” (p. 77), all of which have been viewed as important factors in learning.

Intelligence has been explained based on biological and neurological findings. The G-factor has been correlated with alpha waves, latency, the amplitude of evoked brain potentials, rate of brain glucose metabolism and general health (Neisser et al., 1996), as well as linked to higher speed of information processing (Vernon, 1983).

Research has found a consistent result in the heritability in intelligence, more specifically IQ (Neisser et al., 1996), In general, this heritability of IQ seems to increase as a result of ageing (McCartney, Harris & Bernieri, 1990). The age specific increase in heritability can be an effect of a certain reach in what could be called a genetic potential. This development in intelligence can be related to Neisser and colleagues (1996) allegation, that genes will be affected by environmental factors and could therefore have an impact on the neurological development of general intelligence. This type of interaction is also supported by other scientists such as Gilbert Gottlieb (1997), who claims there is a reciprocal relationship in the development between genes and the environment. The effect of social and cultural environment, as presented by Gottlieb, have also been prominent in the understanding of intellectual development. Neisser and colleagues (1996) they explain how scientists such as Jean Piaget and Lev Vygotsky understand intelligence as a cultural and social intersection, and that it cannot solely be investigated as a biological and heritable feature in an individual (p. 80).

Intelligence testing and educational performance.

The measurement of intelligence is often referred to as intelligence quotient, or IQ. These types of measurements are standardised tests that calculate a total score. The interest in understanding the individual differences found in school grades, seems to have been the ignition of research in the development of intelligent testing (Spearman, 1904). The critics of

such tests claim that they do not calculate intelligence, but a more specific ability related to intelligence. One of the most used tests is Ravens Progressive Matrise (RPM), developed by John C. Raven in 1938 (Raven, 2000). The test is based on a non-verbal intelligence that measures the individual's ability to abstract reasoning (Helland-Riise & Martinussen, 2017). Today you can find several tests that use the same foundation as RPM, such as Adaptive Matrigma. This type of tests is often associated with the theoretical foundation of Spearman's general factor, where one's ability to abstract reasoning will affect the score. RPM is often linked to one of Cattlle's terms known as fluid reasoning. This type of intelligence is often referred to as a person's ability to solve novel problems (Jensen, 1998, p. 123). Another facet of Cattle's description of intelligence, known as crystallized intelligence, ".....arises from educational opportunity and form a history of persistence and good motivation in applying fluid intelligence to approved areas of learning" (Jensen, 1998, p 123).

Intelligence is known to be the best documented predictor for achievement (Neisser et al., 1996; Gottfredson, 2002). Because of its known value, intelligence tests or general mental ability tests, have been used for job recruitment and as an assessment for applying to universities and colleges in the US, in the form of SAT scores. Researchers have found small to strong correlation between the general cognitive ability and educational performance (Wolfe & Johnson, 1995; Lounsbury, Sundstrom, Loveland, & Gibson, 2003). This could be the result of how people with higher intelligence tend to respond quicker to stimuli (Neisser et al., 1996).

Intelligence has also been found to predict years of education attainment (Neisser et al., 1996). The correlation between IQ scores and number of years of education of about .55, implies that differences in psychometric intelligence account for about 30% of the variation of the outcome variance (Neisser et al., 1996). School might affect intelligence, not only by providing increased knowledge, but also by the development of intellectual skills and attitudes. Flynn (1987) found that there seems to be a profound increase in IQ-scores over the past 50 years. Lynn (1990) suggests that Flynn's findings, also known as the "Flynn effect", could be a result of increased welfare and nutrition, based on the negative correlation of malnutrition and IQ scores. Jensen (1998) found that the correlation between the G- factor and grades tended to decrease continuously from elementary school to graduate school and explains this as a result of larger variation in the student population at the lower levels of education. Plomin and DeFries (1980) have also noticed that the predictive value seems to show signs of decrease over the years.

Even though cognitive ability and intelligence testing is widely used as a predictor of achievement in the academic world, the quality of the result of such test is still very much debated as it seems to rely on different general and specific measures of intelligence.

The aim of the current study

As previous research findings show some discrepancies in the variables' association and predictive value towards GPA, it would seem that further investigation is needed to be able to conclude on the uniquely importance of these variables. Also, as previous research focused on combining only a few of these variables, such as personality and intelligence, it is of special interest to see how they would all fit together in a regression model. Personality and Cognitive ability have already been investigated for quite some time, and a compelling approach would therefore be to compare these constructs to the more recent constructs of Passion and Grit and their measurements. This leads us to the two research questions:

1. How does personality, cognitive ability, Grit and Passion affect the students' academic achievements?
2. What kind of psychological and cognitive patterns can we find in high achieving students?

Method

Participants

The sample consists of 141 Norwegian university students in Trondheim, mainly from NTNU (N= 104) and the Air Force academy (N= 37). There were 71 women and 70 men in the sample, ranging in age from 19 – 33, with a mean age of 23.35 (SD=2.74). 25.7 % were from the Air Force Academy, 22.2 % from Gløshaugen, 35.4 % from Dragvoll and 13.2 % from other campuses, which include Tunga, Øya and Kalvskinnet. The sample shows an equal distribution of students from first to last year, with the majority being in their second year (N= 51, 36.2 %).

Inclusion criteria.

Inclusion criteria for participating in this study were full-time students enrolled at a university or an equivalent educational level. The study program had to be graded from A- F, and not only graded approved/ not approved. The participants also needed to be fluent in the Norwegian language as the questionnaire were in Norwegian.

Exclusion criteria.

Participants were excluded as a result of not fully meeting the inclusion criteria that were set. When there were too few participants from a university it would be easy for the researcher to identify the participant, and to maintain anonymity these participants were excluded. Another criteria for exclusion concerned the completion of the test. If the participants did not complete both parts, they were excluded. Some participants were excluded as a result of not following the explicit description of how to conduct the test; they forgot to write down the code so that there was no link between the two part of the tests, or if they used a mobile phone instead of a computer, as a phone screen would be too small to perform well in the cognitive test. A total of 8 participants were excluded based on these criteria.

Procedure

As a result of limited resources, a convenience sample was used to recruit the participants. The recruitment took place on the different campuses in Trondheim in the form of presenting the survey and testing procedures in class, cantinas and on information stands. The testing was administrated by the researcher of this study. For the participants at the Air

Force academy the test was conducted as a group at their campus, on a given date provided by the professor. The participants from NTNU conducted the test at the different campuses on different days and could choose themselves when to conduct the survey and the cognitive ability test according to their availability. If the set time and date of testing did not suit the participants, the possibility of conducting the tests on their own were made available, along with a written information manual. Prior to the test, the participants received an information sheet and consent form and were verbally informed about confidentiality, anonymity and the possibility to withdraw from the test at any point of time. They also received an individual code which identified their answer sheet, to make it possible to connect it to their score in the cognitive ability test. The participants were also encouraged to write down their code to identify their survey if they should later decide to withdraw. This link was not available to the researcher. All the participants received a lottery ticket at the value of 25 NOK as compensation for their participation in the study.

The participation was confidential as the researcher recruited and administrated the testing personally. The raw data was made anonymous, or disidentified if the participants wrote down their name or any other type of personal information, in the data that was retrieved. All emails, or any other type of contact information that made it possible to link the participant with the data were deleted after the tests where completed. The research is ethically conducted in accordance with the Declaration of Helsinki.

Tests and Variables

Grit- S scale

To measure the level of Grit in the participants a Norwegian version of the Grit- Short or Grit - S scale was used. The 8-item short Grit scale was developed by Angela Duckworth and Quinn (2009) and is an abbreviated version of the original 12 items Grit scale, also known as Grit – O scale. Both Grit scales are self-reported questionnaires with a 5-point Likert scale that ranges from “Veldig typisk meg” (Very typical me) to “Ikke meg i det hele tatt” (Not me at all). The measurement is divided in two facets referred to as “Consistency of interest and Perseverance of effort” (4 items per facet/sub scale). The Grit- S scale is recommended by Duckworth and Quinn (2009) due to its superior psychometric properties, and a more effective and simplified measurement. The Grit- O and Grit- S scale correlates highly .96 ($p < .001$), but the Grit- S showed a better goodness of fit indexes than Grit- O

(Duckworth & Quinn, 2009). The Grit – S measurement shows a high internal consistency, test retest stability, consensual validity and predictive validity (Duckworth and Quinn, 2009).

The Norwegian Grit scale used in this thesis is taken from Vibeke Sending's (2014) translation by using parallel blind technique and tested for translation validity using parallel forms (Sending, 2014). She found a strong correlation between Norwegian and English responses for bilingual respondents ($r = .89$, $p < .001$). The correlation between the Norwegian Grit – S and Grit- O stays the same as for the English one $r = .96$, $p < .001$ (Sending, 2014).

Passion scale.

An 8 items passion scale developed by Sigmundsson, Haga and Hermundsdottir (2020c) was used to measure the student's overall passion level related to achievement. The scale consists of statements such as “Jeg har et område/ tema/ ferdighet som jeg brenner for” (I have an area/theme/skill that I am passionate about) and “Min lidenskap er viktig for meg” (My passion is important to me) while the participant's answer is based on a 5- point Likert scale, ranging from “Veldig typisk meg”(Very typical me) to “Ikke meg i det hele tatt” (Not me at all). Jachimowicz et al. (2018) definition of passion “as a strong feeling towards a personally important value/preference that motivates intentions and behaviour to express that value/preference.”, is the basis for the scale being used (Sigmundsson et al., 2020c). The test shows a Cronbach alpha value of .86, and correlations ranging from .51 – .69.

Personality – Big five inventory.

Personality was measured by a 44-items Big five inventory (BFI) developed by John, Donahue and Kentle in 1991 (John & Srivastava, 1999; Benet-Martínes & John, 1998; Rammsted & John, 2007). The measurement consists of 8-10 items that measure the five personality dimensions; openness to experience, conscientiousness, extroversion, agreeableness and neuroticism. The BFI has been found to show high correlations, alpha values of .79, as well as convergent and discriminant validity with other abbreviated personality tests, such as NEO- FFI and TDA, indicating good psychometric properties (John & Srivastava, 1999). The measurement was made as a short personality scale, consisting of short questions based on the trait adjective. Responses is ranked by a Likert scale ranging from 1 = disagree strongly to 5= agree strongly. The Norwegian translation of the scale was done by the researcher in this study, as there were no translations available or resources to assist in the translation.

Cognitive ability.

The participant's cognitive ability is measured by Adaptive Matrigma, developed by Mabon and Sjöberg in 2007. The test is an abbreviated version of the classical Matrigma test provided by the company Assessio international. Both versions of the Matrigma test have the same theoretical background and emphasise measuring Spearman's general-factor, a general mental ability. The Matrigma test shares some similarities with the Ravens Progressiv Matrise as they both use item pattern recognition as their foundation. The participants are given eight different patterns and is supposed to predict the next figure or pattern by choosing the right alternative out of six possibilities. The Matrigma test has a time cap of 40 minutes, while the Adaptive Matrigma has only a 12-minute time cap, and a maximum of one minute per task (Mabon, Niemelä, Sjöberg & Sjöberg, 2017). The goal is to get as many correct alternative patterns as possible. The test uses an algorithm to adjust the difficulty of the pattern. If the participant gets a correct answers the pattern will increase slightly in difficulty, and vice versa. This is an ongoing algorithm. The cognitive test Adaptive Matrigma is not a standardised test and can therefore not provide the participant with an IQ score. Instead, the score on the test is given in a C- score, ranging from 0 – 10. The participants are given the standardised score based on the norm-group; from Under average (0-2 C- score), Average (3-6) or Above average (7-10). The norm group is based on student participation at the university of Stockholm (Mabon & Sjöberg, 2017). The reliability of the C- scale scores (0 - 10) are high and ranges from .79 - .91, except for the lowest score (Mabon & Sjöberg, 2007, p. 11).

Grade Point Average (GPA).

The GPAs were obtained based on self-reported GPA provided by the participants themselves, as there were some difficulties in retrieving the official records due to privacy laws. All the participants got instructions of how to calculate their GPA, where A = 5, B = 4, C = 3, D = 2, E = 1 and 0 = F or fail, and divide them on the number of exams they had completed. An example of this calculation was also provided to the participants (see Appendix A).

The study contains two GPA scores; Last semester GPA and GPA from first year at the university. According to the NTNU credit system it would be possible to have a maximum of four different exams to be able to reach the ECTS (European credit transfer system) credits of 30 points per semester and a maximum of eight exams to be able to reach 60 points each year. Last semester GPA could therefore be based on one to four different exams, and the variable GPA from first year would be based on up to eight separate exams. As the most

recent GPA score was retrieved from the last (or previous semester), this GPA score will be the dependent variable, and our main interest in this study.

Average Study hours.

The students average study hours were retrieved from the self-reported electronic survey. The variables was recoded based on the questionnaire (see appendix A, question 9), as 1 = < 20, 2 = 20 – 29, 3 = 30 – 39, 4 = 40 – 49, the category of > 50 were included in the last group as it seemed appropriate to include it in this latter category.

Statistical analysis

IBM SPSS statistics for mac, version 26 (IBM Corp., Armonk, N.Y., USA) was used to implement the various statistical analysis. Descriptive statistics were calculated to investigate differences in the population and a bivariate correlation was implemented to better understand the relationship between the variables. A multiple regression was used to investigate the predictive value of the different variables on last semesters GPA. An ANOVA was used to investigate the potential group differences in mean level of personality, cognitive ability, Grit and passion in the different GPA levels. Both SPSS and STATA 16 were used to check the assumptions of the different analysis.

Assumptions- sample characteristics

As the sample ranges from 45 – 141 participants depending on the variable included in the potential parametric analysis, a pairwise exclusion was used. To assess the assumption of normality a Kolmogorov-Smirnov and Shapiro- Wilk test was calculated and a visual inspection of the variable's histogram, normal Q – Q plots and box plots to investigate the assumptions. The Kolmogorov – Smirnov and Shapiro – Wilk test ($p > .05$) show that all the variables, except conscientiousness, openness to experience and neuroticism were significant, a result which raises some concern. As these tests are found to be sensitive to small irregularities in big samples, other investigations should be done (Field, 2013). The Q - Q plot, histogram and boxplot show that the data is somewhat skewed and kurtotic. The data is still linear, and the observations are relatively close to the line in the Q - Q plots. Based on this we can conclude that the data is close to a normal distribution.

A few variables did raise some concern, where study hours show a none symmetric box plot and are to a higher degree more skewed than the rest of the variables included. This variable was therefore excluded in the regression model. The tendency of a somewhat kurtotic

distribution found in the two GPA variables can be explained as there might be a higher tendency to receive a B and C average in the different subjects that on the outer ranges such as A or a D (NTNU Exam, Personal communication, April 02. 2020). The kurtotic levels divided by the kurtotic standard deviation are found to be not significant and should therefore not raise a concern in the assessment of normal distribution. The box plots showed no extreme outliers. The three Grit variables, and GPA 1 year have mild outliers. As all the grit variables are based on a Likert scale, we will look at these outliers as a legitimate score as they are in the range of 1 - 5 and will not exclude them from the analysis. The mild outliers found in GPA first year is also within the range of the grading system. The assumptions for normal distribution and no significant outliers are met.

Results

Descriptive statistics

Descriptive statistics in the form of mean score and standard deviation were derived from the group as a whole. As shown in Table 1 there are some differences in the number of participants that answered questions related to the different variables, such as GPA last year and GPA first year. As presented in the table, Grit facet Perseverance of Effort shows a higher mean score than the other two Grit variables; total Grit and Grit facet Consistency of interest. The mean level of Passion shows a higher score than any of the Grit variables. Regarding the personality domains; Agreeableness show the highest, and Neuroticism the lowest mean score. General cognitive ability has a mean score of 5.99, which based on the range (0 -10) would be slightly above the mean score in this test. Study hours is coded in an ordinal level with 1 = < 20 study hours and 2 = 20 – 29 study hours, indicating that the students average study hours each week range from somewhere between 20 - 29 hours. The different GPA scores show some difference in the mean score, where GPA last semester shows slightly greater mean score than GPA first year.

Table 1

Mean and standard deviation of the 13 variables included in the analysis

Variables	Mean	SD	N
Total Grit	3.38	.61	141
Grit PE	3.60	.65	141
Grit CI	3.17	.77	141
Passion	3.76	.74	141
Openness	3.19	.75	141
Conscientiousness	3.52	.66	141
Extraversion	3.42	.78	141
Agreeableness	3.83	.59	141
Neuroticism	2.86	.84	141
Cognitive Ability	5.99	1.43	141
Study hours	1.75	.91	141
GPA last semester	3.55	.75	83
GPA 1. Year	3.39	.76	54

*Note: * GPA = Grade point average, last semester * GPA 1. Year = Grade point average of the first year at University * Study Hours = Average number of hours studied each week *Grit PE = Perseverance of effort * Grit CI= Consistency of interest * Openness = Openness to experience*

Predictive value of the variables

A Pearson correlation was conducted to investigate the relationship between the different variables included in this study. Results are presented in Table 2. The correlation matrix show that GPA last semester only correlates significantly with GPA the first year at university ($r = .542, p < .001$), and that GPA the first year only correlates significantly with two of the Grit variable; Total Grit ($r = .270, p = .048$) and the Grit facet Perseverance of effort ($r = .328, p = .015$). Passion did not correlate with any of the GPA variables but did so with the Grit variables; total Grit and Grit facet Perseverance of effort.

A strong correlation between Conscientiousness and the three Grit variables was also found, with the highest correlation between Conscientiousness and Total Grit ($r = .788, p < .001$). Total Grit score and Conscientiousness both correlated significantly positive with average study hour and negatively with general cognitive ability, with a slightly higher correlation for Conscientiousness on both of them.

Table 2*Pearson correlation between all the included variables*

	GPA N = 83	Grit. T N = 141	Grit. P N = 141	Grit. C N = 141	Pass. N = 141	Neuro. N = 141	Open. N = 141	Con. N = 141	Agree N = 141	Extro N = 141	Cognitive ability N = 141	GPA 1. Year N = 54	Study. Hours N = 141	
1. GPA	1	.086	.122	.031	.010	-.082	-.105	.074	-.111	.079	-.017	.542**	.127	1
2. Grit. T		1	.832**	.884**	.175*	-.105	-.244**	.788**	.048	.148	-.169*	.270*	.308**	2
3. Grit. P			1	.478**	.302**	-.079	-.108	.649**	.095	.231**	-.078	.328*	.240**	3
4. Grit. C				1	.023	-.100	-.289**	.707**	.001	.046	-.202*	.031	.288**	4
5. Pass.					1	-.042	.350**	.106	.087	.207*	-.016	.254	-.006	5
6. Neur.						1	.033	-.145	-.144	-.141	-.090	.071	.186	6
7. Open.							1	-.233**	.155	.176*	.008	.021	.093	7
8. Con.								1	.231**	.225**	-.232**	.098	.323**	8
9. Agree.									1	.328**	.030	-.102	.080	9
10. Extra.										1	-.073	-.026	.052	10
11. Cognitive Ab.											1	-.139	-.118	11
12. GPA.1. Year												1	-.004	12
13. Study. Hours													1	13

Note: *GPA* = grade point average last semester, *Grit. T* = total score grit, *Grit. P* = Grit facet Perseverance of effort, *Grit. C* = Grit facet consistency of interest, *Pass* = Passion, *Neur.* = Neuroticism, *Open.* = Openness to experience, *Con.* = Conscientiousness, *Agree.* = Agreeableness, *Extra.* = Extraversion, *Cognitive Ab* = Cognitive ability, *GPA 1. Year* = GPA from first year of university, *Study. Hours* = Average study hours each week.

* significant at the 0.05 level (2-tailed)

** significant at the 0.01 level (2-tailed)

A multiple regression was made using the Enter method to investigate whether the combination of all the included variables could significantly predict the variation found in last semester GPA, as the majority of the variables have been linked to predicting grades and GPA. The individual beta coefficients were also investigated to determine which of the variables; First years GPA, Personality, Grit, Passion and Cognitive ability that best explained the variation found in GPA last semester. Listwise exclusion was used to allow the regression model to be based on the same sample.

To avoid multicollinearity the two facets of Grit were excluded in the multiple regression as they indicate to highly correlate in the correlation matrix. The decision to include the Total Grit score was based on the theoretical and empirical findings presented by Duckworth et al. (2007) that none of the Grit facets predict better than the total score.

A test for homoscedasticity, the Breuch-Pagan test, showed no heteroskedasticity problem based on the assumption of $p > .05$, $\text{Chi}^2 = .120$, $p = .729$. The test of normal distribution was not significant $p = .550$, and we can assume normal distribution in our regression model. No multicollinearity problem was found as no VIF of the variables was found to be higher than 5. The majority of the values are close to 1, where the highest value is between Grit total and Conscientiousness: 3.263 for Grit and 3.842 for Conscientiousness. The residuals are normal distributed, based on the Shapiro- Wilk test $Z = .0761$, $p - \text{value} = .223$. based on the assumption of $p > .001$. The link test should be greater than .05, and our test show .550. There were found no influential observations based on Cooks distance, where no distance is above the cut- off. < 1.0 . The assumption for the multiple regression were meet and is in the acceptable range.

Table 3*Results of multiple regression*

Variable	Unstandardized		Standardized		
	Coefficients		Coefficients		
	B	95% CI	Beta	T	P
(Constant)	3.008	(-.088, 6.105)		1.972	.056
GPA 1. Year	.558	(.290, .825)	.598	4.235	.000
Cognitive ability	.007	(-.140, .154)	.014	.096	.924
Passion	-.056	(-.314, .202)	-.063	-.441	.662
Total Grit	-.610	(-1.131, -.089)	-.539	-2.376	.023
Extraversion	.074	(-.213, .361)	.074	.525	.603
Agreeableness	-.385	(-.740, -.029)	-.344	-2.197	.035
Conscientiousness	.574	(.030, 1.119)	.527	2.141	.039
Neuroticism	-.040	(-.326, .247)	-.042	-.281	.781
Openness	.022	(-.229, .274)	.026	.182	.857

Note: Dependent (GPA last semester)

The results from the analysis show that the model significantly predicts last semester GPA $F(9,35) = 3.149$ $p = .007$ with an Adjusted R^2 of .305. The model accounts for 30.5% of the variation found in GPA last semester. GPA first year, Grit, Agreeableness and Conscientiousness was found to significantly predict last semester GPA.

The variable GPA first year was a uniquely significant predictor of GPA last semester. Every unit increase in GPA first year, last semester GPA increases on average by $\beta = .598$, $p < .001$. Grit total score show a negative effect on the average GPA last semester score $\beta = -.539$, $p = .023$, for every unit increase in GPA. This was also seen in the personality trait Agreeableness $\beta = -.344$, $p = .035$. Conscientiousness on the other hand shows a positive effect of $\beta = .527$, $p = .039$ on last semesters GPA. The variable Passion did not predict significantly GPA last semester, neither did the variables General cognitive ability, Openness, Neuroticism and Extraversion.

Between group differences

To better understand what patterns are found in high achieving students, a one- way ANOVA was conducted to investigate if there are any significant differences found between the different levels in last semester GPA (see table 4). The results of one- way ANOVA are presented in Table 4 and show no significant difference in the mean score in Personality, cognitive ability, Grit and Passion.

The homogeneity of variance assumption for a one – way ANOVA was met for each dependent variable. The different Levene tests show no significant results, $p < .05$, so we do not reject the null hypothesis (H_0) of equal population variances. However, the different levels in the variable GPA last semester show a non-equal sample size in the different levels of GPA, even though we can assume equal variation, the large difference between the number in the different GPA levels could interfere with the analyse' statistical power, and the findings should therefore be interpreted with some scepticism. The different grouping of GPA does however contain the bare minimum of six to allow for comparison in ANOVA. The Welch and Brown- Forsythe was used to compensate for the unequal group sizes of the different levels in GPA; A, B, C, D average, the test show no significant results in any of the dependent variables; Grit, Passion, Cognitive ability, and Personality.

Table 4*One- way ANOVA to measure the between group difference*

Variables		Sum of squares	Df	Mean Square	F	Sig
Total Grit	Between group	.257	3	.086	.224	.879
	Within group	30.119	79	.381		
	Total	30.37	82			
Passion	Between group	2.653	3	.884	1.545	.210
	Within group	45.223	79	.572		
	Total	47.875	82			
Cognitive ability	Between group	2.368	3	.789	.399	.754
	Within group	156.427	79	1.980		
	Total		82			
Extraversion	Between group	.722	3	.241	.377	.770
	Within group	50.441	79	.638		
	Total	51.163	82			
Conscientiousness	Between group	.660	3	.220	.540	.656
	Within group	32.176	79	.407		
	Total	27.327	82			
Agreeableness	Between group	.425	3	.142	.416	.742
	Within group	26.902	79	.341		
	Total	27.327	82			
Neuroticism	Between group	3.200	3	1.067	1.771	.159
	Within group	47.587	79	.602		
	Total	50.787	82			
Openness to experience	Between group	1.799	3	.600	.918	.436
	Within group	51.629	79	.654		
	Total	53.428	82			

Note: Grouping variable = Last semester GPA

Discussion

The objective of the current study is to look at how the different psychological and cognitive factors affect the students' academic achievements at the university level, and whether there are any specific characteristics found in high achieving students. The results from the multiple regression analysis indicate that GPA first year, Grit, Agreeableness and Conscientiousness was statistically significant predictors of last semesters GPA and explained 30.5% of the variance found in last semesters GPA. This seems to be consistent with similar combinations of constructs in the findings of Kappe and Flier, where personality and intelligence accounted for 27% of the variance found in GPA (2012), and the 32% variance explained in GPA by Wolfe and Johnson (1995). First year GPA and Conscientiousness had a positive effect, whilst Grit and Agreeableness had a negative effect on last semester GPA. The combination of a significant positive value of Conscientiousness and negative value in Agreeableness has not been prominent in similar studies (O'Conner & Paunonen, 2007), indicating that the findings in this study are not consistent with previous findings. Cognitive ability, Passion, Extroversion, Neuroticism and Openness to experience were not significant predictors in this model. The findings might indicate that Grit, Agreeableness and Conscientiousness play a more important role in predicting academic achievements at the university level compared to cognitive ability and the other psychological factors. Duckworth et al., (2007) do find some merit as to intelligence or cognitive tests appears to be of less importance than Grit or personality traits, in predicting academic success in university students. Wolfe and Johnson (1995) also show results in their forward regression that the personality trait Conscientiousness shows a greater value of explained variance in GPA than intelligence (SAT).

Grit

Firstly, the combination of the non-significant correlation as well as the size of the correlation would indicate that Grit is not a very good predictor of GPA. This raises some concern as the majority of published research suggest that there is a moderate to a high significant positive relationship between GPA and Grit (Duckworth et al., 2007; Chang, 2014; Sheehan, 2014; Bazelais, Lemay & Doleck, 2016). Other scientists have also found significant correlation, though somewhat small to moderate ranging from $r = .093, p < .01$ to $r = .38, p < .01$ (Cross, 2013; Strayhorn, 2014). Still, there is some Grit research that is consistent with the correlation found in this study. Hogan (2013) found that Grit and GPA

showed no significant correlation across educational level; law school GPA ($r = .044$), undergraduate GPA ($r = .065$) and high school GPA ($r = -.008$). The result of the Pearson correlation matrix suggests that there is no association between Grit and last semester GPA, which is of some concern as it do show a negative beta in the multiple regression. This combination increases my suspicion that an interaction effect may have occurred between the included variables based on the information presented in Table 2, that Grit correlates with GPA first year, which again correlates with GPA last semester. It could be suggested that the interaction is found here, but without further investigation no conclusive suggestions as to which variables that might affect the direction of the Grit variable in the multiple regression can be made. Because of this uncertainty, there is still a possibility of Grit showing a real effect and so this findings need to be discussed.

Perhaps the most interesting finding, is that Grit shows a significant negative effect on last semesters GPA score, as this would be the contrary to the positive effect that is found in other studies (Duckworth et al., 2007; Strayhorn, 2014; Cross, 2013). Karabenick (2003) explains how very high levels of grit can reduce the likelihood of help-seeking, or result in the refusal to abandon unsuccessful learning strategies (Credé et al., 2017), and thereby work counterproductive in an academic setting where quite small differences could separate a B from a C score. A possible explanation to this finding relates to the definition put forward by Duckworth suggesting that being gritty involves “working strenuously towards challenges, maintaining interest and effort over years despite failure” (2007, p.1088). This description, with it emphasize on behaviour regarding failure, would strengthen the argument that a student could score high in Grit and still get a poor exam grade resulting in a lower GPA. However, because of the high Grit level the student continues to persevere and finishes the degree, suggesting that Grit is a better predictor of academic attainment. As mentioned earlier, research have associated Grit with retention and attainment (Duckworth et al., 2007; Eskreis-Winter et al., 2014).

To deliberate, to be able to achieve a C average there is still need for perseverance or Grit, especially if the challenge (the study-program itself) is a bit beyond the student’s skill level (the ability or prior knowledge), where high levels of Grit might in some cases predict lower levels of GPA. On the other hand, we do find a significant, small to moderate correlation between Grit and first-year GPA which is consistent with previous research mentioned above. This would indicate that there might be some latent or constructed difference between the two GPA constructs. The first year at university is a considerable step-up in difficulty from high school, however, the sample of students differ from first to the sixth

year at the university which presents difficulties in interpreting the relationship between first-year GPA and present-day Grit scores and GPA. In other words, there could be a latent effect which is not controlled for between those who are early and those who are later in their studies.

An equally interesting finding based on an independent one- way ANOVA is that there is no significant difference between the mean score in Grit in any of the levels in last semester GPA. This could be understood in a developmental perspective, where university students already have a certain amount of Grit, to be able to get enrolled at the university or that the students gradually develop the level of Grit to be able to get through the first year. This argument seems to be supported by Duckworth et al. (2007) concluding in their research that people with higher education have higher Grit scores than less educated individuals, but that there were no significant differences between the level of degrees (bachelor or master).

To summarize, it seems that Grit is not necessarily a good predictor in a context such as a university where the individual's perception of success might differ from one person to the other; getting a high GPA score or to just finish a degree. Based on previous research, it seems that grit shows higher predictive value where the goal is more universal, such as in sport competitions. From an academic student perspective simply persevere and graduate could be a goal in itself GPA would not have a subjective value and Grit would therefore not be able to significantly predict such outcomes. As a result, Grit might be a better predictor in academic attainment and retention than to predict a specific GPA outcome, as we do not know for sure that high GPA are a universal goal in this student sample. An important finding presented in Table 2, however is that Grit Perseverance of effort seems to be a better predictor of GPA first year than total Grit score, emphasising the importance of perseverance in the student population. This is consistent with other findings of the predictive value of the facets (Sheehan, 2013; Credé et al., 2017). If the Grit value is a result of a methodical error or a real effect cannot be determined as further investigations are needed.

Passion and Grit

The result and findings in this study contributes to our understanding of how Grit defined as “perseverance and passion...” relates to GPA. The reason for these non-significant associations between passion and GPA could also explain the non- positive findings in Grit. Scientists have confirmed that passion mediates the effect between deliberate practise and performance (Vallerand, 2010) and that passion moderates the relationship between perseverance (Grit) and performance (Jachimowicz et al., 2018). So if there is no passion in

the academic setting, the individual's ability to persevere may also suffer as a result, affecting the possibility of finding a significant value of Grit. In studies that include both passion and Grit might give some merit to the accusation of Grit neglecting its composite of passion (Credé et al., 2018; Jachimowicz, 2018)

Passion and academic achievement

The analysis suggests a similar correlation pattern in passion as found in Grit. Based on the Pearson correlation, the passion scale shows a non-significant association with the GPA variables. This implies that there is no linear relationship between grades and passion in this sample, which is consistent with previous findings that passion and similar constructs are more related to non-academic contexts (Ruiz-Alfonso & León, 2016; Fredricks et al., 2010). Because the passion scale used in this study is quite new, there has not been performed any studies about the predictive value or external validity of the scale. We can, however, still look at the mean score in different studies to demonstrate that there is quite a difference between a non-academic sample and the academic sample in this study ($M = 3.76$, $SD = .74$, $N = 141$). As an example, Sigmundsson et al. (2020b) found a significantly higher mean in Norwegian football players ($M = 4.62$, $SD = .354$, $N = 63$). This indicates that passion is higher in non-academic settings. But why is that?

A suggestion is that the academic context is not optimal for passion development. The way the Norwegian school system is organized it would seem that there is little autonomy when it comes to themes or areas to engage in. Students are most often told what to do and what they need to learn as a result of the Norwegian "curriculum", and passion development would not necessarily be stimulated. As proposed by early philosophers, passion can result in the experience of loss of control (Vallerand, 2015). This would imply that to be able to experience passion or flow about a certain area of expertise, the possibility of autonomy in engaging in the activity or area, require some level of "loss of control". This can also be related to the state of flow, where a student experience "forgetting time" when engaging in a specific passionate task (Csikszentmihalyi et al., 2014). Because autonomy and choice are only to a limited extent available prior to university, students associate school with work and not passion. This attitude might to some extent also be present at the university level, and it would seem that passion is not a very dominant factor in school. However, studies show how passionate teachers, increased autonomy in learning and better feedback can ignite a student's passion in a specific subject. As passion indicates several benefits of behaviour towards achievement, the necessity to open up to more autonomy to peruse one's interest could

potentially be an important factor in achieving higher academic performance among student. The academic situation where passion experience, or flow, would be most prominent could perhaps be linked to writing of a thesis, as a result of high autonomy, increase in knowledge and mastery.

In summary, previous research has suggested that passion is related to several positive outcomes, such as increased wellbeing and life satisfaction and ignites internal motivation and gives direction to specific goals. There are a lot of convincing arguments and research as to how and why passion could be an important factor in learning. However, most students do not seem to associate schoolwork as a passionate activity, but rather as work. This provides the university, and especially university professors, an opportunity to strategically develop learning outcomes and school tasks to facilitate passion development in their students.

Personality and academic achievement

None of the personality traits in the BFI- 44 measurement seems to be associated with any of the GPA variables (see Table 2). These findings are to some degree inconsistent with meta-studies (O'Connor & Paunonen, 2007), as well as research where BFI measurements are used (Hair & Hampson, 2006; Wolfe & Johnson, 1995). Wolfe and Johnson (1995) show how several of the personality dimensions do not significantly correlates with university students' GPA scores, except conscientiousness. The association between GPA and conscientiousness is also found in Hair and Hampson (2006). O'Conner and Paunonen (2007) mention that conscientiousness seems to be the most stable personality trait of the five big five dimensions, but that conscientiousness varies from quite small to high associations. Despite the non-significant correlation found in Table 2, conscientiousness was found to significantly explain the variance in last semester GPA, which is in line with the majority of research in the field (Downey et al., 2014; Furnham et al., 2003; Poropat, 2009; O'Conner & Paunonen, 2007). Based on the many characteristics and associations mentioned in the previous sections in this thesis, these findings are not surprising.

An interesting finding in Table 2, is how Conscientiousness and Grit seems to share a lot of the same patterns in their associations. They both show a negative correlation with general cognitive ability and a positive association with study hours. Furnham, Chamorro-Premuzic, and Moutafi (2005) suggest that high conscientiousness can be seen as a defence mechanism to be able to succeed in an academic context. This could imply that people with a lower cognitive ability, have a higher need to plan or organize to be able to do well on tests and vice versa. Conscientiousness associated with average study hours each week is in line

with findings in other studies that conscientious students tend to spend more time on campus (Mehl, Gosling & Pennebaker, 2006). The reason why Grit show a negative beta while Conscientiousness show a positive beta, can possibly be explained as a result of latent variables found in the regression model, or that the variables associated with Grit and Conscientiousness differ in their correlations with the two constructs.

Agreeableness seems to vary the most regarding the construct's association towards academic performance, more specifically GPA (O'Conner & Paunonen, 2007). As seen in the multiple regression (Table 3), the personality trait Agreeableness seems to show a unique negative variance in last semester GPA. Other researchers have found this negative association using NEO-FFI (Paunonen, 1998), while researchers using the BFI measurement have not found any significant association with Agreeableness in high school students (Wolfe & Johnson, 1995) or in university students (Hair & Hampson, 2006).

This negative value can possibly be explained by the altruistic foundation in agreeableness, where individuals high in agreeableness have a higher tendency of providing help to others (John, Naumann & Soto, 2008). This type of help-giving behaviour is often related to the need for social interaction and spending time with others, as again can reduce the amount of time available for study. The basis for the facet of agreeableness shows some sign of pacifistic behaviour such as measured in question 17 (see appendix A) "Has a forgiving nature" and question 32 "Is considerate and kind to almost everyone". This type of mentality, as well as the straightforwardness found to be inverse in agreeableness, could perhaps be counterproductive in a context where individuality, originality and the ability to discuss for and against and even argue, can result in the difference between an A and a B score.

The variation in findings across studies might origin from the basis that different personality dimensions show irregularities in correlation and regression models as a result of the multiple contexts or tasks one might find at the university. In a study done by Vedel (2016), she found that the score of the different personality traits might vary from major to major. This could perhaps be a confounding variable; how different traits might affect the GPA in the different majors (cross-cultural review). This is also based on the argument that different traits can predict specific aspects of job performance or tasks (John & Srivastava, 1999).

Cognitive ability

The cognitive ability test Adaptive Matrigma showed no correlation with any of the GPA variables. Neither did it show a significant contribution to the regression model or a unique contribution in explaining the variation found in GPA last semester. Students with high cognitive abilities tend to get better grades at the lower educational levels and are more motivated to enrol in higher education. This could mean that by university level there might already be a separation between individuals with lower and higher cognitive abilities. Based on the fact that student enrolment has its foundation in high school GPA, a selection has already been done based on some levels of crystallized intelligence. We see in Table 1 that the mean level of the cognitive ability test in this sample is above average ($M = 5.99$, $SD = 1.43$), with the possible score from 0 - 10. Based on the norm group of the C- scores, our sample showed to be within the average group and can therefore conclude that the sample is within the range of cognitive score found in other university samples, and exclude explanations that are based on the sample showing unusually high or low scores on general cognitive ability. Another explanation could be the so called “Flynn effect”, how there seems to be a decrease in the predictive value of intelligence as a result of a general higher intelligence found in the population all over the world, including Norway (Flynn, 1987). This might suggest that less variation found in the variables might actually result in an increase in association or predictive value.

Neisser et al. (1996) claim that successful school learning depends on many personal characteristics other than intelligence, such as persistence, interest in school, and willingness to study. Also, Duckworth et al. (2007) found results that Grit showed higher predictive values than intelligence tests. It is, however, important to remember that Adaptive Matrigma is not a standardised IQ test, and might therefore not show the same reliable scores for the individual differences in cognitive ability.

A limitation that might affect the reliability of the test relates to when the participants conducted the cognitive test. It is possible that the results found in this study are influenced by the time of day for test-taking, general fatigue and basic needs regarding thirst, hunger and sleep all of which are well-known confounding variables that might affect the test results. Another important factor is the test motivation. Duckworth et al. (2011) claim that individuals might show different motivation regarding the taking of intelligence tests (high stake = high motivation). The context while taking a test in a research study might be regarded as a low stake based on the fact that there is no external motivation as to praise. The test-takers do not see the results or get any external price when receiving a specific score, as they are only given

their results compared to the norm groups. Daniel H. Pink (2011) have pointed out in his book “Drive” that the simple liking/ disliking of the test itself could result in motivational factors directed towards the test.

Previous performance (GPA first year)

First years GPA show the only significant correlation towards last semester GPA ($r = .542, p < .001$). GPA from the first year at the university also contributes to a unique variance in GPA last semester, ($\beta = .598, p < .001$). Wolfe and Johnson (1995) found that previous GPA from high school predict GPA at university. This could be explained by prior knowledge and mastery of a subject result in a higher probability that there will be made a connection and that the information will be remembered. The learning principles by Kleim and Jones (2008) and the theory presented by Edelman (1993) explain this as a result of neural selection, where it is easier to make a neural connection if the connections (types of information) are close to one another.

Another important aspect of why previous performance can predict future performance is that learning strategies and perseverance in studying will probably be transferred to future academic performances. An important argument is also the fact that GPA from the first year includes more grades than from the last semester, making it a more robust measurement to predict last semester GPA.

The patterns of success in high achievers

In this study, there was no significant differences between the levels of GPA last semester and the mean score of Grit, passion, personality and cognitive ability. This could imply that the difference between receiving an A from a B score, or a B from a C score is quite small. As the included variables can be considered to be somewhat general regarding achievement in different domains, there might be the possibility that more specific measurements towards the individual’s ability to learn and to process information are needed to explain these differences in GPA.

« There are many roads to Rome...», meaning that there are many different ways for the students to achieve their many faceted goals, something which fairly accurately reflects the findings in this study. For instance, we see that both Grit and Conscientiousness show a negative correlation with cognitive ability. This could be explained by having a high cognitive ability one needs to be less conscientiousness, as one might easier plan and organise information more abstractly. The same could be said about Grit regarding a student’s ability

to persevere when faced with situations where learning and information processing taking a lot of effort and time. Grit could in certain situations be an important factor to be able to achieve a certain grade. For instance, if you do not have the ability to concentrate continuously for long periods of time, you might balance this by taking more breaks, and extend the number of hours of study. As Conscientiousness and Grit do correlate with the number of study hours, we can imply that students with lower cognitive abilities than some of their peers can equalise this by studying more hours, be conscientious and persevere. Furnham and Chamorro-Premuzic (2004) explains this with cognitive ability reflects what an individual can do, personality traits reflect what an individual will do.

Limitation

The sample.

The sample was selected based on a convenience sample and the possibility to generalise the findings is therefore not considered accurate. The use of convenience sampling might result in bias regarding measurements of personality. As a characteristic in this type of sampling might show higher scores of openness to experience and agreeableness, as they appear more interested in participating to gain a new experience, as well as an altruistic approach to the willingness to help others.

The equality in gender distribution make sure that the different effect found is not confounded with the effect of gender differences. However, based on this the sample might not reflect the student population in Trondheim, as there would be a greater amount of female at the universities, in NTNU. The distribution of participants derived from the different campuses in Trondheim might also not be representative of the population as a whole. Participants from other universities in Trondheim was also excluded as a result of resources.

Questionnaire.

The questionnaire did not include any questions that can exclude any confounding variables regarding general satisfaction, motivation in their education, as well as self- efficacy and general well-being. The general well-being perceived by the students could affect the answer regarding psychological factors such as grit or passion, where the participants are supposed to rate their own ability to perceive and experience these variables. The general satisfaction with the participant`s curriculum might also affect the amount of time used for studying.

Another limitation in the questionnaire is that some of the questions do not relate to the student's diversity or non-traditional education, such as single subject study. There is also a limitation in the question of study year, as it does not say how many years in total the student has been studying, only the specific year in their study the student finds themselves.

There would also be a limitation regarding the generalisation or direction of the questions to measure Passion, Grit and Personality. As no specific context were provided by the scientist, we cannot say for sure whether the student's answers are related to how they do at school, work or after school activities.

There is also a limitation regarding psychological studies using self-reporting questionnaires, as it is associated with social desirability (Van de Mortel, 2008) which may affect the validity and reliability of the findings. Big five measurements; extraversion, openness to experience and neuroticism have been found to be robust against such response bias (Costa & McCrae, 1983). In trying to limit this effect, the scientist or test responsible left the room, until the participants were finished. Also, the GPAs in this study were a result of self-reporting as the access to each student's transcript would be difficult to obtain and could affect the anonymity in the resulting answers. Therefore, there is a chance that the participants are not always truthful when answering their GPA, although information about confidentiality and anonymity might reduce the effect of social desirability.

Theory.

Only literature that have open access or that are available online were included, which would limit the availability of several original works. The literature included in this study might be limited as a result of Covid – 19 outbreak, where the availability of certain literature at the university library or other national libraries requires physical appearance, which was limited during the writing process.

Possible systematic error in GPA variables.

Based how the GPA variables should be calculated the grades divided on the number of grades, it is within reason that there might be some decimal GPA such as 3.5, and not just whole GPA such as 3. The results from the survey only found whole grades. Where only 45 out of 141 participants reported both GPAs. There are several explanation for this 1. The participant was not comfortable reporting their GPAs and left them out, 2. A systematic error found in the electronic survey. As a trial the researcher found out that to rapport their "half" GPA one needed to use 3.5 and not 3,5 as it seemed that the program did not allowed this

symbol. This could result in only the participants that had a “whole” GPA in the form of 3 = C, have been reported.

Corrections

I have detected an error in question 3 in the Passion scale used (see Appendix A). The survey reads “Jeg tror jeg kunne tenke meg å bruke mye tid til å bli god innen et område/emne/ferdighet”, (I think I could use a lot of time to be good in an area/theme/ skill), where the correct phrase is “Jeg tror jeg kan bli ekspert på et område” (I think I can become an expert in an area/theme/skill). Even though the two statements are quite similar, it needs to be taken into account in future studies to further strengthen the validity and reliability of the Passion instrument.

Ethical issue and participant care

As participation in cognitive ability test can be experienced as a bit sensitive for some participants, the scientist made herself available for questions and discussing the experience of participating to reduce potential negative associations regarding participation. Some of the participants did reveal their cognitive ability score to the scientist even though they were told not to, this affects the anonymity of answer and results.

The anonymity and confidentiality might have been affected as a result of the participation being done at the campus and increasing the possibility that the participants meet peers or other students they knew. Regarding the anonymity of the answer of the study, there were situations where the students had questions and told the researcher what they wanted to write, instead of the options, as well as include their name in their email, even though they were told not to. The participants used a code to link the cognitive test results with the survey. So, by a stepwise process it would be possible to locate whom answered what on part 2 (the electronic survey) as well. This knowledge could help the researcher identify whom answered what in the questionnaire, and anonymity might be reduced. To reduce this the researcher deleted all emails or contact before starting the analysis and looking at the data.

Conclusion

The findings support a direction of where latent, changeable variables are more important than general cognitive ability. Based on the findings in this study it seems that Grit and the personality traits agreeableness and conscientiousness are important factors to better understand the individual differences in achieving a high GPA. As previous research emphasizes the importance of high conscientiousness, we can conclude that this might also be quite important in a Norwegian sample. The ability to plan, structure and implement good solutions are crucial for high academic achievements. Being able to discuss and demonstrate critical thinking are important cornerstones of university education. As the measurement of BFI- 44 agreeableness might be slightly different from the NEO-PI or NEO-FFI, more research is needed to be able to conclude with the predictive value of this trait regarding high GPA. The negative beta value of Grit has not been found in other research associated with GPA and might be best explained as Grit being a factor that make less successful students not drop out and continues to persevere despite the setbacks of getting lower grades. More importantly, these findings indicate that more research is needed on Grit in a Norwegian context to better understand the construct's association with GPA.

Practical implication and further research

Based on the findings in this study one could argue that passion is an unexplored and neglected variable related to education. To increase educational performance, as well as general well-being, interventions or increased focus on passion should be included as a part of the curriculum. The contradictory findings in the present study demonstrates that Grit is a complex construct which needs further evaluation in an academic setting. Indeed, if Grit, in combination with the other factors, has a negative impact on GPA, further investigation is needed. The use of other multiple factors to assess academic achievement should be further investigated such as grade on thesis internship, training, lectures, skill training, team projects, as presented by Kappe and Flier (2012)

As this study was trying to investigate the predictive value on a general student population, are of interest to look at between majors to investigate if there might be some cultural or social differences, as well as investigating how different types of exams might affect the predictive value in Grit, Passion, Personality and Cognitive ability.

In order to develop academic skills in the best way possible, one must be able to handle challenges, and here it seems that Grit, Conscientiousness and Agreeableness play

important roles. Finally, I suggest that the role of a good mentor could enhance the student's academic passion.

Based on an expertise perspective towards the academic context, the use of mentors could be essential for the student to provide them with better insight into gaps in their skill, as well as to contribute with directions of goalsetting in the specific subjects.

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Appendix A The questionnaires



Akademiske faktorer

Resultater test 1

1. Din deltakerkode:*

Vennligst skriv deltakerkoden du har fått oppgitt. NB: Dette er obligatorisk - uten denne kan vi ikke kople svarene dine sammen med data fra Matrigma-testen.

2. Hva var din score på Matrigma testen?

Dette kan være lav, middels, høy



Akademiske faktorer

Vennligst besvar alle spørsmålene i én økt.
Bryter du av underveis, må du starte på nytt.

Bakgrunnsspørsmål

3. Kjønn

- Mann
 Kvinne
 Jeg definerer ikke meg selv som noen av de øvre

4. Din alder:

5. Universitet/høyskole

- NTNU
 Annet

6. Hvilket institutt er du tilknyttet?

Page 1

7. Hvilket årstrinn er du på nå?

1. studieår
2. studieår
3. studieår
4. studieår
5. studieår
6. studieår

8. Er dette studieåret (2019/2020) ditt siste år på studiet du tar nå?

- Ja
- Nei



Akademiske faktorer

Arbeidsvaner og oppnåelser

9. Ca. hvor mange timer i uken bruker du på å studere?

Dette inkluderer ikke forelesninger, (men kan inkludere kollokvier, arbeid relatert til innleveringer, eksamen, oppgaver osv).

- < 20 20-24 25-29 30-34 35-39 40-45 46-49 50 +

10. Hva var din gjennomsnittlige karakter etter første året på universitetet?

A=5 B=4 C=3 D=2 E=1 F=0 Finn gjennomsnittet (omgjør alle karakterene til tall som vist nedenfor. Pluss alle tallene sammen og del på antall karakterer.) Eksempel på svar 3.4

11. Hva var din gjennomsnittlige karakter basert på de fagene du tok eksamen i forrige semester?

(Vær obs på dette kunn er for et semester)

12. Har du noen gang strøket på en eksamen på universitetet/høyskolen?

- Ja
- Nei

13. Har du noen vansker som kan påvirke ditt akademiske resultat eller antall timer du studerer?

Eksempler på lidelser eller sykdommer som potensielt kan påvirke det akademiske resultatet: konsentrasjonsvansker, diabetes, ADHD, dysleksi, depresjon, angst for å nevne noen.

- Nei
- Ja
- Usikker

14. Har du noen gang byttet studium?

- Ja
 Nei
 Byttet retning innad i mitt studie

15. Hvor ofte går du i forelesningene dine?

- Jeg går i alle
 Jeg går i alle, så lenge jeg ikke jobber
 Jeg går i de jeg synes virker interessante
 Jeg går ikke i noen, leser helst selv.



Akademiske faktorer

Motivasjon

16. Hvor enig eller uenig er du i følgende utsagn?

Det er viktig for meg å få gode karakterer på universitetet/høyskole

	Veldig enig	Litt enig	Verken /eller	Litt uenig	Veldig uenig
Fordi det viser til prestisje, eller viser til en status blandt mine medstudenter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For å få en god jobb etter studiene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For å tilfredstille mine foreldre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For å min egen del	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Hvor enig eller uenig er du i følgende utsagn?

Jeg går på universitet/høyskole fordi

	Veldig enig	Litt enig	Verken /eller	Litt uenig	Veldig uenig
For å kunne tilegne meg ny kunnskap og ferdigheter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Komme inn på videreutdanning slik som master eller Phd	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Å få en god jobb når jeg er ferdig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For gjøre mine foreldre stolte	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fordi jeg føler det er forventet av meg	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. Hvor enig eller uenig er du i følgende påstander?

Jeg føler et press for å få gode karakterer av..

- Meg selv
 Mine foreldre
 Mine medstudenter

Akademiske faktorer

GRIT - Short scale (8 item)

19. Her vil du få noen påstander om deg selv, så skal du velge i hvilken grad du føler det er typisk deg.

	Veldig typisk meg	Ganske typisk meg	Litt typisk meg	Ikke typisk meg	Ikke meg i det hele tatt
Noen ganger distraherer nye ideer og prosjekter meg fra tidligere prosjekter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg mister ikke motet ved tilbakegang/motgang	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg har vært besatt av en bestemt ide eller prosjekt i en kort periode, men har senere mistet interessen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg er arbeidsom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg setter meg ofte et mål, men bestemmer meg så for et annet isteden.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg har vansker med å beholde fokus på prosjekter som tar mer enn et par måneder å fullføre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg fullfører alt jeg påbegynner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg er flittig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Passion scale (8 item)

20.

	Veldig typisk meg	Ganske typisk meg	Litt typisk meg	Ikke typisk meg	Ikke meg i det hele tatt
Jeg har et område/tema/ferdighet som jeg brenner for	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg kunne tenke meg å bruke mye tid til å bli god innen et området/emne/ferdighet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg tror jeg kunne tenke meg å bruke mye tid til å bli god innen et område/emne/ferdighet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg har lidenskap nok til å bli ekspert i det området/temaet/ferdigheten jeg liker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg er arbeidsom nok til å oppfylle mine mål	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg har brennende lidenskap for noen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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områder/tema/ferdigheter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg bruker mye tid på prosjekter jeg liker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Min lidenskap er viktig for meg	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Akademiske faktorer
Personlighet- Big five inventory

21. Hvor uenig eller enig er du i hvert av disse utsagnene?

	Veldig uenig	Litt uenig	Verken /eller	Litt enig	Veldig enig
Er snakkesalig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har en tendens til å finne feil hos andre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gjør en grundig jobb	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er nedfor, lei meg	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er original, kommer på med nye ideer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er reservert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er hjelpsom og omtensksom mot andre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kan være uforsiktig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er avslappet, håndterer stress på en god måte	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er nysgjerrig på mange ulike ting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er full av energi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starter krangler med andre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er en pålitelig medarbeider	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kan være litt anspent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er smart, en dyp tenker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Genererer entusiasme	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har lett for å tilgi/ har en tilgivende natur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har en tendens til å være uorganisert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har lett for å bekymre seg	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har en frodig fantasi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har en tendens til å være stille	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er generelt tillitsfull	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

22. Hvor uenig eller enig er du i hvert av disse utsagnene?

	Veldig uenig	Litt uenig	Verken /eller	Litt enig	Veldig enig
Har en tendens til å være lat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er følelsesmessig stabil, blir ikke lett opprørt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er oppfinnsom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Har en selvsikker personlighet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kan være kald og reservert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Står på til oppgaven er fullført	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kan ha humørsvingninger	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setter pris på/verdsetter kunstneriske, estetiske opplevelser	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er noen ganger sjenert, hemmet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er snill og oppmerksom mot de fleste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er effektiv	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beholder oren i ansente situasjoner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Foretrekker rutinemessige arbeid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er utadvendt og sosial	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Oppfører seg noen ganger uhøflig mot andre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lager planer og gjennomfører dem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Blir lett nervøs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Liker å reflektere, leke rundt med ideer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har få kunstneriske interesser	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Liker å samarbeide med andre	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Blir lett distraheret	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har sofistikerte interesser innenfor kunst, musikk, eller litteratur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix B: information sheet and consent form

Har du anledning til å delta i forskningsprosjektet ”Predicting the future” ?

Dette er en forespørsel til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke ulike velkjente tester innen personlighet og kognitiv evne opp mot ulike psykologiske faktorer. I dette skrivet gir vi deg litt informasjon om målene for prosjektet og hav deltakelsen vil innebære for deg.

Formål

Formålet med prosjektet er å se på hvilke psykologiske variabler som i størst grad bidrar til å predikere karakterer (eksamensresultater) hos universitets studenter. Dette er et prosjekt som skal gå over ett år fra august 2019 – mai 2020. Problemstilling: Hvilke psykologiske faktorer kan best predikere semester karakterene til universitetets studenter. Forskningsprosjektet er en del av en masteroppgave innenfor psykologi med spesialisering innenfor læring, atferd, hjerne og omgivelser.

Hvem er ansvarlig for forskningsprosjektet?

Hermundur Sigmundsson er ansvarlig for prosjektet og fungerende veileder.

Hvorfor får du spørsmål om å delta?

I prosjektet er vi spesielt interessert i studentgrupper som på bakgrunn av ulike teorier vil ha ulik målorientering. Dette vil da gjerne være studentgrupper fra forskjellige institutter eller campuser.

Hva innebærer det for deg å delta?

Testingen består av to deler som skal gjennomføres fortløpende og kun en gang. Del 1 vil være en test av kognitive evner; adaptive Matrigma. Denne testen er laget og brukes i selskapet Assessio. Her har deltakerne 12 minutter på å gjennomføre så mange oppgaver som mulig og du vil få ett minutt på å gjennomføre hver oppgave. Dersom du overstiger tiden, vil du få en skåre på null på oppgaven og testen går automatisk videre til neste oppgave. Etter 12 minutter vil testen avsluttes av seg selv. Resultatet vil bli oppgitt i lav, middel og høy skåre.

Del 2 vil bestå av et elektronisk spørreskjema om ulike psykologiske faktorer. Det vil ta mellom 8-10 minutter å gjennomføre denne delen.

Det er frivillig å delta

Deltagelsen i prosjektet er frivillig. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg om du ikke ønsker å delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- Det er kun masterstudent Vilde Johannessen som har tilgang til alle data. I analysene vil vi benytte tall-koding for å sikre at svarene i Del 1 og 2 samsvarer med personen som deltar i prosjektet. Veileder vil ikke få tilgang til informasjon om hvem som deltok. Datamaterialet vil bli lagret på NTNU sin server og tilgang til dette krever personlig innlogging av masterstudent Vilde Johannessen. Svar på den kognitive evnetesten vil bli slettet ved prosjektets avslutning den 01.10.2020.
- NTNU har interne leverandører av Select survey. Det er kun masterstudent Vilde Johannessen som skal gjennomgå, bearbeide og lagre data.
- Det kan bli gitt opplysninger i masteroppgaven om den generelle studentmassen for å demonstrere at utvalget til prosjektet er representativt for populasjonen man ønsker å se nærmere på. Det kan også bli gitt noe informasjon om forskjeller mellom de ulike studentgruppene som deltar, men dette vil ikke inneholde sensitiv informasjon, eller annen informasjon som direkte eller indirekte kan virke personidentifiserende.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?

Prosjektet skal etter planen avsluttes den 01.10.20. Alle personopplysninger skal slettes etter prosjektslutt.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- sende klage til Personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra NTNU har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?

Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, vennligst ta kontakt med:

- Student: Vilde Johannessen, på email: (vildejo@stud.ntnu.no) eller på telefon: 95462968
- Psykologisk institutt: Hermundur Sigmundsson, email: (hermundur.sigmundsson@ntnu.no)
- Vårt personvernombud: Thomas Helgesen, email: (thomas.helgesen@ntnu.no)
- NSD – Norsk senter for forskningsdata AS, på epost (personverntjenester@nsd.no) eller på telefon: 55 58 21 17.

Med vennlig hilsen
Vilde Johannessen

Samtykkeerklæring

Jeg har mottatt og forstått informasjonen om prosjektet [*Predicting the future*], og har fått anledning til å stille spørsmål. Jeg samtykker til å delta i del 1 [*Kognitive evne test: Adaptive Matrigma.*] og del 2 (*elektronisk spørreskjema*)

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. [01.oktober2020]

(Signert av prosjektdeltaker, dato

Appendix C Permission from the Air Force Academy



FHS LKSK

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Vår saksbehandler
Maj. Pål Kristian Fredriksen
Seksjonssjef Veiledning, Trening og Øving
+47 73995440/ +47 95077998, 0550-5440
pafredriksen@fhs.mil.no

Vår dato 2020-02-17
Vår referanse 2020/ /FORSVARET

Tidligere dato **Tidligere referanse**

Til
Vilde Johannessen

Kopi til

Vedlegg

Tillatelse til å gjennomføre undersøkelse ved Luftkrigsskolen

1 Bakgrunn

Vilde Johannessen er masterstudent i psykologi. I sin masteroppgave undersøker hun ulike kognitive og psykologiske faktorer hos ulike studentgrupper i Trondheim. I denne studien ønsker hun å inkluderer informanter fra Luftkrigsskolen.

2 Konklusjon

Luftkrigsskolen ønsker å støtte akademisk arbeid som omhandler tema som er relevant for Luftkrigsskolen. Denne oppgave faller innenfor denne kategorien. Vilde Johannessen gis tillatelse til å gjennomføre undersøkelse ved Luftkrigsskolen med følgende rammer:

- Respondentene informeres om undersøkelsens tema og rettigheter som respondent i vitenskapelig arbeid.
- Respondentene anonymiseres.
- Studien godkjennes av FHS og NSD.
- Koordinerer adkomst og gjennomføring med Luftkrigsskolen

Pål K Fredriksen
Major
Seksjonssjef Veiledning, Trening og Øving

|

Postadresse Postboks 800 Postmottak 2617 Lillehammer	Besøksadresse Luftkrigsskolen 61 7046 Trondheim	Sivil telefon/telefaks +47 03 003/+47 61 10 36 99	Epost/ Internett forsvaret@mil.no www.forsvaret.no	Vedlegg 0
		Militær telefon/telefaks 99/0500 3699	Organisasjonsnummer NO 986 105 174	

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Dokumentet er elektronisk godkjent, og har derfor ikke håndskreven signatur.

Appendix D Information to external participants

Infoskriv til eksterne deltakere – Trinnvis forklaring:

1. Les og skriv under på samtykkeskjema.
2. Gjennomfør del 1: Adaptive Matrigma. Denne skal du ha fått på mail. Dersom du ikke har fått åpnet denne, send en mail til vildejohs@gmail.com eller ta kontakt via telefon 95462968.

Del 1

3. Gjennomfør del 1. Dette er en kognitiv evne test. Her er det viktig at du er et sted som har optimale testforhold. Det burde være rolig, uten noen forstyrrende elementer, eller mulighet for at noen kan forstyrre deg mens du gjennomfører testen. Gerne sett mobil på flymode.

Testen vil ta 12 minutter å gjennomføre, du vil få max 1 minutt på å svare på hver oppgave, har du ikke svart innen 1 minutt går testen videre automatisk. Formålet er å få riktig svar på så mange oppgaver som mulig i løpet av 12 minutter. Du vil få to testoppgaver som ikke vil være med i beregningen.

Første side i matrigma skriver du inn:

Navn: koden du får oppgitt

Kjønn: velg ditt kjønn

Fødselsår: skriv året du ble født

Morsmål: norsk

Nasjonalitet: valgfritt

Bostedsland: valgfritt

Høyeste nivå av fullført utdanning: valgfritt, her kan du også velge ønsker ikke å oppgi

Nåværende yreksområde: ønsker ikke å oppgi.

Formål med testingen: forskning

Husk svaret på del 1, denne skal du skrive opp i del 2.

Del 2

4. Gjennomfør del 2: denne skal du også ha fått via mail. Åpne og start. Her er det viktig at du svarer på alle spørsmålene, så les nøye. Her kan du bruke så lang tid du vil.

Skulle du ønske å trekke deg ved et tidspunkt? Er det bare til å sende en mail til Vildejohs@gmail.com å si at du ønsker å trekke deg, det kreves ikke at du oppgir årsak. Du må kunn huske koden du brukte under forsøket, slik at det er mulig å koble hvilken respons det er ønskelig å fjerne.

