



**UIT**

THE ARCTIC  
UNIVERSITY  
OF NORWAY

Institute of Psychology

# How to Measure a Growth Mindset:

*A validation Study of the Implicit Theories of Intelligence Scale and a Novel Norwegian Measure*

—

**Magnus Ingebrigtsen**

*Master's thesis in psychology - May 2018*



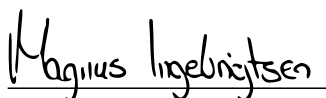


# MEASURING GROWTH MINDSET

## Foreword

To my supervisor, Prof. Frode Svartdal. During the writing of my bachelors thesis, as my second supervisor, you told me that my initial bachelors project was too big... “After all, it’s not a master’s thesis” you said. Being the fast paced, “just do it” kind of supervisor, you were an obvious choice of supervisor for my master’s thesis. So what was your response to my initial master’s project? “That’s too much, after all, it’s not a PhD”... Even though my first thought was - What - you said that last time!? - I now have to thank you for invaluable guidance to create a project that was both achievable, interesting and extremely educative, even within the limits of time one has on a master’s project. You have been an amazing help in everything from planning to overseeing the final draft of my thesis, and I could never have done it without your help.

To my emotional supervisor, fiancée and best friend, Kristine Lillegård, who also deserves a huge credit! From the idea of applying to the master’s program, to the final days of completion, you have been my biggest cheerleader and support. Thank you for taking the time to listen to me, even though I certainly bored you with lengthy monologues about latent constructs. Thank you for letting me sleep an extra hour, even though you hadn’t slept much either. And thank you for being an amazing mom and taking such good care of Elias, when his dad was deeply into his final draft. I love you, and couldn’t have done it without you.



Magnus Ingebrigtsen



Frode Svartdal





How to Measure a Growth Mindset: A Validation Study of the Implicit Theories of  
Intelligence Scale and a Novel Norwegian Measure

Magnus Ingebrigtsen

Supervisor: Prof. Frode Svartdal

PSY-3900

UiT - The Arctic University

### Sammendrag

En persons tankesett, eller såkalt implisitt intelligensteori, har blitt forbundet med faktorer som akademisk oppnåelse, resiliens og velbehag. Forskere har derimot betvilt definisjonsklarheten til konstruktet, og nylige metaanalyser har rapportert forvirrende funn, som at intervensjoner kun har en positiv effekt på akademisk oppnåelse når manipulasjonssjekkene viser at tankesett ikke har endret seg. Dette setter spørsmålstegn ved de psykometriske egenskapene til nåværende måleverktøy. Det finnes heller ikke en publisert norsk måleskala for en persons tankesett. For å adressere dette, ba vi norske studenter ( $n = 544$ ) om å besvare en undersøkelse bestående av den engelske Implicit Theory of Intelligence Scale (ITIS), en ny norsk tankesett skala (NGMM), og selvrapporterte karakterer. Vi brukte konfirmatorisk faktoranalyse og Item Response Theory for å vurdere de psykometriske egenskapene til skalaene. Konvergent og divergent validitet ble også undersøkt ved hjelp av mål på prokrastinering og standhaftighet. Resultatene viste at ITIS er et pålitelig mål, om det måler et todelt konstrukt, men det korrelerer ikke med karakterer. NGMM har lovende psykometriske egenskaper, og representerer et første steg på veien til et nytt tankesett mål.

Keywords: implicit theory of intelligence, growth, fixed, mindset, entity theory, incremental theory, procrastination, grit, psychometric, validation

### Abstract

A person's mindset, or implicit theory of intelligence, has been linked to many factors such as academic achievement, resiliency, and well-being. However, researchers have questioned the definitional clarity of the mindset construct and recent meta-analyses have reported confusing findings, such as interventions only having an effect on academic achievement if manipulation checks fail. This poses concerns about the psychometric properties of current methods, and in addition, there is no published Norwegian scale for assessing a person's mindset. In order to resolve this, the present study asked Norwegian students ( $n = 544$ ) to answer an online questionnaire consisting of the 6-item Implicit Theory of Intelligence Scale (ITIS), a novel Norwegian mindset scale (NGMM), and self-reported grade averages (GPA). We used Confirmatory Factor Analysis and Item Response Theory to assess psychometric properties of the scales. Convergent and discriminant validity was also examined using measures of procrastination and grit. In conclusion, the ITIS was found to be reliable for assessing a two-part construct, but did not correlate significantly with GPA. The NGMM shows promise in terms of psychometric qualities, and presents a first step toward a new type of mindset measure.

Keywords: implicit theory of intelligence, growth, fixed, mindset, entity theory, incremental theory, procrastination, grit, psychometric, validation

How to Measure a Growth Mindset: A Validation Study of the Implicit Theories of  
Intelligence Scale and a Novel Norwegian Measure

Do you believe intelligence is a fixed quality, or something you can improve upon? What about talent for music, sports, or math? Do you believe that talents are inscribed in your genetic code, and hence the explanation for your clumsiness, brilliance or line of work? Or is success more a matter of effort and learning the right strategy?

Beliefs in the malleability of intelligence has become a popular field of study, with its roots dating back to 1988, when Dweck and Leggett published an article about what they called *implicit theories of intelligence*. The article built on research that looked at how children, often with equal abilities, responded very differently to setbacks. Some children experienced setbacks as interesting learning opportunities, while others experienced them as negative and demotivating failures (Diener & Dweck, 1978; Dweck & Reppucci, 1973; Elliott & Dweck, 1988). Dweck and Leggett theorized that believing intelligence was fixed, could lead to a helpless response, while the opposite belief might lead to a mastery response.

Fast forward to today, and the belief that intelligence can grow, or having a so called growth mindset, has been associated with improved academic achievement (Blackwell, Trzesniewski, & Dweck, 2007; Yeager et al., 2016), a reduction in the negative effects of poverty (Claro, Paunesku, & Dweck, 2016; Sisk, Burgoyne, Sun, Butler, & Macnamara, 2018), setting favorable learning goals instead of less helpful performance goals (Robins & Pals, 2002), resilience in the face of mental illness (Schroder, Dawood, Yalch, Donnellan, & Moser, 2014), a reduction in the stereotype threat effect (Aronson, Fried, & Good, 2002), improvements in motivation, diligence and concentration (Ommundsen, Haugen, & Lund, 2005) and much more (Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013).

A person's belief about the malleability of intelligence is often referred to as an implicit theory of intelligence. Implicit theory of intelligence beliefs are usually grouped into



*entity theory*, sometimes called having a fixed mindset, or *incremental theory*, sometimes called a growth mindset (Lüftenegger & Chen, 2017). Sternberg, Conway, Ketron and Bernstein (1981) define implicit theories as personal constructions about particular phenomena. The term implicit theory is widely used in different areas of psychology (Furnham, 1988), but in the present context, it addresses intelligence, and specifically, the possibility of changing one's intelligence. Terms such as lay theories or naive theories (Furnham, 1988; Levy, Chiu, & Hong, 2006) are also sometimes used. There current debate regarding the terminology in this area, which will be addressed later in the thesis.

According to Elliot, Dweck and Yeager (2017), when both children and adults are tested, 40% of the population fall into a category characterized by the incremental theorist view, and 40% fall into the entity theory view. About 20% of the population are undecided or mixed, meaning that they fall somewhere in the middle on the traditional scales that are used. Growth or fixed mindsets seem to be relatively stable over time (Blackwell et al., 2007; Goldstein & Brooks, 2013), and are largely unrelated to actual intelligence or to personality (Spinath, Spinath, Riemann, & Angleitner, 2003). Both a growth mindset and a fixed mindset, seems to be possible to prime for shorter periods of time (McConnell, 2001; Niiya, Crocker, & Bartmess, 2004; Plaks & Halvorson, 2013), or changed more permanently by interventions, something that has lead researchers to postulate causal connections between mindset and academic achievement (Donohoe, Topping, & Hannah, 2012; Lin-Siegler, Ahn, Chen, Fang, & Luna-Lucero, 2016) among other factors.

Even though the topic of growth mindset has become extremely popular in both public and academic domains (Busch, 2018; Rustin, 2016; Stanford University, 2017), and has even been referred to as a “mindset revolution” (Boaler, 2013), there are many contradictory findings (Dommett, Devonshire, Sewter, & Greenfield, 2013; Rheinschmidt & Mendoza-Denton, 2014; Sisk et al., 2018). Meta-analyses have reported inconsistent findings,

with effect sizes of mindset on academic performance ranging from small (.10) (Sisk et al., 2018) to large (.56) (Lazowski & Hulleman, 2016). In addition, the most recent meta-analysis (Sisk et al., 2018) found that all meta-analytic effects included in the study were below .35, and concluded that earlier effect sizes may have been largely over-estimated. This meta-analysis however, also reported the confusing finding that mindset interventions were most effective for improving grades when manipulation checks demonstrated that participants' mindset had *not* been changed (Sisk et al., 2018). This serves to underscore an argument made by Lüftenegger and Chen (2017), that there are still “large gaps in the research base”, and further impress the importance of valid and reliable measures of the mindset construct.

Hence, the purpose of the present paper, is to address the reliability and validity of mindset measures, with the goal of minimizing inconsistencies and confusing findings in the future. Although many hypothesis can be made to explain the divergent findings in existing research, what will be addressed in this thesis is that improved definitional clarity of the mindset construct, and better psychometrically validated measures, can put mindset research on firmer scientific ground. Important questions about the domain specificity and the dimensionality of the construct has gone largely overlooked, and existing research has rarely asked if the effects of a growth mindset changes as people's conceptions of intelligence changes. Also, there is no validated scale for assessing a person's mindset in Norwegian, and little research has addressed the generalizability of mindset research to different populations (Park, Callahan, & Ryoo, 2016). Since previous studies have demonstrated promising potential from very short and simple interventions, with quite significant, long lasting positive effects (Lazowski & Hulleman, 2016; Walton, 2014; Yeager et al., 2014), it is useful to be able to measure people's mindset in a valid and reliable way. This can contribute to a qualified assessments of whether or not precious resources in organizations and institutions should be spent on mindset interventions.

### **The current thesis**

Mainly, this thesis addresses three questions based on previous research, that is mostly limited to an educational setting. The first question is reviewed theoretically, and the other two empirically. Based on arguments made by Lüftenegger and Chen (2017), regarding the lack of definitional clarity, the first question is; 1) How is the mindset construct defined and how does this relate to current ways of measuring a person's mindset? Secondly, since a large number of studies in the mindset literature relies on a single scale (the ITIS), which mostly rely on a single publication for assessments of validity, the second questions is 2) Are current measures psychometrically valid and reliable? This question is answered in light of the discussion about how the mindset construct is defined. Thirdly, since recent research has found divergent evidence of the effectiveness of mindset on academic achievement, a first step in the direction of a different way of measuring a person's mindset is made. Therefore, the last questions is; 3) Can a measurement based on the mindset theory be reliable, valid and perhaps more predictive than existing measures?

Hence, the first part of this thesis will focus on defining mindset and the mindset theory. Then, with a clearer idea of the mindset theory, part two will focus on a theoretical discussion of the mindset construct and how this relates to current measures of a person's mindset. Part three will empirically assess the psychometric properties of the current mindset measure, and a novel Norwegian measure based on the mindset theory. As for my more personal aspirations, I wish that this thesis can create a better foundation for understanding and assessing effective interventions in the educational sector, so that we can help students become more engaged in the learning process, more resilient to difficult circumstances and more self-driven and motivated as learners.

### **What is a mindset?**

First it is necessary to clarify some of the terminology used to describe the

phenomenon addressed in this thesis. Because “definitional murkiness leads to challenges in measuring or assessing the construct” (Lüftenegger & Chen, 2017), this is an important starting point before discussing the theory, construct and different measures. Lüftenegger and Chen (2017) recommends using the term implicit theory of intelligence when describing the concept.

The term *implicit*, as used by psychologists, refer to something automatic or unconscious (Greenwald & Banaji, 1995). In the present context however, since asking people is currently the primary way to measure a person’s implicit theory of intelligence, we have to assume that implicit refers to something usually *not verbalized* rather than unconscious. *Theory*, refers to an individuals generalized explanation of how something works, or so called “inferred theory”. In some sense, it is like a scientific theory (Nisbett & Ross, 1980), however it is often not tested in an optimal sense, and the subject of many potential biases and heuristics (Plaks, 2017).

Carol Dweck, one of the originators of the implicit theories of intelligence concept, and a lead researcher in the field, has also popularized the terms fixed or growth mindset. Dweck’s definitions seem to encompass more than implicit theories about intelligence, and since mindset is often used interchangeably with implicit theory, we must also understand what a mindset is in the present context.

### **Mindset as cognitive process**

French (2016) argues that mindset definitions can be grouped into three main definitions, and that the original definition was the cognitive process definition. This cognitive definition defines a mindset as «the general cognitive operations with distinct features that facilitate a given task» (Torelli & Kaikati, 2009 p. 232). In other words, a mindset is the cognitively active processes in relation to a specific task. Using this definition, a mindset could, for instance, be measured by fMRI, in which one could assess what areas of

the brain were active at specific times, creating an understanding of the processes by which subjects solve specific tasks (Mather, Cacioppo, & Kanwisher, 2013). This definition has proven helpful in understanding how mindsets influences processes such as attention (Mangels, Butterfield, Lamb, Good, & Dweck, 2006) and goal orientation (Mangels, Rodriguez, Ochakovskaya, & Guerra-Carrillo, 2017), however it is not the definition used for the topic I am currently addressing in this thesis.

### **Mindset as cognitive filter**

Benson, Dresdow (2003), Gupta and Govindarajan (2002) describe a mindset as a cognitive filter or a “frame of reference” for thinking, something more commonly used in the social psychology and organizational leadership literature (French, 2016). In contrast to the cognitive process conceptualization, cognitive filters are seen as something that influences the totality of cognitive processes, without necessarily relating to a single specific task. For example a “global mindset” is used to describe the frame of reference that employees in an enterprise use when they think of the marketplace and their customers. With a global mindset, they consider their enterprise as part of a global community as opposed to simply a local enterprise. Thinking from a global mindset then influences all decisions an enterprise and it’s workers partake in (Gupta & Govindarajan, 2002; Story, 2010). This is also not the definition of a mindset I will be referring to.

### **Mindset as belief**

The last, and perhaps most plain definition, is the belief definition. Dweck (2007, p. 16) states that; “mindsets are just beliefs”. This definition falls under what French (2016), calls the positive psychology conceptualization and characterization. Going forward, I will presuppose the belief definition of a mindset, meaning that summarized, a mindset is *just a belief that is not usually verbalized, about the malleability of intelligence and/or personal characteristics*. The division between *intelligence and/or personal abilities* will be addressed

later, however this definition lays the foundation for addressing the measurements of a person's implicit theory of intelligence or mindset. Following, are the two ends of this belief.

A person who believes that intelligence is flexible and something that can grow, is an incremental theorist or growth minded person. Incremental theorists believe intelligence is a work in progress, and thinks of ones intelligence as something that evolves with practice, effort or experience. Having an incremental theory has been correlated with a mastery-oriented response, well-being and several other positive attributes (Dweck, 2000, 2007; Dweck, Chiu, & Hong, 1995a; Dweck & Leggett, 1988; Howell, 2016).

On the other hand, people who believe that intelligence is a fixed quality, are often referred to as entity theorists or fixed mindset person. They believe intelligence is not something that can be changed, but rather a fixed or inborn trait. Having an entity theory has been correlated with giving up more easily, neglecting important feedback, and viewing failure as something negative, as opposed to something that contributes to learning (Dweck, 2000, 2007; Dweck et al., 1995a; Dweck & Leggett, 1988).

### **The Growth Mindset Theory**

The growth mindset theory proposes that a person's mindset affect outcomes such as academic achievement, through a series of social-cognitive motivational factors. Since there is a somewhat long line of reasoning between mindset and achievement, and since understanding the mindset theory is crucial for knowing how to measure the mindset construct, I will briefly review the theory from a historical perspective, beginning with the conception of the idea by Dweck and Leggett (1988).

#### **Mastery vs. helpless-orientation**

As noted in the introduction, Dweck and Leggett built the first article on implicit theories of intelligence on previous research on mastery- and helpless-oriented responses in children (Diener & Dweck, 1978; Dweck & Reppucci, 1973; Elliott & Dweck, 1988).

Mastery oriented children would become intrigued, excited and show persistence to challenges, whilst helpless oriented children would become demotivated, uninterested and just stop trying. Helpless oriented children often engaged in self-handicapping explanations or try to draw attention away from their momentary failure by talking about previous achievements, at the same point as mastery oriented children was noted to having said “I was hoping this would be informative” and “I love a good challenge”. Since Dweck and Leggett (1988) remarked that these orientations seemed to be unaffected by initial ability level, Dweck and Elliott (1988) proposed a goal theory to explain the differences.

### **Achievement goal theory**

The achievement goal theory that Dweck and Elliott conceptualized, attempted to explain some of the cognitive and affective process that led children to respond so differently to challenges. Achievement goal theory stated that individuals set either performance or learning goals, where performance goals are oriented towards looking good in the eyes of others, gaining positive feedback, or obtaining extrinsic measure of success like good grades. Learning goals, on the other hand, are oriented towards learning and improving skills and competences (e.g item: “It is much more important for me to learn things in my classes than it is to get the best grades”). The goal theory proposed that differences in goals lead to either a helpless or mastery oriented response because of the different affective responses they produced in the face of failure. If a person was most concerned with extrinsic factors, they would be more likely to experience negative affect when they failed, which in turn would make them less inclined to keep trying, and therefore exhibit a helpless pattern. If, on the other hand, a person was most concerned with learning, it would reduce the likelihood of feeling the same negative affect when failing, since they could nonetheless learn from the situation, leading to perseverance and a mastery response instead (Elliott & Dweck, 1988).

Dweck and Leggett (1988) then asked the question of “why individuals in the same

situation would pursue such different goals?”. This spurred the idea that different implicit theories of intelligence would create different goals. Dweck and Leggett noted that they found support for this theory in several articles that unfortunately remain unpublished (Bandura & Dweck, 1985; Dweck, Tenney, & Dinces, 1982; Leggett, 1985).

### **Causal attributions**

Related to the theory, was also the questions of causal attributions. Attribution theories (Heider, 1958; Jones & Davis, 1965; Kelley, 1967), and attributional theory (Weiner, 1985), was a big research topic during the 1980's, which posited that people create different forms of attributions for events and behaviors, which were linked to both motivation, affect and behavioral outcomes (Peterson & Seligman, 1984; Weiner, 1985). Most relevant for the mindset theory, were attributions of failure, and specifically, helpless attributions (Peterson & Seligman, 1984). As failure can either be attributed to unstable causes inside ones influence (such as effort), or stable causes outside of ones influence (such as innate ability) (Weiner, 1985), there is a clear connection to a persons mindset. As Dweck and Leggett suggested, if one believes intelligence is important for solving a specific problem, and one also believes intelligence is a fixed quality, then helpless attributions may ensue, again leading back to the division between helpless and mastery orientations.

### **Effort beliefs**

The last of the motivational factors that were historically tied to mindset theory, was the theory of effort beliefs (Leggett & Dweck, 1986). Positive effort beliefs can simply be stated as believing that ones effort leads to success, with the opposite being true for negative effort beliefs. As an example, Dweck and Leggett (1988) explained that previous work had shown that children who reported negative effort beliefs, felt proud of low-effort success, whilst children with more positive effort beliefs were most proud of successes that had demanded higher levels of effort. In summary, it was theorized that these effort beliefs would



contribute to mastery or helpless responses.

### **Mechanism and empirical support**

All in all, this means that mindset theory proposed that outcomes such as academic achievement, were obtained through an interplay of the four above mentioned factors. A growth mindset encourages learning goals and instill adaptive effort beliefs and failure attributions. This, in turn, leads to positive, mastery--oriented strategies, which then lead to achievement by way of effort and persistence.

Returning to more recent times and research, a large number of studies have tested the predictions made by the mindset theory (Burnette et al., 2013; Sisk et al., 2018; Vella, Braithewaite, Gardner, & Spray, 2016). Some studies have tested the proposed mechanisms in path models, and have found support for the theory (Blackwell et al., 2007; Bråten & Strømsø, 2006; Burnette et al., 2013; Dupeyrat & Mariné, 2005; Park et al., 2016; Stipek & Gralinski, 1996), although not always for all elements of the model (Burnette et al., 2013; Dupeyrat & Mariné, 2005). Some studies have included newer contributions to the elements in the theory, such as the sub-division of performance goals into approach and avoidance (De Castella & Byrne, 2015; Elliot, 1999), or looked more closely at the relationship between mindset and strategy use (Bråten & Olaussen, 1998).

Other studies have tested only isolated elements of the theory. For example, one study showed that growth minded individuals tend to attribute failures more often to unstable factors, such as a lack of effort, compared to the fixed mindset individuals, who tend to attribute failure to stable factors such as their innate abilities (Hong, Chiu, Dweck, Lin, & Wan, 1999). Another study tested this element less direct, demonstrating that person praise (praising the children, e.g. «you are smart») and person criticism (e.g. «you are not so good at this»), can both lead to increased helplessness and self blaming in response to failure, also supporting the attribution element of the theory (Kamins & Dweck, 1999).

What is most relevant for this thesis, however, is that some studies have found that the relationships between mindset and other factors vary, depending on the measurement that is employed. For instance, Dupeyrat and Marinè (2005), used path analysis to assess the tenants of the mindset theory, but failed to find the predicted effects of mindset on goal orientation. De Castella and Byrne (2015) however, found a different result when they tested the relationship between mindset and goal orientation, using different variations of the implicit theories of intelligence scale. One scale asked participants about the malleability of intelligence in general, by far the most commonly used phrasing in the mindset research. The other scale asked questions oriented towards ones own intelligence, simply using “my intelligence” instead of “intelligence”, in all questions. This allowed the researchers to factor in the potential difference in a persons confidence to changes to his or her own intelligence as well. The researchers found significant effects for all three types of goals (learning, performance-approach and performance-avoidance) using the self-scale, whereas the general scale predicted only two types of goal orientations. Another study by Bråten and Olaussen (1998), found no relationship between beliefs about the malleability of intelligence and learning strategy or motivational beliefs. They did however find significant relationships between all these, when they measured beliefs about the malleability of commonly associated facets of intelligence, a finding that will be discussed below.

These findings, in addition to the confusing finding that the effect of mindset on academic achievement is significant when manipulation checks fail, but null when manipulation checks succeeded (Sisk et al., 2018), forces us to consider that the measurement of a person’s mindset may not be adequately psychometrically defensible. Hence, the following sections of this thesis, will concern the mindset construct and it’s existing measures, so that a discussion regarding the validity and reliability of these measures can be made.

### The mindset construct and existing measure

Questions have been raised about the mindset construct and its measures (Dweck, Chiu, & Hong, 1995b; French, 2016; Lüftenegger & Chen, 2017; Park et al., 2016), and two elements are of high relevance for developing and assessing effective measures. These elements will be addressed in a theoretical fashion, by examining existing research and empirical findings. These questions are fundamentally important because a precise understanding of the construct - and its relation to current measures - contribute valuable information in the assessment and development of valid and reliable measures.

#### Unidimensional or not?

The first question regards the dimensionality of the mindset construct. Entity theory and incremental theory beliefs have often been thought to represent the two ends of a single construct (Dweck et al., 1995a, 1995b), meaning that they are defined as opposite ends of a continuum, ranging from entity (fixed mindset) to incremental theory (growth mindset). This idea may have warranted the use of items that are solely consistent with an entity theory, however several researchers have challenged this notion, explaining that the correlation between entity and incremental theory responses are not strong enough to support a single construct (Lüftenegger & Chen, 2017; Tempelaar, Rienties, Giesbers, & Gijsselaers, 2014).

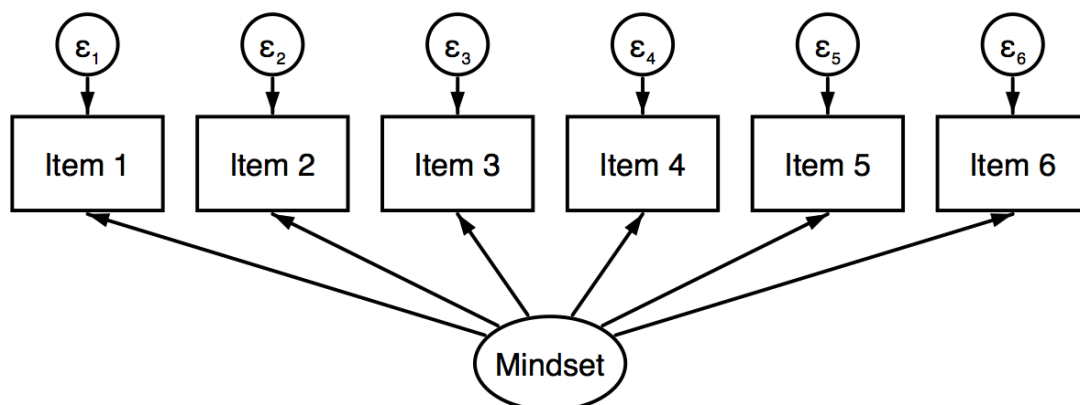


Figure 1. Proposed model for a single mindset construct, using the six-item ITIS.

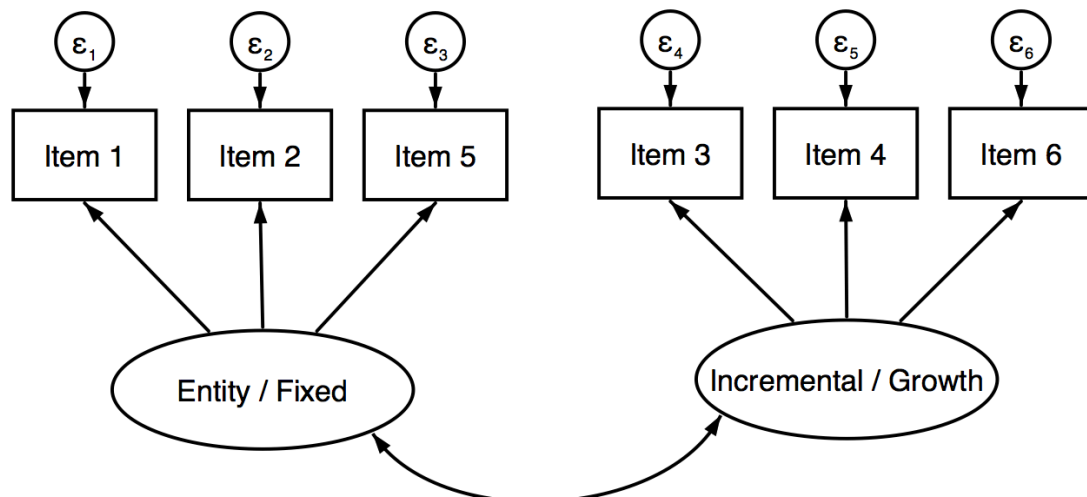


Figure 2. Proposed model for a two-part construct, using the six-item ITIS.

Dweck, Chiu and Hong (1995a) argued that it may be perfectly possible for people to hold both theories at once, even though they are “logical opposites”, but they nonetheless argued for a single construct. Referring to the practice of measurements that only use questions consistent with an entity theory, the researchers claimed that “our validation studies, our manipulation studies, and the results from a new version of the implicit theory measure all attest to the validity of the measures for assessing both the entity and the incremental theory”. Unfortunately, Dweck, Chiu and Hong referred mainly to unpublished work, which is nonetheless contradicted by more recent and published research (Dupeyrat & Mariné, 2005; Lüftenegger & Chen, 2017; Stipek & Gralinski, 1996; Tempelaar et al., 2014).

Studies have for instance found that responses to entity theory and incremental theory items correlate anywhere from -.19 to -.74, with average correlations being too weak to justify consolidation of these two constructs into one (Tempelaar et al., 2014). Other studies, using factor analysis (Dupeyrat & Mariné, 2005), have failed to find support for a single construct, showing moderate correlations of -0.55 between entity and incremental theory responses, and a poor fit for a single-construct model. Stipek and Gralinski (1996) also reported similar findings, with a correlation of -.46 between entity and incremental theory responses. On the other hand, some studies, for example Bråten and Strømsø (2004) and

Cury, Elliot, Da Fonseca, and Moller(2006) have found stronger correlations between entity and incremental theory responses, but the majority of recent evidence seem to favor two separate constructs (De Castella & Byrne, 2015; Dupeyrat & Mariné, 2005; Lüftenegger & Chen, 2017; Spinath et al., 2003; Tempelaar et al., 2014).

A possible explanation for the seemingly illogical act of simultaneously agreeing that intelligence is and is not malleable at the same time, could be that entity and incremental theory beliefs act as knowledge structures. Individuals could access these knowledge structures based on things such as contextual clues or other factors making the beliefs salient (Anderson, 1995), something several researchers have pointed out (Chiu, Hong, & Dweck, 1997; Plaks, Levy, & Dweck, 2009).

In summary, early definitions of mindset as a single construct (Figure 1), has gone largely unsupported by recent evidence, and more refined statistical methods (De Castella & Byrne, 2015; Dupeyrat & Mariné, 2005; Lüftenegger & Chen, 2017; Spinath et al., 2003; Tempelaar et al., 2014). Therefore, in the current thesis, entity and incremental theory is hypothesized to be two, correlated, but separate constructs. Since current evidence is not entirely without disagreement, the fit of both the one-factor model (Figure 1) and the two-factor model (Figure 2), will be tested.

### **Intelligence mindset versus whole mindset**

The second question, more closely regarding the measurement and application of mindset research, regards domain specificity. Given that mindset interventions have found divergent results, particularly when it comes to manipulation checks (Sisk et al., 2018), it's important to ask what specifically mindset measures actually measure. To properly understand this, it's necessary to look at items of the most commonly used assessments.

Three items, which are still common in most scales today, are; (1) “You have a certain amount of intelligence and you really can't do much to change it” (2) “Your intelligence is

something about you that you can't change very much" and (3) "You can learn new things but you can't really change your basic intelligence" (Dweck, 2000; Dweck et al., 1995a, 1995b; Dweck & Henderson, 1988; Dweck & Leggett, 1988). Responses to these items, hereafter referred to as the Implicit Theories of Intelligence Scale (ITIS-3), are collected on a 1- 6 Likert scale, ranging from strongly disagree to strongly agree. Average scores are then computed, and respondents are grouped as either entity theorists, incremental theorists or mixed, depending on the level of their average score. As we can see, all items in the original ITIS, are consistent with an entity theory, since Dweck and her colleagues (Dweck & Henderson, 1988; Dweck & Leggett, 1988) theorized that items congruent with an incremental theory were more desirable, and could therefore lead people to drift toward incremental responses.

Table 1.

*Formulation of items in the Implicit Theories of Intelligence Scales*

Formulation
Item 1: You have a certain amount of intelligence and you really can't do much to change it*
Item 2: Your intelligence is something about you that you can't change very much*
Item 3: No matter who you are, you can significantly change your intelligence level
Item 4: You can always substantially change how intelligent you are
Item 5: You can learn new things but you can't really change your basic intelligence*
Item 6: You can change even your basic intelligence level considerably

\* Reversed. The first Implicit Theories of Intelligence Scale (Dweck & Henderson, 1988) consisted of only these three, entity congruent items.

However, newer iterations of the scale have included incremental congruent questions such as "No matter who you are, you can significantly change your intelligence level", "You can always substantially change how intelligent you are" and "You can change even your basic intelligence level considerably" (Dweck, 2000, p. 177). The six items, in Table 1 and a slight iteration with a total of eight items, are the most commonly used in published mindset research.

Although the reversed items seem like simple negations of the entity questions, Dweck has posited that she was able to find formulations of the questions that prevented a drift towards incremental responses, although references are not provided (Dweck, 2000). For simplicity's sake, all versions of this scale (three, six and eight item scale), will subsequently be referred to as the implicit theories of intelligence scale or ITIS.

Returning to the question regarding domain specificity, the important thing to note is that all questions in the ITIS reflect only beliefs about the malleability of *intelligence*, and makes no mention of other domains such as talent or abilities. Although there is new research to support the reliability of the ITIS (Burnette et al., 2013), many researchers seem to have generalized research using the ITIS, to signify the implicit belief that *all human attributes are malleable*. In her 2007 book, for example, Dweck wrote “a belief that your qualities can be cultivated leads to a host of different thoughts and actions”. In popular publications, Dweck has stated that “they understood that their abilities could be developed” (Dweck, 2014) and “...like those with the growth mindset, you believe you can develop yourself” (Dweck, 2007). This implies that a growth mindset reflects both abilities and personality, although there seems to be very little agreement on the relationship between beliefs about intelligence and beliefs about other human characteristics (Lüftenegger & Chen, 2017). Other researchers have made similar generalizations to Dwecks, but in scientific publications (Drews, Chiviacowsky, & Wulf, 2013; Spinath et al., 2003), implying that responses to the ITIS somehow reflect what we could call a domain general implicit theory of all human attributes, or what I will refer to as a *whole mindset*.

The *whole mindset*, in contrast to the *intelligence mindset*, stands for the belief that human attributes *and* specific abilities can be developed. The main problem then is, that findings from research using the ITIS, have been confused with findings about a whole mindset, rather than limited to findings about just intelligence beliefs. Scientifically, this

would only be justifiable if there were strong and consistent correlations between beliefs about the intelligence domain, and many other domains. Hence, the question becomes, what does previous research show, that justifies the generalization from beliefs about the malleability of intelligence to beliefs in the malleability of all human abilities? If a person's beliefs about the malleability of intelligence is strongly correlated with their beliefs about the malleability of musical talent, moral character, athletic ability and others, this would warrant a generalization. However if they are only moderately or weakly correlated, it would suggest that we cannot generalize questions about intelligence to a "whole mindset"?

Testing this question, Spinath, Spinath, Riemann and Angleitner (2003), assessed people's implicit theory of personality (broken into each of the big five personality traits), intelligence and more specific abilities of mathematics and athletics for a total of eight domains. All in all, intelligence was rated as significantly less malleable than personality and specific abilities, and specific abilities were considered to be less malleable than personality. There were significant correlations (ranging from .48 to .53) between the three domains of personality, intelligence, and specific ability, indicating that they are related, but not strongly. Age and gender analysis showed that women considered intelligence to be less stable than men did, and there was a tendency to hold a stronger entity theory in all three domains with increasing age. This study is one of few studies that has used a very diverse group of participants, instead of the all too commonly used "weird" (Henrich, Heine, & Norenzayan, 2010) participants in psychological research.

Another study, conducted by Bråten and Olaussen (1998), tested this question in a very different manner. They tested if people's conception of intelligence strongly correlate with each of the attributes they associate with intelligence. Bråten and Olaussen originally set out to test how people's learning strategies and self-efficacy related to their implicit theory of intelligence, and therefore began by creating a scale they called the conceptions of



intelligence (CIS) scale. The scale was constructed by first making a list of 60 typical behaviors of an intelligent person, based on Sternberg, Conway, Ketron, and Bernstein's (1981) analyses of laypersons' and experts' ratings of characteristic behaviors of an ideally intelligent person. By asking 70 students to indicate which behaviors were most and least typical of an intelligent person, they were left with the 13 most typical behaviors associated with the intelligent person. These attributes were; Vocabulary, understanding of the essence of a problem, attention, thinking speed, application of knowledge to solve problems at hand, reading comprehension, logical reasoning, approaching problems thoughtfully, identification of connections among ideas, intellectual curiosity, assessing the relevance of information to a problem at hand, learning speed, and reading pleasure. They then asked the study participants to rate to what extent they thought each of those characteristics could be further developed on a scale ranging from "to a very little extent" to "to a very large extent". This means that they in essence assessed a person's implicit theory about 13 different abilities that are commonly associated with an intelligent person. Lastly, they included one question adapted from the ITIS, which asked how much on the five point scale the participants believed *intelligence* could be developed. Interestingly, Bråten and Olaussen found that the single intelligence item did not correlate greater than .47 with the 13 different conceptions of intelligence, indicating that people's beliefs about the nature of intelligence in general can differ quite a bit from people's beliefs about specific behaviors attributed to intelligence. Their findings also showed that scores on the single intelligence item was not significantly correlated to the participants learning strategies, although the correlation between the CIS and learning strategy was significant. The conclusion from this study is that there is only a moderate connection between people's beliefs about the malleability of intelligence, and their beliefs about the malleability of the 13 most commonly associated behaviors of intelligent people, something that would warrant caution against sweeping generalizations about a whole mindset.

Another study that warrants caution, is the primary validation study on the ITIS, by Dweck, Chiu and Hong (1995a). They tested the ITIS in combination with both an implicit theory of morality and an implicit theory of “kind of person” (example: Everyone is a certain kind of person and there is not much that can be done to really change that), so they could assess the degrees to which they were related. They found a strong correlation (.78) with a person’s implicit theory of intelligence and the sum implicit person theory measure, which included the implicit theory of morality and kind of person measure. This supported the view for domain generality, however, the researchers stated that when using factor analysis, they found that all implicit theories were statistically independent. Dweck, Chiu and Hong (1995b) proceeded by saying; ”People need not have one sweeping theory that cuts across all human attributes“. They also stated that “implicit theories are conceptually domain specific. Indeed, at the assessment level, endorsing an entity theory of one attribute is statistically independent of endorsing an entity theory of a different attribute” and “our research shows that although some people do have one very generalized theory, others have different theories of different attributes”.

It is unclear how these conclusions have led to dozens of books and articles that all refer to a domain independent whole mindset (Brooks, Brooks, & Goldstein, 2012; Drews et al., 2013; Dweck, 2000, 2007, 2014; Elliot et al., 2017; Harvard Business Review Staff, 2017; Komarraju & Nadler, 2013; Parrish, 2015). On one hand, researchers have made this generalization, while on the other hand, researchers are creating increasingly more and more fine grained mindset scales, such as in sports, with an “implicit theory of natural ability”(Golby & Wood, 2016; Vella et al., 2016), in mental health with an “implicit theory of anxiety” (Schroder et al., 2014) and in weight management with an “implicit theory of body weight” (Burnette, 2010). There are also numerous examples where the term intelligence in the ITIS has simply been exchanged with other terms, such as mathematical ability

(Blackwell et al., 2007), athletic ability (Vella et al., 2016), science ability (Chen & Pajares, 2010) and emotional intelligence (Cabello & Fernandez-Berrocal, 2015), seemingly assuming that no further validation of the relationship between these beliefs and the mindset construct is necessary.

In summary, the studies reviewed here do not support a domain independent, whole mindset. This means, that without further examination, responses to the ITIS can not justifiably be generalized to mean that people believe in the malleability of all human characteristics. Implications of these findings are twofold. First, it necessitates a more careful consideration when drawing general conclusions from mindset studies, when the mindset construct has not been aptly operationalized in the study. Secondly, it implies that researchers should take more care to clarify the intentions of a mindset intervention, so that mindset interventions can be grouped as either whole mindset interventions, intelligence mindset interventions, or specific ability mindset interventions. If researchers hold different opinion about what a mindset refers to, theoretically similar research could be practically very different, by way of a construct identity fallacy (Larsen & Bong, 2016).

Regarding this thesis, the domain specificity issue can be addressed in one of two ways. The first way would be to conduct exploratory studies to find differences and similarities between different domain mindsets, and in time, come to a psychometrically valid and multifaceted scale. This scale could for instance include entity and incremental theory of both intelligence, musical ability and athletic ability. Another way of addressing this issue would be to create an operationalized scale that was based on the mindset theory, that did not explicitly ask about beliefs, but rather presented people with choices based on the different mindset construct elements, such as attributions, effort beliefs, goals and mastery versus helpless orientations. On the positive side, this method could sidestep the challenge of separating domains, whilst on the negative side, it runs the risk of becoming a “scale of

scales”, meaning that it no longer measures mindset as a separate construct. Svartdal (2016), has created a step in the direction of an operationalized scale, called the Norwegian Growth Mindset Measure (NGMM). In this thesis, the psychometric properties of this measure will be examined, so that the viability of this beginning direction towards an alternative mindset measure can be assessed. Hence the hypothesis to test is whether such a scale is both psychometrically reliable, and shows adequate convergent and discriminant validity.

### **The current study**

In summary, the current study examines psychometric properties of the existing mindset measure (ITIS) and the proposed operationalized measure (NGMM), using an online survey that include self-reported grade averages and previously validated scales for procrastination and grit. The measures of grit, procrastination and self-reported grades, were included with the purpose of establishing convergent and discriminant validity, a valuable element of psychometric validity (John, Benet-Martínez, Reis, & Judd, 2013).

Grit is hypothesized to be positively associated with a growth mindset. Grit is defined as passion for and perseverance toward especially long-term goals (Duckworth, Peterson, Matthews, & Kelly, 2007). Grit can be thought of as a personality trait of tenaciously pursuing a goal, and keeping up hard work in the face of challenge, adversity and setbacks. This definition coincides with a mastery-oriented response, and positive effort beliefs that have been associated with grit (Eskreis-Winkler et al., 2016). In 2007, Blackwell, et al., demonstrated that increases in academic performance in the growth mindset group, was mediated by positive effort beliefs, suggesting a positive relationship between growth mindset and grit. Recently, a meta-analysis of the grit literature suggested that the construct is very strongly correlated with conscientiousness and self-control ( $\rho = .84$ ) (Crede, Tynan, & Harms, 2017). Such a strong correlation suggests that grit may in fact be a redundant measure when factoring in conscientiousness, however, for the purposes of this study, this redundancy

is unimportant, and a convergent validity should be found.

Procrastination is hypothesized as being negatively associated with a growth mindset. Procrastination is an irrational delay of an intended activity, meaning that a person is aware that delay will be disadvantageous, but delays nonetheless (Steel, 2010a; Svartdal & Steel, 2017). This is sometimes accompanied with negative affects such as shame, guilt or regret, and theories about what cause procrastination include both situational and personal factors (Steel, 2010b). Steel (2010a; 2010b) has proposed that expectancy and value motivation is one of the important personal factors in procrastination. Given that a the growth mindset is associated with more positive effort beliefs, this could increase the motivation element in the model proposed by Steel, making it reasonable to find a discriminant relationship between mindset and procrastination. A study by Rickert, Meras and Witkow (2014) found that the strength of one's entity beliefs were positively associated with procrastination ( $r = .24$ ), supporting this assumption.

The current study uses the following scales: The English 6-item Implicit Theory of Intelligence Scale for children over the age of 10 (ITIS) (Dweck, 2000), the Norwegian Growth Mindset Measure (NGMM) (Svartdal, 2016), the Norwegian Irrational Procrastination Scale (IPS) (Svartdal, 2015) and the Norwegian Short Grit Scale (Grit-S) (Sending, 2014).

The two main hypothesis that are tested are: 1. Since there is still debate about the dimensionality of the construct, and it's beneficial to test psychometric properties in different populations, we test if, for the current population, the ITIS is (a) a reliable measure of mindset, when defined as two constructs, consisting of entity theory items and incremental theory. We then test if incremental theory correlates (b) positively with grit, (c) self-reported grades and (d) negatively with procrastination, whilst entity theory correlates (e) negatively with grit, (f) self-reported grades and (g) positively with procrastination.

Second, to examine the viability of a new type of operationalized mindset measure, we test if (2) the Norwegian Growth Mindset Measures (a) is a reliable measure, which (b) correlates positively with incremental theory, (c) grit and (d) self-reported grades. It should also correlate (e) negatively with entity theory and (f) procrastination, and (g) correlate to all named measures more strongly than the ITIS.

## **Method**

### **Participants**

A total of 601 participants were recruited, 74,2% ( $n = 446$ ) women and 25,8% ( $n = 155$ ) men. 66,9% ( $n = 395$ ) were students at university or college level, and 20,3% ( $n = 120$ ) were high school students. 4,1% ( $n = 24$ ) were junior high school students and 8,8% ( $n = 51$ ) did not report being in either of these three categories. Participants not belonging to the student population ( $n = 55$ ) were excluded from analysis, as were two participants ( $< 0,5\%$ ) that had given the same response to all questions. This left 90% ( $n = 544$ ) respondents for final analyses.

### **Recruitment**

Participants were recruited in two ways. Some were invited to fill out the questionnaire when they were participants in a seminar on study skills, taught by the author, while others were invited to take part when they signed up for a free, online video seminar on study skills. Participants were asked if they had previously taken part in a seminars on study skills taught by the author, and of the participants, 26,6% ( $n = 158$ ) reported that they indeed had participated, either fully or partially in an online or live seminar previously, whilst 73,4% ( $n = 437$ ) of participants had not. Potential implications of selection bias and effects of participation in a previous seminars will be examined in the discussion.

### **Data collection**

Data collection was done with the online survey tool Typeform ([www.typeform.com](http://www.typeform.com)),

which participants accessed using either their mobile device or a laptop. The participants were first presented with a consent agreement, stating that participation was voluntary and that they had to be at least 16 years of age to participate. They were informed that they were anonymous and could refrain from answering or withdraw from the study at any point.

## Measures

**Implicit Theories of Intelligence Scale.** We used the English 6-item Implicit Theory of Intelligence Scale for children over the age of ten. Norwegian students are highly adept at English, so we confidently assumed that they would understand the questions, however we chose the children over the ages of ten version since the subjects were adolescents and non-native English speakers.

The child and adult scale only differs by level of linguistic simplicity (e.g. “you can significantly change your intelligence level” versus “you can change your intelligence a lot”), and is, according to Dweck (2000), as valid as the other proposed implicit theory of intelligence scales, although documentation is not provided. The reliability data for the scale comes from Dweck, Chiu and Hong (1995a; 1995b), and is based on the 8-item general implicit theory of intelligence scale for adults. The scale shows good internal consistency ( $\alpha = .85$ ) and test-retest reliability at 2 weeks ( $r = .80$ ), and correlates significantly with several notable variables. The scale “...appears unaffected by social desirability, intellectual ability, political beliefs or self-presentation concerns, indicating good discriminant validity against a range of potentially confounding variables” (De Castella & Byrne, 2015).

**Norwegian Growth Mindset Measure.** In order to create an alternative measure for implicit theory of intelligence, Svartdal (2016), adapted assumptions about fixed and growth mindset, and the growth mindset theory, as described in Dweck (2007), to a simple preference scale. Assumptions about the mindsets regarded tendencies to either embrace or avoid challenges, persist or give up after setbacks, think of effort as fruitful or fruitless, and

learn from or avoid feedback and criticism.

The operationalized assumptions are adapted into the following four choices, which were preceded by “På de neste fire spørsmålene skal du skal du velge mellom to forskjellige avslutninger - Velg bare det du oppriktig opplever at passer deg best”: (1) Når jeg mislykkes med noe faglig, A) viser det at jeg prøvde på noe som var for vanskelig for meg B) ser jeg det som en mulighet til å lære mer. (2) Tilbakemelding og kritikk fra andre (som lærere, foreldre og trenere), A) Gjør meg mindre motivert og gjør at jeg føler meg dårlig. B) Motiverer meg til å bli bedre. (3) Når jeg lykkes med noe vanskelig, A) viser det at jeg har gjort en bra innsats B) bekrefter det at jeg er flink. (4) Hvis det er noe jeg ikke er særlig flink til. A) gir jeg raskt opp. B) gir jeg meg ikke før jeg har klart det.

The term Norwegian Growth Mindset Measure was chosen since it attempts to measure more than a person’s specific implicit theory of intelligence, by measuring a contextualized and operationalized implicit theory of intelligence. No previous psychometric data has been published.

**Irrational Procrastination Scale.** We used a Norwegian version of the Irrational Procrastination Scale (IPS) (Steel, 2010a; Steel & David, 2002), translated and validated by Svartdal(2015). IPS is designed to measure how much people irrationally delay taking action on tasks. Procrastination is here defined as irrational delay, and participants rate statements on a five point Likert scale (1 = “Stemmer veldig sjelden eller ikke i det hele tatt”, 5 = “Stemmer veldig ofte eller hele tiden”), where high scores reflect higher levels of procrastination. Irrationality is reflected in items such as “Jeg venter med å gjøre ting mer enn hva som er fornuftig.”, and studies have shown that the scale reflects a single latent construct(Svartdal & Steel, 2017).

The IPS originally contains nine items, three of which are reverse scored, however, we only used the six items that are consistent with procrastination. These six items have been



found to be consistent with complete IPS, with a Cronbach's alpha of .93 and factor analysis showing an excellent fit (Svartdal & Steel, 2017). Since evidence has demonstrated the psychometric reliability of the IPS, no further analysis was made in the current study.

**Grit-S.** We used the 8-item short grit scale (Grit-S) developed by Duckworth and Quinn (2009), originally devised from a longer, 12-item scale (Grit-O) by Duckworth, Peterson, Matthews and Kelly (2007). Duckworth and Quinn recommends the short Grit-S over the longer Grit-O due to superior psychometric properties and simplicity. The scale consists of two subscales, Consistency of Interest and Perseverance of Effort. The Consistency of Interest subscale has acceptable internal consistency with Cronbach's alpha ranging from .73 to .79, but internal consistency is lower for the Perseverance of Effort subscale, with Cronbach's alpha ranging from questionable ( $\alpha = .60$ ) to acceptable ( $\alpha = .78$ ). Despite the lower Cronbach's alpha, CFA has demonstrated a good fit for larger sample sizes (Duckworth & Quinn, 2009), a more reliable measure of psychometric properties (Brown, 2015; Dunn, Baguley, & Brunsten, 2014; Kline, 2015).

Both the Grit-S and the Grit-O were translated to Norwegian by Sending (2014), using a parallel blind technique. Sending found a strong correlation ( $r = .89$ ) between the Norwegian and English responses for bilingual respondents. Mean grit scores were also similar to those found in Duckworth and Quinn(2009). The relationship between the Grit-S and the Grit-O also remained the same in Norwegian and English ( $r = .96$ ). In the Norwegian Grit-S, subscales showed acceptable to good Cronbach's alpha (Consistency of Interest,  $\alpha = .84$ , Perseverance of Effort  $\alpha = .78$ ).

Items on the Norwegian Grit-S are rated on a 1 - 5 Likert type scale, (1 = ikke meg i det hele tatt, 5 = veldig typisk meg), and include sentences such as “Jeg mister ikke motet ved tilbakeslag/motgang” and “ and “Jeg setter meg ofte et mål, men bestemmer meg så for et annet isteden”. In our analysis, we only used total scores, as Ducksworth et. al. (2007)

reported that “neither factor (sub-scale) was consistently more predictive of outcomes than the other, and in most cases, the two together were more predictive than either alone.”

**Self-reported grades.** Participants were asked to estimate their grade average on a scale ranging from 1-6 or E-A depending on their education level. Junior high-school and high-school students reported grades on a scale of 1-6 while students at college and university level reported grades from E to A.

### **Statistical procedure**

In order to examine psychometric properties of the ITIS, we used a Confirmatory Factor Analysis (CFA). One reason for selecting to use CFA as a reliability measure, is that compared to Cronbach’s alpha, it is more robust against factors such as correlated errors between items (Furr, 2011). We examined skewness and kurtosis, in addition to Q-Q plots for each items, since normality is an important assumption for SEM models (Brown, 2015). These were all found to be within acceptable ranges. We evaluated the fit of each model according to the Root Mean Square Error of Approximation (*RMSEA*), the Bentler Comparative Fit Index (*CFI*), and the Standardized Root Mean Square Residual (*SRMR*). Acceptable goodness of fit was adopted using the standard criteria of  $RMSEA < 0.08$ , *CFI* values above 0.90, and  $SRMR < 0.08$  (Brown, 2015; Byrne, 2001; Kline, 2015). Chi square was not used since it is often considerably inflated with larger sample sizes such as the one for this thesis (Stevens, 2012). Estimates were all made using the maximum likelihood.

Because responses to the NGMM are dichotomous, psychometric properties was examined using Item Response Theory (IRT). IRT has been shown to contribute substantially to statistical analysis in the development of psychometric scales, and offers a number of advantages classical test theory cannot, due partly to the fact that it can illuminate how well each item discriminates and explains different ranges of a construct (Fraley, Waller, & Brennan, 2000; Zanon, Hutz, Yoo, & Hambleton, 2016). Responses to the NGMM were not

normally distributed, however we proceeded with our analysis without transformations since IRT is considered a robust test, and normality assumptions are less important for IRT than for CFA (Furr, 2011). Unidimensionality is however, an important assumption for IRT (Zanon et al., 2016), something we assessed with a factor analysis prior to IRT. All IRT and CFA tests were performed using StataMP version 15.1.

After assessing psychometric properties of the ITIS and NGMM, we used correlations to assess convergent and discriminant validity between all measures. Correlations were computed using SPSS version 25.

## Results

### Summary statistics and correlations

No sex differences were observed in the Incremental, Entity, IPS or Grit-S. A small effect of gender was found on NGMM ( $d = 0.27$ ) with men scoring higher than women. A small gender difference in the outcome variable GPA was also found ( $d = 0.20$ ), where women scored higher than men. Since gender invariances were not considered an essential element of this study, all analysis are reported for the whole sample. Table 2 shows summary statistics for all instruments, and Table 3 shows correlations between all measures.

Table 2

*Summary statistic, including skewness, kurtosis and Cronbach's alpha*

	<i>N</i>	<i>M (SD)</i>	<i>Skew (SE)</i>	<i>Kurtosis (SE)</i>	Items	$\alpha$
Entity	541	1.84 (1.01)	0.48 (0.11)	-0,01 (0.21)	3	0.77
Incremental	540	3.51 (0.92)	-0.75 (0.11)	0.96 (0.21)	3	0.81
NGMM	542	2.79 (1.16)	-0.67 (0.11)	-0.53 (0.21)	4	-
IPS	540	3.42 (0.85)	-0.79 (0.11)	-0.40 (0.21)	6	0.91
Grit-S	542	3.06 (0.60)	-0.21 (0.11)	-0.35 (0.21)	8	0.76
GPA	521	4.24 (0.83)	-0.40 (0.11)	0.42 (0.21)	1	-

*Note: For additional information about the Grit-S, See appendix B.*

Table 3

*Correlations between all measurements*

	1.	2.	3.	4.	5.	6.
1. Entity	1	-.56**	-.25**	.10*	-.18**	-.08
2. Incremental		1	.18**	-.08	.21**	.03
3. NGMM			1	-.30**	.43**	.16**
4. IPS				1	-.62**	-.19**
5. Grit-S					1	.25**
6. GPA						1

\*\* . Correlation is significant at the 0.01 level (2-tailed)

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

As presented in Table 3, correlations were moderate between a fixed (entity) and growth (incremental) mindset, favoring the two-factor structure of the ITIS, further assessed below using CFA.

Incremental theory correlated (1b) positively with the Grit-S, but not with (1c) GPA, or (1d) the IPS. Entity theory correlated (1e) negatively with the Grit-S, as expected, but not significantly with (1f) GPA. Even though incremental theory did not correlate negatively with the IPS, entity theory correlated (1g) positively with the IPS. This demonstrates the superior explanatory value of a two-factor structure in the ITIS. Correlations between all measurements and the sum ITIS score was also examined, but no further relationships were found, over what the two sub-scales had already demonstrated. The non-significant correlations between entity and incremental theory to GPA, support the arguments by Sisk, et al. (2018), that this relationship is generally weak or non-existent, although it's important to note that this regards the ITIS as a measurement of mindset, and not necessarily the theoretical mindset construct.

The NGMM correlated as expected with both (2b) incremental theory, (2c) the Grit-S, (2d) GPA, and (2e) entity theory. It also correlated as expected with (2f) the IPS and correlated (2g) more strongly to all measurement than did the ITIS. This supports both

convergent and discriminant validity of the NGMM, and supports the idea for a potential improvement in the measurement of a person's mindset when an operationalized measure is used.

### 6-item Implicit Theories of Intelligence Scale

Both the one-factor model of the ITIS, suggested by Dweck, Chiu and Hong (1995a), and the two-factor structure suggested by other researchers (De Castella & Byrne, 2015; Dupeyrat & Mariné, 2005; Lüftenegger & Chen, 2017; Tempelaar et al., 2014), were tested. The CFA indicated a poor fit for the one-factor model.  $RMSEA = 0.186$ ,  $CFI = 0.86$ ,  $SRMR = 0.078$ , but a very good fit for the two-factor model  $RMSEA = 0.036$ ,  $CFI = 0.99$ ,  $SRMR = 0.023$ . The present data indicates clear support for a two factor model, and that (1a) the ITIS is a reliable measure when constructed this way. Item loadings can be seen in figure 3. All loadings were significant.

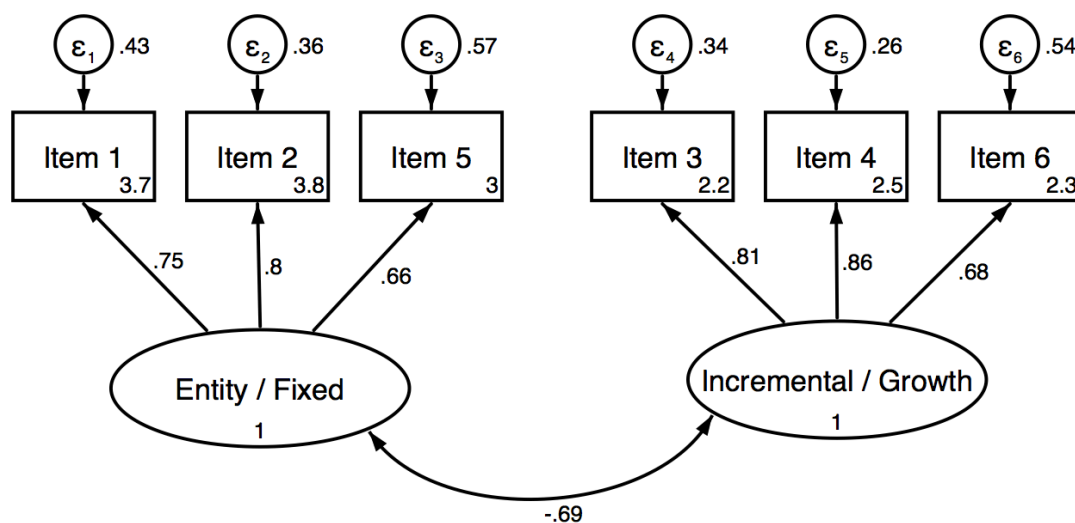


Figure 3. Confirmatory Factor Analysis of a two-factor structure of the ITIS, reported using standardized values.

### Norwegian Growth Mindset Measure

IRT assumes that the model reflects a single latent construct (Zanon et al., 2016). To assess the factor structure of the NGMM, an exploratory factor analysis was used, and since standard methods of performing factor analysis assume continuous variables, we used

polychoric correlations instead. This was done with the user written polychoric command in StataMP version 15.1, in accordance with directions provided by the UCLA Statistical Consulting Group (2017). The analysis ( $n = 532$ ) showed that the scale reflects a single latent construct, meeting the assumption for IRT.

Table 4

*Item Response Theory Coefficients*

Item	Discrimination	Difficulty
NGMM-1	1.99223**	-.6170505**
NGMM-2	1.148102**	-.9076604**
NGMM-3	.4837289**	-3.034812**
NGMM-4	1.835827**	-.4561695**

\*\*All Items were significant below 0.002.

To assess both item discrimination and difficulty parameters, we used a two-parametric (2PL) IRT test. Results are presented in Table 4. These results indicate that the four questions on the NGMM can reliably assess the latent construct, but item three discriminates less between the different levels of the construct, and has a higher difficulty.

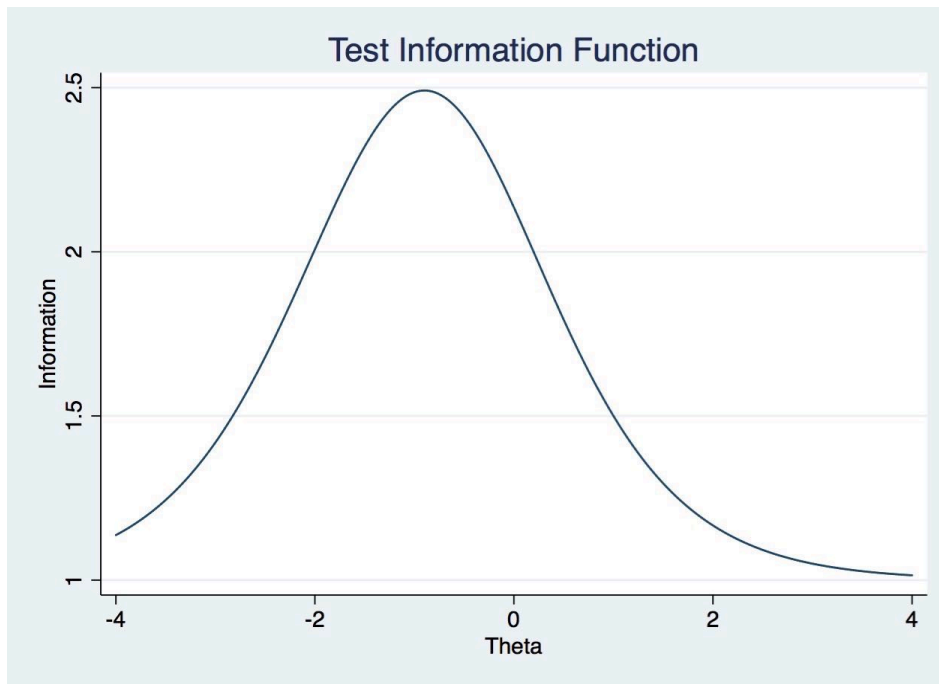


Figure 4. Test Information Function - Illustrates at what range, and how well the NGMM measures the latent construct.

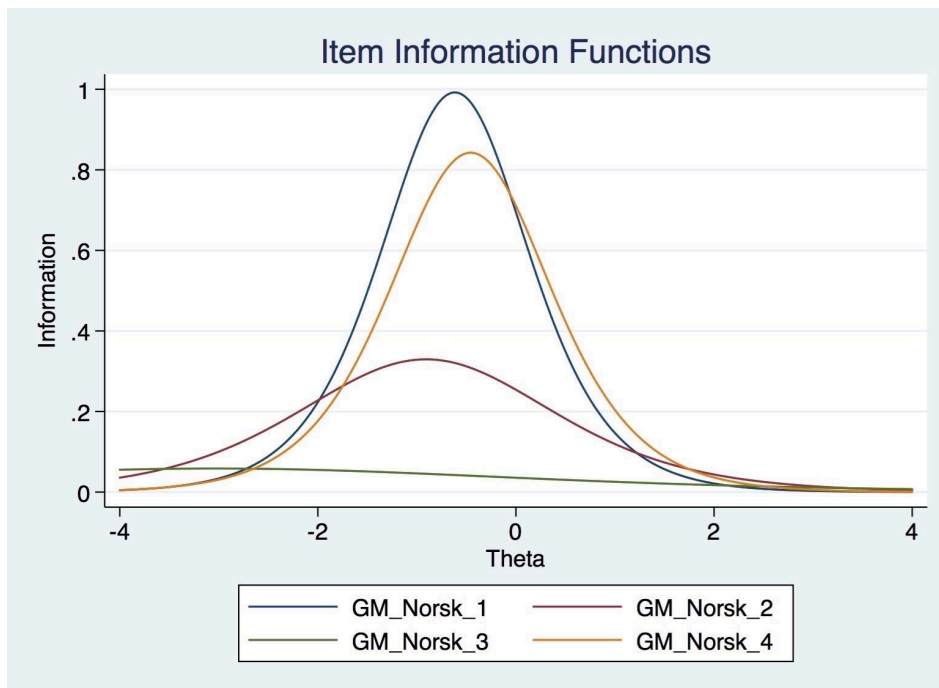


Figure 5. Item Information Function - Illustrates at what range, and how well each of the questions measures the latent construct.

The Test Information Function (figure 4), shows that questions on the NGMM assess the construct well, although somewhat better at lower levels. The Item Information Function (figure 5) reveals that item three has a higher difficulty, and mostly assess only lower levels

of the construct. Item means also helped reveal a difference in responses to item three ( $M = 0.198$ ) compared with item one ( $M = 0.320$ ), two ( $M = 0.304$ ) and four ( $M = 0.369$ ). Overall, this indicates that (2a) the NGMM is a reliable measure, although improvements can certainly be made, which will be addressed in the discussion.

### Discussion

The purpose of the current thesis was to assess the psychometric properties of the existing mindset measure, the ITIS, and a novel Norwegian measure, the NGMM. This study finds support for the reliability of both the ITIS and NGMM, even though some limitations are warranted. Support for the reliability of the ITIS was only found when it was treated as a two-part construct, with correlated factors, a distinction of great importance to psychometric validity (Furr, 2011). The reliability of the NGMM is also supported, although this conclusion is a somewhat less definite than for the ITIS, since there are less precise cutoff criteria for reliability with IRT than for CFA. Since item three (Når jeg lykkes med noe vanskelig: viser det at jeg har gjort en bra innsats - bekrefter det at jeg er flink), has a high difficulty and discriminates only the lower levels of the construct, improvements of the scale are recommended, which will be addressed below.

There was also found support for the convergent and discriminant validity of both measures, although the validity of the ITIS depends highly on what it is considered a measure of. Considering that validity is the degree to which a tool measures what it is actually intended to measure, validity relies on the definition of the mindset construct, making it a more complex matter (Furr, 2011). Examination of existing research and the mindset definition, shows that the *face validity* of the ITIS can only be supported if it is intended to measure a person's implicit theory of intelligence or intelligence mindset, and not if it is intended to measure a person's whole mindset. The ITIS did not significantly correlate with GPA, supporting arguments by Sisk et al., (2018), that the relationship between implicit



theory of intelligence and grades may be overestimated.

The current study also demonstrate that a persons *whole mindset*, measured by the NGMM, correlates more strongly to procrastination and grit, than when *intelligence mindset* is measured by the ITIS. Also, the NGMM correlates significantly with grades, in sum showing promise for the NGMM as a psychometrically defensible measure. Results should nonetheless be considered preliminary, and improvements to - and tests of the scale - are welcomed in future research. A factor to keep in mind is that the NGMM has only a small correlation to the entity and incremental elements of the ITIS, whilst a moderate correlation to the Grit-S. This implies that the NGMM measures a construct more related to grit, which could question it's validity as a mindset measure. On the contrary, a mastery-orientation is one of the behaviors that the growth mindset theory proposes, which is a response closely related to persistence, a hallmark of grit (Duckworth et al., 2007; Gardner, 2006). Some research has found that grittier people adhere to a growth mindset more often (Hogan, 2013), meaning that the two are most likely related.

The further discussion will be subdivided into three topics. First, some implications of these findings will be addressed. Second, to inform the understanding of the mindset construct and it's measures, and the potential causal role in academic achievement, I will provide a brief discussion of mindset interventions. Then thirdly, limitations and future research is addressed.

### **Implications**

Drawing on the examination of existing research in the introduction, and the empirical findings of the current study, three main implication were found to be of value.

**Factor structure of the Implicit Theories of Intelligence Scale.** First and foremost, early research has defined mindset as a single construct, while more recent evidence suggests that the construct, if measured by the ITIS, consists of two correlated factors. In practice, this

means that a person can hold both an entity and incremental theory at the same time.

Although they normally have an inverse relationship, these results imply that researchers should be cautious when interpreting findings from prior research that has either consolidated responses to the ITIS into a single score, or only used entity congruent questions. Even if it is unlikely that the consolidation of entity and incremental responses into a single score has major implications, the practice could mask findings of interest. For example, this thesis found that entity theory correlated positively with the IPS, while incremental theory did not correlate negatively with the IPS. The practice of only using questions congruent with an entity theory may be somewhat more problematic than the consolidation into a single construct. Since entity theory and incremental theory are not perfectly negatively correlated, high or low scores on the entity congruent items cannot be assumed to inform what a person's incremental theory is, and the dichotomization of entity theory scores could result in misleading findings such as inflated or deflated effect sizes (MacCallum, Zhang, Preacher, & Rucker, 2002).

**Future use of The Norwegian Growth Mindset Measure.** The second implication of this thesis, is that the NGMM has proven to be a potential first step in the direction of a new type of mindset measure. The primary benefit is that it could sidestep issues of domain specificity, and instead of asking about beliefs in the malleability of intelligence, the measure could potentially measure something closer to the actual latent mindset construct. It could also prove to be a more *ecologically valid* measure, since it is more contextualized.

One of the other upsides of the NGMM, is that it inherently uses a person's self-theory and not a general theory. A study by De Castella and Byrne (2015) asked 680 Australian high-school students to answer a self-theories version using the "my intelligence" formulation of the ITIS, which supported the idea that self-theories are more predictive than general theory measures. They found that students endorsed entity beliefs less when asked

about their self-theory than when asked about a general theory. Although the effect was small ( $d = .17$ ), it is comparatively large because of the very minor adjustment in wording on the scale. They also found that the self scale correlated significantly with performance-approach goals, something the general scale did not do, and in general, the self-scale predicted significantly more of the outcome variance in all variables.

Potential downsides of the NGMM is that it may lead to response biases, such as acquiescence, social desirability or random responding. Because it only measures a persons response with two options, it may force a response that is inconsistent with what participants would actually think or feel. It is also more difficult to detect random responding when there are only two response options, and the social desirability of one option becomes clearer with two possible responses side by side (Furr, 2011). Another potential downside is that since the NGMM is built on the four elements of the growth mindset theory, it risks becoming a redundant, compound measure, consisting of elements such as effort beliefs, attribution style, level of persistence and mastery-orientation. Nonetheless, the scale may prove to be valuable if future research demonstrates support for the underlying mindset construct, and that future psychological interventions can effectively change a persons mindset in a way that leads to significant positive outcomes.

**Definitional clarity and domain specificity.** The third main implication, regards domain specificity. Examination of existing research found that there is a tendency to define a mindset as a domain general belief regarding all human abilities. At the same time, most research has used domain specific scales such as the ITIS, albeit sometimes with variations, which only measure beliefs about the malleability of intelligence, or other specific domain attributes such as mathematical ability. Since the evidence reviewed in the introduction demonstrate that one domain specific theory does not strongly relate to other domain theories, the ITIS is used inconsistently with the construct it attempts to measure. At best, it

measures only an element of the total construct it is intended to measure. Hence, both from a *face validity* standpoint, and a *content validity* standpoint, the ITIS as a measure of a person's mindset is questionable. Although the current study does not address the question of causality, the lack of definitional clarity and resulting lack of validity of the ITIS, could be a contributing factor to the inconsistent findings in the meta-analysis by Sisk et al., (2018). For studies using the ITIS as a manipulation check, the term *intelligence mindset* or *implicit theory of intelligence*, would be more appropriate and precise than the more general term mindset. The non-significant correlation between the ITIS and GPA is also a red flag regarding the relationship between mindset and grades, especially since academic achievement has been one of the prime motivations for mindset interventions in the education sector. However, as argued in this thesis, the ITIS may not be a valid measurement of a person's whole mindset, which may limit the measures predictive capabilities.

Contrary to this argument about lack of definitional clarity and validity, one could, of course, make the argument that it has nothing to do with validity, but rather that there actually is no effect of mindset has on academic achievement. This argument is certainly well grounded, and is one that has been extensively argued by Sisk et al.(2018). The meta analytic effect size found of mindset on achievement, averaged no more than .10, suggesting that the effect is, at best, a small one. However it is still difficult to reconcile this conclusion with the positive effects some studies have found (Aronson et al., 2002; Blackwell et al., 2007; Burnette et al., 2013; Lazowski & Hulleman, 2016; Yeager et al., 2014), and the curious finding that “the effect was significant when the manipulation checks failed but null when manipulation checks succeeded” (Sisk et al., 2018). These findings lead to many questions, both related to how a mindset is defined, and what makes some mindset interventions work, while some don't.

### **Mindset interventions**

Interventions provide a valuable tool in understanding the causal relationships between factors, such as between a person's mindset and academic achievement. However, for interventions to be effective and lead to scientific clarity, they depend on clear definitions and understandings of the underlying psychological process they intend to influence (Walton, 2014; Yeager et al., 2016; Yeager & Walton, 2011). Since this thesis has found that the definitional clarity of the mindset construct is not always satisfactory, and that there is conflicting evidence about the effectiveness of mindset interventions, it is interesting to briefly see if mindset interventions adhere to a clear definition. Therefore, a brief discussion of mindset interventions is included here.

Mindset interventions range from game based interventions (Donohoe et al., 2012; O'Rourke, Haimovitz, Ballweber, Dweck, & Popović, 2014), to one time passage readings about well-known scientists (Lin-Siegler et al., 2016) to comprehensive, multi-week lectures about neuroplasticity and the brain (Dommett et al., 2013). The 2018 meta-analysis by Sisk et al., defined their inclusion criteria as "...intervention(s), where the primary goal was to increase students' belief that one or more human attributes (e.g., intelligence) can improve with effort". Moderator analysis in this meta-analysis found that neither intervention type, nor intervention length, was a significant moderator. The intervention mode however, was found to be significant, with the reading of "growth mindset materials" being the most effective ( $d = .20$ ) (Sisk et al., 2018). What we will see however, is that the following three example interventions (all included in the meta-analysis by Sisk et al., (2018)), are not *just* mindset interventions.

The first example is a study that attempted to bias high-school students to believing that science ability was not a matter of exceptional talent, but rather a matter of effort (Lin-Siegler et al., 2016). They used stories about how accomplished scientists such as Albert

Einstein and Marie Curie, had struggled intellectually with developing their scientific theories, and personally with poverty and oppression. A control group read a story about how the scientists had simply made great discoveries, without any descriptions of the hard work it took to achieve them. Results demonstrated that the control group had significantly lower science grades, weeks later, compared to both the intellectual and personal struggle story group ( $d = .16$ ). Improvement were most prominent in the low-performing students, something that has been reported in several studies (Claro et al., 2016; Sisk et al., 2018). Most surprising was the fact that the stories did not affect students' implicit theory of intelligence or effort at all. The scientists theorized that students' behavior was "more subject to change than students' beliefs" (Lin-Siegler et al., 2016).

The second example study, was one who taught a group of New York minority 7th graders that their brain was like a muscle, and that it would grow stronger with use (Blackwell et al., 2007). The 7th graders were also taught how to implement this mindset over eight distributed sessions that included lessons on the brain, that labels like smart or dumb should be avoided, and that stereotyping was harmful. This intervention used an active control group who also received eight distributed sessions, but instead was taught only study skills such as mnemonics and how memory works. Results showed that the control group had a marginally significant positive effect of the study skills, but their grades continued to decline, as it had during the past school year. The manipulation group however, improved significantly compared to their previous projection and compared to the control group. This study did find a significant change in implicit theory of intelligence beliefs, and the researchers concluded that;

This research confirms that adolescents who endorse more of an incremental theory of malleable intelligence also endorse stronger learning goals, hold more positive beliefs about effort, and make fewer ability-based, "helpless" attributions, with the result that they choose more positive, effort-based strategies in response to failure, boosting mathematics achievement over the junior high school transition (Blackwell et al., 2007)

The third example study, conducted by Donohoe, Topping & Hannah (2012), demonstrated that a short term, online, game based intervention did *not* significantly improve secondary school pupils mindsets or resilience in the long term. The study used a pedagogical game (Brainology), developed by Carol Dweck and Lisa Blackwell (Mindset Works Inc, 2008), where children learned how the brain works, and are taught that effort can make them more intelligent over the course of four sessions. The short term qualitative and quantitative analysis, showed that immediately after playing the game, there was a shift towards a growth mindset, with a large effect size of 1.20. However there was no effect at a three month follow up, and no significant difference was found in academic achievement at a one year follow up.

The reason for discussing these three studies, is to highlight an interesting finding, which is that out of these three interventions, only the last study, (Donohoe et al., 2012) exclusively targeted malleability beliefs about intelligence. The two other studies, that also demonstrated significant effects on academic achievement, can also be said to have targeted beliefs about effort and the natural role of struggle in the learning process. What is important to note from this is that these interventions are not *just* mindset interventions, they also touch on other subjects, such as for example, self-compassion. Neff, Hsieh and Dejitterat (2005) defined self-compassion as “being kind to oneself in instances of failure, perceiving one’s experiences as part of the larger human experience, and holding painful feelings in mindful awareness”. Narratives have already been found to be potent tools of persuasion (Hinyard & Kreuter, 2007), and stories such as those who highlight the struggles of Albert Einstein and Marie Curie, may just as well influence students’ self-compassion as their implicit theory of intelligence. Neff, Hsieh and Dejitterat (2005) has found that self-compassion is positively associated with mastery goals and negatively associated with performance goals among students, a relationship that is mediated by a lesser fear of failure. The second example study included lessons on the importance of avoiding negative stereotypes and labels such as dumb,

which are also central to self-compassion (Neff & McGehee, 2010). Higher self-compassion has been related to increased academic self-regulation, and more positive control beliefs about learning (Iskender, 2009; Martin & Kennett, 2017), and is also found to be especially relevant for people in difficult life situations (Cunha, Xavier, & Castilho, 2016), similar to that of mindset interventions (Claro et al., 2016; Sisk et al., 2018).

In summary, it is not intended to imply that all mindset interventions are really self-compassion interventions, but rather to highlight that interventions are inherently messy, and it is likely that mindset interventions could have inadvertently affected more psychological processes than *just* a person's mindset. Sisk et al., (2018) concluded in their study that "successful intervention may not be attributable to students' mind-sets after all". After reviewing some of the evidence in this thesis, this conclusion seem warranted, and the question remaining for future researchers is if a mindset should be defined as narrowly as the belief that intelligence is malleable, or if growth mindset should be defined as a more general *belief that human abilities can be developed, and that effort, failure and setbacks are a natural part of the learning process.*

### **Future research**

As for future research, a clear recommendation is for researchers to be mindful about the definition of a mindset they use, both when designing studies, and when designing systematic and precise psychological interventions in the future. The discovery made by Bråten and Olaussen (1998), where malleability beliefs about the 13 most commonly associated behaviors of an intelligent individual did not correlate with malleability beliefs about intelligence in general, shows a curious finding that may be expanded upon.

Researchers such as Sternberg, Conway, Ketron, & Bernstein (1981) have found that most people relate at least three separate factors to intelligence, namely problem solving, verbal and social ability. It would be interesting to design a study that measures malleability beliefs



about all three of these intelligence specific attributes, and find out if they correlate with a person's responses to the ITIS, and if outcomes such as academic achievement relate to one of these domain specific beliefs and not the others.

Future research could also use the whole mindset definition, and measure a person's mindset using an operationalized scale such as the NGMM. However, since item three discriminates mostly among the lower levels of the construct, it could be useful to instead of removing it, adding an item that discriminates more on the higher levels of the construct. I would like to suggest an additional question, based on my own experience and evidence from an interesting EEG study, that may discriminate more among the higher levels of the construct. The EEG study (Moser, Schroder, Heeter, Moran, & Lee, 2011) demonstrated that when participants made mistakes at a computer task, levels of brain activation were significantly different for the different levels of intelligence mindset, as assessed by the ITIS. Entity theorists had lower brain activation than incremental theorists in response to the mistakes, and subsequently did not improve performance as much as the incremental theorists. From my own experience working with students, I have observed that people who are more convinced that their shortcomings are merely temporary, tend to respond with less frustration and with more curiosity in face of difficult subjects and tests. The question I then would propose, could be phrased as; "When I do not understand or get something, it is A) mostly frustrating to me, or B) mostly interesting to me" (Når jeg ikke forstår, eller ikke får til noe, blir jeg: mest bare frustrert - aller mest nysgjerrig). This question is intended to gauge a person's interest and engagements in response to difficult subjects, which may be correlated with a person's mindset.

Future research may also benefit from developing a behavioral measures of a person's mindset, in addition to self-report measures, something that could be an important contribution to determine the validity of self-reports. As an example of a clever type of

behavioral measure, procrastination researchers sent out a self-report measure of procrastination, but also recorded when the survey was returned (Tice & Baumeister, 1997). They then correlated if the survey was returned long before, just before or after the deadline, with the self-report measures. There were moderate to large correlations between the self-report measures and the behavioral measure, supporting the measurements that were used.

### **Limitations**

One of the main limitations of the current thesis regards the selection process. Although the sample in this study comes from a variety of different Norwegian high-schools and universities, with students ranging from engineering, to health-sciences among others, most participants were recruited in relation to seminars about study skills. This could skew the mean levels of both mindset, procrastination, grit and GPA, although arguments could be made for a skew in either direction. On the one hand, participants could be attracted to a study skill seminar because they are getting poor grades, and want help with their strategy, while on the other hand, they could be attending because that's what good students do. Since this means that the current study did not include a random sample, the limitation should be considered when generalizing the findings from this study to other populations.

Another limitation relates to the demographics of the study participants. Previous research has demonstrated that effects of mindset on academic performance is stronger for lower performing students (Blackwell et al., 2007; Sisk et al., 2018; Yeager et al., 2016), and for lower socioeconomic groups (Claro et al., 2016; Sisk et al., 2018). Although socioeconomic status was not collected, education in Norway is free, and almost all students receive a government issued stipend that covers basic living costs, making it unlikely that any strong effect of poverty would be present in the dataset. Since average GPA for subjects in this study was also high, it could explain the non-significant correlations between the ITIS and GPA.

Another limitation of this study is the use of self-report grades, which could be considered less viable than school records, due to factors such as memory biases and social desirability effects. However, research has found surprisingly close relations between reported grades and actual grades. For example, Cassady (2001) investigated this disparity by asking 89 undergraduate students for both their Scholastic Assessment Test (SAT) and their Grade Point Average (GPA) for research purposes, and found that reported scores and actual scores were surprisingly similar. The GPA scores correlated with .97 and SAT scores with .88. Score accuracy was highest for the quartile of students with the highest grades, and lowest for the lowest grade quartile, suggesting that inflation of grades is more common among lower performing students. A 2005 meta-analysis (Kuncel, Crede, & Thomas, 2005) found that self-reported grades can be well correlated with actual grades, as long as moderators such as generally low grades are not persistent in the dataset. The researchers reported that high school GPA on average was somewhat less reliably reported ( $r = .82$ ) than college GPA ( $r = .90$ ). All in all, it is hard to know if the self-reported grades we have collected are accurate, but the above mentioned research supports the idea that they are, especially since the average reported grade is relatively high in this study's responses.

### **Conclusion**

In summary, this thesis has found support for the general psychometric reliability of both the Implicit Theories of Intelligence Scale (Dweck, 2000; Dweck & Henderson, 1988) and the Norwegian Growth Mindset Measure (Svartdal, 2016), in the Norwegian student population. There was some support for the convergent and discriminant validity of the ITIS, although both face and content validity was questioned, and the measure did not correlate significantly with grades. This mainly has to do with the definition of mindset, which in some studies has been defined as a belief in the malleability of intelligence (Dweck & Leggett, 1988), while it has been defined as the belief that human abilities are malleable in other

studies (Sisk et al., 2018). There was stronger support for the convergent and discriminant validity of the NGMM, which was found to be more strongly correlated with both procrastination and grit than the ITIS, while also being correlated with GPA. Important limitations of the study was the non-random sampling and a relatively high GPA and socioeconomic status. As for the questions that still remain unanswered about mindset interventions, this is a challenge left for future research.

## References

- Anderson, C. A. (1995). Implicit Theories in Broad Perspective. *Psychological Inquiry*, 6(4), 286-289. [https://doi.org/10.1207/s15327965pli0604\\_2](https://doi.org/10.1207/s15327965pli0604_2)
- Aronson, J., Fried, C. B., & Good, C. (2002). Reducing the Effects of Stereotype Threat on African American College Students by Shaping Theories of Intelligence. *Journal of Experimental Social Psychology*, 38(2), 113-125.  
<https://doi.org/10.1006/jesp.2001.1491>
- Bandura, M., & Dweck, C. S. (1985). *The relationship of conceptions of intelligence and achievement goals to achievement-related cognition, affect and behavior*.  
Unpublished Manuscript.
- Benson, J., & Dresdow, S. (2003). Discovery mindset: a decision-making model for discovery and collaboration. *Management Decision*, 41(10), 997-1005.  
<https://doi.org/10.1108/00251740310509526>
- Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: a longitudinal study and an intervention. *Child Development*, 78(1), 246-263.  
<https://doi.org/10.1111/j.1467-8624.2007.00995.x>
- Boaler, J. O. (2013). Ability and Mathematics: the mindset revolution that is reshaping education. *Forum*, 55(1). <https://doi.org/10.2304/forum.2013.55.1.143>
- Brooks, R., Brooks, S., & Goldstein, S. (2012). *The Power of Mindsets: Nurturing Engagement, Motivation, and Resilience in Students*. In: Christenson S., Reschly A., Wylie C. (eds) *Handbook of Research on Student Engagement*. Boston: Springer.
- Brown, T. A. (2015). *Confirmatory Factor Analysis For Applied Research* (2nd ed.). New York, NY: The Guilford Press.
- Bråten, I., & Olaussen, B. S. (1998). The relationship between motivational beliefs and

- learning strategy use among Norwegian college students. *Contemporary Educational Psychology*, 23(2), 182-194. <https://doi.org/10.1006/ceps.1997.0963>
- Bråten, I., & Strømsø, H. I. (2004). Epistemological beliefs and implicit theories of intelligence as predictors of achievement goals. *Contemporary Educational Psychology*, 29(4), 371-388. <https://doi.org/10.1016/j.cedpsych.2003.10.001>
- Bråten, I., & Strømsø, H. I. (2006). Predicting Achievement Goals in Two Different Academic Contexts: A longitudinal study. *Scandinavian Journal of Educational Research*, 50(2), 127-148. <https://doi.org/10.1080/00313830600575932>
- Burnette, J. L. (2010). Implicit theories of body weight: entity beliefs can weigh you down. *Pers Soc Psychol Bull*, 36(3), 410-422. <https://doi.org/10.1177/0146167209359768>
- Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mindsets matter: a meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin*, 139(3), 655-701. <https://doi.org/10.1037/a0029531>
- Busch, B. (2018). Research every teacher should know: growth mindset. Retrieved from <http://www.theguardian.com/teacher-network/2018/jan/04/research-every-teacher-should-know-growth-mindset>
- Byrne, B. M. (2001). Structural Equation Modeling With AMOS, EQS, and LISREL: Comparative Approaches to Testing for the Factorial Validity of a Measuring Instrument. *International Journal of Testing*, 1(1), 55-86. [https://doi.org/10.1207/S15327574IJT0101\\_4](https://doi.org/10.1207/S15327574IJT0101_4)
- Cabello, R., & Fernandez-Berrocal, P. (2015). Implicit theories and ability emotional intelligence. *Front Psychol*, 6, 700. <https://doi.org/10.3389/fpsyg.2015.00700>
- Cassady, J. C. (2001). Self-Reported GPA and SAT: A Methodological Note. *Practical Assessment, Research and Evaluation*, 7(12).
- Chen, J. A., & Pajares, F. (2010). Implicit theories of ability of Grade 6 science students:

Relation to epistemological beliefs and academic motivation and achievement in science. *Contemporary Educational Psychology*, 35(1), 75-87.

<https://doi.org/10.1016/j.cedpsych.2009.10.003>

Chiu, C., Hong, Y., & Dweck, C. S. (1997). Lay dispositionism and implicit theories of personality. *Journal of personality and social psychology*, 73(1), 19-30.

<https://doi.org/10.1037/0022-3514.73.1.19>

Claro, S., Paunesku, D., & Dweck, C. S. (2016). Growth mindset tempers the effects of poverty on academic achievement. *Proc Natl Acad Sci U S A*, 113(31), 8664-8668.

<https://doi.org/10.1073/pnas.1608207113>

Crede, M., Tynan, M. C., & Harms, P. D. (2017). Much ado about grit: A meta-analytic synthesis of the grit literature. *Journal of personality and social psychology*, 113(3), 492-511. <https://doi.org/10.1037/pspp0000102>

Cunha, M., Xavier, A., & Castilho, P. (2016). Understanding self-compassion in adolescents: Validation study of the Self-Compassion Scale. *Personality and Individual Differences*, 93, 56-62. <http://dx.doi.org/10.1016/j.paid.2015.09.023>

Cury, F., Elliot, A. J., Da Fonseca, D., & Moller, A. C. (2006). The social-cognitive model of achievement motivation and the 2 x 2 achievement goal framework. *Journal of personality and social psychology*, 90(4), 666-679. <https://doi.org/10.1037/0022-3514.90.4.666>

De Castella, K., & Byrne, D. (2015). My intelligence may be more malleable than yours: the revised implicit theories of intelligence (self-theory) scale is a better predictor of achievement, motivation, and student disengagement. *European Journal of Psychology of Education*, 30(3), 245-267. <https://doi.org/10.1007/s10212-015-0244-y>

Diener, C. I., & Dweck, C. S. (1978). An analysis of learned helplessness: Continuous changes in performance, strategy, and achievement cognitions following failure.

*Journal of personality and social psychology*, 36(5), 451-462.

<https://doi.org/10.1037/0022-3514.36.5.451>

Dommett, E. J., Devonshire, I. M., Sewter, E., & Greenfield, S. A. (2013). The impact of participation in a neuroscience course on motivational measures and academic performance. *Trends in Neuroscience and Education*, 2(3), 122-138.

<https://doi.org/10.1016/j.tine.2013.05.002>

Donohoe, C., Topping, K., & Hannah, E. (2012). The impact of an online intervention (Brainology) on the mindset and resiliency of secondary school pupils: a preliminary mixed methods study. *Educational Psychology*, 32(5), 641-655.

<https://doi.org/10.1080/01443410.2012.675646>

Drews, R., Chiviacowsky, S., & Wulf, G. (2013). Children's Motor Skill Learning Is Influenced by Their Conceptions of Ability. *Journal of Motor Learning and Development*, 1(2), 38-44. <https://doi.org/10.1123/jmld.1.2.38>

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of Personality Social Psychology*, 92(6), 1087-1101. <https://doi.org/10.1037/0022-3514.92.6.1087>

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the short grit scale (grit-s). *Journal of Personality Assessment*, 91(2), 166-174.

<https://doi.org/10.1080/00223890802634290>

Dunn, T. J., Baguley, T., & Brunsten, V. (2014). From alpha to omega: a practical solution to the pervasive problem of internal consistency estimation. *Br J Psychol*, 105(3), 399-412. <https://doi.org/10.1111/bjop.12046>

Dupeyrat, C., & Mariné, C. (2005). Implicit theories of intelligence, goal orientation, cognitive engagement, and achievement: A test of Dweck's model with returning to school adults. *Contemporary Educational Psychology*, 30(1), 43-59.



<https://doi.org/10.1016/j.cedpsych.2004.01.007>

Dweck, C. S. (2000). *Self-theories: Their Role in Motivation, Personality, and Development*.

New York: Psychology Press.

Dweck, C. S. (2007). *Mindset The New Psychology of Success*: Ballantine Books.

Dweck, C. S. (2014). Transcript of "The power of believing that you can improve". TED:

TEDxNorrkoping.

Dweck, C. S., Chiu, C., & Hong, Y. (1995a). Implicit Theories and Their Role in Judgments and Reactions: A Word From Two Perspectives. *Psychological Inquiry*, 6(4), 267-

285. [https://doi.org/10.1207/s15327965pli0604\\_1](https://doi.org/10.1207/s15327965pli0604_1)

Dweck, C. S., Chiu, C., & Hong, Y. (1995b). Implicit Theories: Elaboration and Extension of the Model. *Psychological Inquiry*, 6(4), 322-333.

[https://doi.org/10.1207/s15327965pli0604\\_12](https://doi.org/10.1207/s15327965pli0604_12)

Dweck, C. S., & Henderson, V. L. (1988). *Theories of Intelligence: Background and Measures*. Unpublished manuscript.

Dweck, C. S., & Leggett, E. L. (1988). A social cognitive approach to motivation and personality. *Psychological Review*, 95(2), 256-273. [https://doi.org/10.1037/0033-](https://doi.org/10.1037/0033-295X.95.2.256)

[295X.95.2.256](https://doi.org/10.1037/0033-295X.95.2.256)

Dweck, C. S., & Reppucci, N. D. (1973). Learned Helplessness and Reinforcement Responsibility in Children. *Journal of personality and social psychology*, 25(1), 109-

116. <https://doi.org/10.1037/h0034248>

Dweck, C. S., Tenney, Y., & Dinces, N. (1982). *Implicit theories of intelligence as determinants of achievement goal choice*. Unpublished Raw Data.

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, 34(3), 169-189. [https://doi.org/10.1207/s15326985sep3403\\_3](https://doi.org/10.1207/s15326985sep3403_3)

Elliot, A. J., Dweck, C. S., & Yeager, D. S. (2017). *Handbook of Competence and*

*Motivation, Second Edition: Theory and Application*: Guilford Publications.

Elliott, E. S., & Dweck, C. S. (1988). Goals: an approach to motivation and achievement.

*Journal of personality and social psychology*, 54(1), 5-12.

<https://doi.org/10.1037//0022-3514.54.1.5>

Eskreis-Winkler, L., Shulman, E. P., Young, V., Tsukayama, E., Brunwasser, S. M., &

Duckworth, A. L. (2016). Using Wise Interventions to Motivate Deliberate Practice.

*Journal of personality and social psychology*, 111(5), 728-744.

<https://doi.org/10.1037/pspp0000074>

Fraley, R. C., Waller, N. G., & Brennan, K. A. (2000). An item response theory analysis of

self-report measures of adult attachment. *Journal of personality and social*

*psychology*, 78(2), 350-365. <https://doi.org/10.1037/0022-3514.78.2.350>

French, R. P. (2016). The fuzziness of mindsets. *International Journal of Organizational*

*Analysis*, 24(4), 673-691. <https://doi.org/10.1108/ijoa-09-2014-0797>

Furnham, A. (1988). *Lay theories: everyday understanding of problems in the social*

*sciences*: Pergamon Press.

Furr, R. M. (2011). *Scale Construction and Psychometrics for Social and Personality*

*Psychology*.

Gardner, E. A. (2006). Instruction in mastery goal orientation: Developing problem solving

and persistence for clinical settings. *Journal of Nursing Education*, 45(9), 343-347.

Golby, J., & Wood, P. (2016). The Effects of Psychological Skills Training on Mental

Toughness and Psychological Well-Being of Student-Athletes. *Psychology*, 07(06),

901-913. <https://doi.org/10.4236/psych.2016.76092>

Goldstein, S., & Brooks, R. B. (2013). *Handbook of Resilience in Children*.

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem,

and stereotypes. *Psychological Review*, 102(1), 4-27. <https://doi.org/10.1037/0033->

[295x.102.1.4](#)

- Gupta, A. K., & Govindarajan, V. (2002). Cultivating a global mindset. *Academy of Management Executive*, 16(1), 116-126. <https://doi.org/10.5465/Ame.2002.6640211>
- Harvard Business Review Staff. (2017). How Companies Can Profit from a "Growth Mindset". Retrieved from <https://hbr.org/2014/11/how-companies-can-profit-from-a-growth-mindset>
- Heider, F. (1958). *The Psychology of Interpersonal Relations*. New York: : John Wiley & Sons.
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, 33(2-3), 61-83; discussion 83-135. <https://doi.org/10.1017/S0140525X0999152X>
- Hinyard, L. J., & Kreuter, M. W. (2007). Using narrative communication as a tool for health behavior change: a conceptual, theoretical, and empirical overview. *Health Educ Behav*, 34(5), 777-792. <https://doi.org/10.1177/1090198106291963>
- Hogan, M. L. (2013). *Non-cognitive traits that impact female success in biglaw*. University of Pennsylvania.
- Hong, Y., Chiu, C., Dweck, C. S., Lin, D. M. S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of personality and social psychology*, 77(3), 588-599. <https://doi.org/10.1037/0022-3514.77.3.588>
- Howell, A. J. (2016). Implicit theories of personal and social attributes: Fundamental mindsets for a science of wellbeing. *International Journal of Wellbeing*, 6(3), 113-130. <https://doi.org/10.5502/ijw.v6i3.529>
- Iskender, M. (2009). The Relationship Between Self-Compassion, Self-Efficacy, and Control Belief about Learning in Turkish University Students. *Social Behavior and Personality: an international journal*, 37(5), 711-720.

<https://doi.org/10.2224/sbp.2009.37.5.711>

John, O. P., Benet-Martínez, V., Reis, H. T., & Judd, C. M. (2013). Measurement *Handbook of Research Methods in Social and Personality Psychology* (pp. 473-503).

Jones, E. E., & Davis, K. E. (1965). From Acts To Dispositions The Attribution Process In Person Perception. *Advances in Experimental Social Psychology*, 2(4), 219-266.

[https://doi.org/10.1016/S0065-2601\(08\)60107-0](https://doi.org/10.1016/S0065-2601(08)60107-0)

Kamins, M. L., & Dweck, C. S. (1999). Person versus process praise and criticism: implications for contingent self-worth and coping. *Developmental Psychology*, 35(3), 835-847. <https://doi.org/10.1037/0012-1649.35.3.835>

Kelley, H. H. (1967). Attribution theory in social psychology. *Nebraska Symposium on Motivation*, 15, 192-238.

Kline, R. B. (2015). *Principles and Practice of Structural Equation Modeling, Fourth Edition*: Guilford Publications.

Komarraju, M., & Nadler, D. (2013). Self-efficacy and academic achievement: Why do implicit beliefs, goals, and effort regulation matter? *Learning and Individual Differences*, 25, 67-72. <https://doi.org/10.1016/j.lindif.2013.01.005>

Kuncel, N. R., Crede, M., & Thomas, L. L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research*, 75(1), 63-82.

<https://doi.org/10.3102/00346543075001063>

Larsen, K. R., & Bong, C. H. (2016). A Tool for Addressing Construct Identity in Literature Reviews and Meta-Analyses. *MIS Quarterly*, 40(3), 529-551.

<https://doi.org/10.25300/MISQ/2016/40.3.01>

Lazowski, R. A., & Hulleman, C. S. (2016). Motivation Interventions in Education. *Review of Educational Research*, 86(2), 602-640. <https://doi.org/10.3102/0034654315617832>

- Leggett, E. L. (1985, March) *Children's entity and incremental theories of intelligence: Relationships to achievement behavior*. Annual meeting of the Eastern Psychological Association, Boston.
- Leggett, E. L., & Dweck, C. S. (1986). *Individual differences in goals and inference rules: Sources of causal judgments*. Unpublished manuscript.
- Levy, S. R., Chiu, C., & Hong, Y. (2006). Lay Theories and Intergroup Relations. *Group Processes & Intergroup Relations*, 9(1), 5-24.  
<https://doi.org/10.1177/1368430206059855>
- Lin-Siegler, X., Ahn, J. N., Chen, J., Fang, F. F. A., & Luna-Lucero, M. (2016). Even Einstein Struggled: Effects of Learning About Great Scientists' Struggles on High School Students' Motivation to Learn Science. *Journal of Educational Psychology*, 108(3), 314-328. <https://doi.org/10.1037/edu0000092>
- Lüftenegger, M., & Chen, J. A. (2017). Conceptual Issues and Assessment of Implicit Theories. *Zeitschrift für Psychologie*, 225(2), 99-106. <https://doi.org/10.1027/2151-2604/a000286>
- MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods*, 7(1), 19-40.
- Mangels, J. A., Butterfield, B., Lamb, J., Good, C., & Dweck, C. S. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, 1(2), 75-86.  
<https://doi.org/10.1093/scan/nsl013>
- Mangels, J. A., Rodriguez, S., Ochakovskaya, Y., & Guerra-Carrillo, B. (2017). Achievement Goal Task Framing and Fit With Personal Goals Modulate the Neurocognitive Response to Corrective Feedback. *AERA Open*, 3(3).  
<https://doi.org/10.1177/2332858417720875>

- Martin, R. D., & Kennett, D. J. (2017). To be kind or not to be kind: The moderating role of self-compassion in the relationship between general resourcefulness and academic self-regulation. *J Soc Psychol*, 1-13. <https://doi.org/10.1080/00224545.2017.1407286>
- Mather, M., Cacioppo, J. T., & Kanwisher, N. (2013). How fMRI Can Inform Cognitive Theories. *Perspectives on Psychological Science*, 8(1), 108-113. <https://doi.org/10.1177%2F1745691612469037>
- McConnell, A. R. (2001). Implicit theories: Consequences for social judgments of individuals. *Journal of Experimental Social Psychology*, 37(3), 215-227. <https://doi.org/10.1006/jesp.2000.1445>
- Mindset Works Inc. (2008). Brainology: Brainology. Retrieved from <https://www.mindsetworks.com/>
- Moser, J. S., Schroder, H. S., Heeter, C., Moran, T. P., & Lee, Y. H. (2011). Mind your errors: evidence for a neural mechanism linking growth mind-set to adaptive posterror adjustments. *Psychol Sci*, 22(12), 1484-1489. <https://doi.org/10.1177/0956797611419520>
- Neff, K. D., Hsieh, Y., & Dejitterat, K. (2005). Self-compassion, Achievement Goals, and Coping with Academic Failure. *Self and Identity*, 4(3), 263-287. <https://doi.org/10.1080/13576500444000317>
- Neff, K. D., & McGehee, P. (2010). Self-compassion and Psychological Resilience Among Adolescents and Young Adults. *Self and Identity*, 9(3), 225-240. <http://dx.doi.org/10.1080/15298860902979307>
- Niiya, Y., Crocker, J., & Bartmess, E. N. (2004). From vulnerability to resilience - Learning orientations buffer contingent self-esteem from failure. *Psychological Science*, 15(12), 801-805. <https://doi.org/10.1111/j.0956-7976.2004.00759.x>
- Nisbett, R. E., & Ross, L. (1980). *Human inference: strategies and shortcomings of social*

*judgment*: Prentice-Hall.

- O'Rourke, E., Haimovitz, K., Ballweber, C., Dweck, C. S., & Popović, Z. (2014). *Brain points: A growth mindset incentive structure boosts persistence in an educational game*. Paper presented at the Conference on Human Factors in Computing Systems, Toronto, ON, Canada.
- Ommundsen, Y., Haugen, R., & Lund, T. (2005). Academic Self-concept, Implicit Theories of Ability, and Self-regulation Strategies. *Scandinavian Journal of Educational Research*, 49(5), 461-474. <https://doi.org/10.1080/00313830500267838>
- Park, S., Callahan, C. M., & Ryoo, J. H. (2016). Assessing Gifted Students' Beliefs About Intelligence With a Psychometrically Defensible Scale. *Journal for the Education of the Gifted*, 39(4), 288-314. <https://doi.org/10.1177/0162353216671835>
- Parrish, S. (2015). The Two Mindsets and the Power of Believing That You Can Improve. 31.03.2015. Retrieved from <http://time.com/3765563/carol-dweck-two-mindsets/>
- Peterson, C., & Seligman, M. E. P. (1984). Causal Explanations as a Risk Factor for Depression - Theory and Evidence. *Psychological Review*, 91(3), 347-374. <https://doi.org/10.1037/0033-295x.91.3.347>
- Plaks, J. E. (2017). Implicit Theories: Assumptions That Shape Social and Moral Cognition (Vol. 56, pp. 259-310).
- Plaks, J. E., & Halvorson, H. G. (2013). Does Accountability Attenuate or Amplify Stereotyping? The Role of Implicit Theories. *Social Cognition*, 31(5), 543-561. <https://doi.org/10.1521/soco.2013.31.5.543>
- Plaks, J. E., Levy, S. R., & Dweck, C. S. (2009). Lay Theories of Personality: Cornerstones of Meaning in Social Cognition. *Social and Personality Psychology Compass*, 3(6), 1069-1081. <https://doi.org/10.1111/j.1751-9004.2009.00222.x>
- Rheinschmidt, M. L., & Mendoza-Denton, R. (2014). Social class and academic achievement

- in college: the interplay of rejection sensitivity and entity beliefs. *J Pers Soc Psychol*, 107(1), 101-121. <https://doi.org/10.1037/a0036553>
- Rickert, N. P., Meras, I. L., & Witkow, M. R. (2014). Theories of intelligence and students' daily self-handicapping behaviors. *Learning and Individual Differences*, 36, 1-8. <https://doi.org/10.1016/j.lindif.2014.08.002>
- Robins, R. W., & Pals, J. L. (2002). Implicit Self-Theories in the Academic Domain: Implications for Goal Orientation, Attributions, Affect, and Self-Esteem Change. *Self and Identity*, 1(4), 313-336. <https://doi.org/10.1080/15298860290106805>
- Rustin, S. (2016). New test for 'growth mindset', the theory that anyone who tries can succeed. Retrieved from <http://www.theguardian.com/education/2016/may/10/growth-mindset-research-uk-schools-sats>
- Schroder, H. S., Dawood, S., Yalch, M. M., Donnellan, M. B., & Moser, J. S. (2014). The Role of Implicit Theories in Mental Health Symptoms, Emotion Regulation, and Hypothetical Treatment Choices in College Students. *Cognitive Therapy and Research*, 39(2), 120-139. <https://doi.org/10.1007/s10608-014-9652-6>
- Sending, V. (2014). *Thinking Success, Behaving Successfully: The Relation between Hypothetical Thinking Strategies, Effort towards Goal Attainment and Grit*. (Masters Masters), University of Tromsø, The Arctic University, Tromsø.
- Sisk, V. F., Burgoyne, A. P., Sun, J., Butler, J. L., & Macnamara, B. N. (2018). To What Extent and Under Which Circumstances Are Growth Mind-Sets Important to Academic Achievement? Two Meta-Analyses. *Psychol Sci*, 29(4), 549-571. <https://doi.org/10.1177/0956797617739704>
- Spinath, B., Spinath, F. M., Riemann, R., & Angleitner, A. (2003). Implicit theories about personality and intelligence and their relationship to actual personality and



intelligence. *Personality and Individual Differences*, 35(4), 939-951.

[https://doi.org/10.1016/s0191-8869\(02\)00310-0](https://doi.org/10.1016/s0191-8869(02)00310-0)

Stanford University. (2017, 2017-09-19). Stanford psychologist recognized with \$4 million prize | Stanford News. Retrieved from

<https://news.stanford.edu/2017/09/19/stanford-psychologist-recognized-4-million-prize/>

Steel, P. (2010a). Arousal, avoidant and decisional procrastinators: Do they exist?

*Personality and Individual Differences*, 48(8), 926-934.

<https://doi.org/10.1016/j.paid.2010.02.025>

Steel, P. (2010b). *The procrastination equation: How to stop putting things off and start getting stuff done*.

Steel, P., & David, G. (2002). *The measurement and nature of procrastination*. (63), ProQuest Information & Learning, US.

Sternberg, R. J., Conway, B. E., Ketron, J. L., & Bernstein, M. (1981). People's conceptions of intelligence. *Journal of personality and social psychology*, 41(1), 37-55.

<https://doi.org/10.1037/0022-3514.41.1.37>

Stevens, J. P. (2012). *Applied multivariate statistics for the social sciences*: Routledge.

Stipek, D., & Gralinski, J. H. (1996). Children's beliefs about intelligence and school performance. *Journal of Educational Psychology*, 88(3), 397-407.

<https://doi.org/10.1037/0022-0663.88.3.397>

Story, J. S. (2010). Testing the impact of global mindset on positive outcomes: A multi-level analysis. *Dissertation Abstracts International Section A: Humanities and Social Sciences*, 71(4-A), 1376.

Svardal, F. (2015). Measuring procrastination: Psychometric properties of the Norwegian versions of the Irrational Procrastination Scale (IPS) and the Pure Procrastination

Scale (PPS). *Scandinavian Journal of Educational Research*, 61(1), 18-30.

<https://doi.org/10.1080/00313831.2015.1066439>

Svartdal, F. (2016). Norwegian Growth Mindset Measure.

Svartdal, F., & Steel, P. (2017). Irrational Delay Revisited: Examining Five Procrastination Scales in a Global Sample. *Frontiers in Psychology*, 8, 1927.

<https://doi.org/10.3389/fpsyg.2017.01927>

Tempelaar, D. T., Rienties, B., Giesbers, B., & Gijsselaers, W. H. (2014). The Pivotal Role of Effort Beliefs in Mediating Implicit Theories of Intelligence and Achievement Goals and Academic Motivations. *Social Psychology of Education*, 18(1), 101-120.

<https://doi.org/10.1007/s11218-014-9281-7>

Tice, D. M., & Baumeister, R. F. (1997). Longitudinal Study of Procrastination, Performance, Stress, and Health: The Costs and Benefits of Dawdling. *Psychological Science*, 8(6), 454-458. <https://doi.org/10.1111/j.1467-9280.1997.tb00460.x>

Torelli, C. J., & Kaikati, A. M. (2009). Values as predictors of judgments and behaviors: The role of abstract and concrete mindsets. *Journal of personality and social psychology*, 96(1), 231-247. <https://doi.org/10.1037/a0013836>

UCLA Statistical Consulting Group. (2017). How can I perform a factor analysis with categorical (or categorical and continuous) variables? Retrieved from

<https://stats.idre.ucla.edu/stata/faq/how-can-i-perform-a-factor-analysis-with-categorical-or-categorical-and-continuous-variables/>

Vella, S. A., Braithewaite, R. E., Gardner, L. A., & Spray, C. M. (2016). A systematic review and meta-analysis of implicit theory research in sport, physical activity, and physical education. *International Review of Sport and Exercise Psychology*, 9(1), 191-214.

<https://doi.org/10.1080/1750984X.2016.1160418>

Walton, G. M. (2014). The New Science of Wise Psychological Interventions. *Current*

*Directions in Psychological Science*, 23(1), 73-82.

<https://doi.org/10.1177/0963721413512856>

Weiner, B. (1985). An attributional theory of achievement motivation and emotion.

*Psychological Review*, 92(4), 548-573. <https://doi.org/10.1037/0033-295X.92.4.548>

Yeager, D. S., Johnson, R., Spitzer, B. J., Trzesniewski, K. H., Powers, J., & Dweck, C. S.

(2014). The far-reaching effects of believing people can change: implicit theories of personality shape stress, health, and achievement during adolescence. *Journal of personality and social psychology*, 106(6), 867-884. <https://doi.org/10.1037/a0036335>

Yeager, D. S., Romero, C., Paunesku, D., Hulleman, C. S., Schneider, B., Hinojosa, C., . . .

Dweck, C. S. (2016). Using Design Thinking to Improve Psychological Interventions: The Case of the Growth Mindset During the Transition to High School. *Journal of Educational Psychology*, 108(3), 374-391. <https://doi.org/10.1037/edu0000098>

Yeager, D. S., & Walton, G. M. (2011). Social-Psychological Interventions in Education.

*Review of Educational Research*, 81(2), 267-301.

<https://doi.org/10.3102/0034654311405999>

Zanon, C., Hutz, C. S., Yoo, H., & Hambleton, R. K. (2016). An application of item response theory to psychological test development. *Psicologia: Reflexão e Crítica*, 29(1).

<https://doi.org/10.1186/s41155-016-0040-x>

For å tilpasse videre kurs ville det vært supert om du svarte på disse raske spørsmålene. Anonyme data fra dette vil bli brukt til forskning.

Hvis du aksepterer det, og er over 16 år, er det bare å fortsette. Du kan når som helst avslutte, eller la være å svare. Det er kun 28 kjappe spørsmål, så dette går ganske fort...

**Start...**

Trykk **ENTER**

---

**1** Kjønn:

- Mann  Kvinne
- 

**2** Hva beskriver deg best:

- Annet  Forelder til elev eller student  Ungdomsskoleelev  VGS-elev  Student
- 

**3** Har du allerede sett gjennom et nettkurs eller deltatt på et kurs i Moderne Studieteknikk?

- Ja  Nei
- 

På denne skalaen, omtrent hvor ligger det du tror mest på?



Intelligens og talent er noe man er født med, og man kan ikke gjøre så mye med det.

Intelligens og talent handler bare om øvelse og hardt arbeid. Man kan bli smartere og flinkere til hva som helst.

---

Her kommer seks utsagn på engelsk som du skal vurdere om du er enig eller uenig i. Svar så godt du kan. Det er ingen rette eller gale svar, vi er bare interessert i hva du mener.

Du kan la være å svare på spørsmålene på engelsk om du ikke forstår de.

---

**5** You have a certain amount of intelligence, and you can't really do much to change it.

- 1 - Strongly Agree  
 2 - Agree  
 3 - Mostly agree  
 4 - Mostly disagree  
 5 - Disagree  
 6 - Strongly disagree
- 

**6** Your intelligence is something about you that you can't change very much.

- 1 - Strongly Agree  
 2 - Agree  
 3 - Mostly agree  
 4 - Mostly disagree  
 5 - Disagree

6 - Strongly disagree

---

**7** No matter who you are, you can significantly change your intelligence level.

1 - Strongly Agree

2 - Agree

3 - Mostly agree

4 - Mostly disagree

5 - Disagree

6 - Strongly disagree

---

**8** You can always substantially change how intelligent you are.

1 - Strongly Agree

2 - Agree

3 - Mostly agree

4 - Mostly disagree

5 - Disagree

6 - Strongly disagree

---

**9** You can learn new things, but you can't really change your basic intelligence.

1 - Strongly Agree

2 - Agree

3 - Mostly agree

4 - Mostly disagree

5 - Disagree

6 - Strongly disagree

---

**10** No matter how much intelligence you have, you can always change it quite a bit.

1 - Strongly Agree

2 - Agree

3 - Mostly agree

4 - Mostly disagree

5 - Disagree

6 - Strongly disagree

---

På de neste fire spørsmålene skal du skal du velge mellom to forskjellige avslutninger.

---

**11** Når jeg mislykkes med noe faglig....

- viser det at jeg prøvde på noe som var for vanskelig for meg.  ser jeg det som en mulighet til å lære mer.
- 

**12** Tilbakemelding og kritikk fra andre (som lærere, foreldre og trenere)...

- gjør meg mindre motivert og gjør at jeg føler meg dårlig.  motiverer meg til å bli bedre.
- 

**13** Når jeg lykkes med noe vanskelig....

- bekrefter det at jeg er flink.  viser det at jeg har gjort en bra innsats.
- 

**14** Hvis det er noe jeg ikke er særlig flink til...

- gir jeg meg ikke før jeg har klart det...  gir jeg raskt opp.
- 

Supert. Du er halvveis! Nå kommer det noen enkle spørsmål hvor du skal vurdere om det er "typisk deg" eller "ikke deg i det hele tatt"

---

**15** Noen ganger distraherer nye ideer og prosjekter meg fra tidligere prosjekter.

- Veldig typisk meg  
 Ganske typisk meg  
 Litt typisk meg  
 Ikke typisk meg  
 Ikke meg i det hele tatt
- 

**16** Jeg mister ikke motet ved tilbakeslag/motgang.

- Veldig typisk meg  
 Ganske typisk meg  
 Litt typisk meg  
 Ikke typisk meg  
 Ikke meg i det hele tatt
- 

**17** Jeg har vært besatt av en bestemt ide eller prosjekt i en kort periode, men har senere mistet interessen.

- Veldig typisk meg
  - Ganske typisk meg
  - Litt typisk meg
  - Ikke typisk meg
  - Ikke meg i det hele tatt
- 

**18** Jeg er arbeidsom.

- Veldig typisk meg
  - Ganske typisk meg
  - Litt typisk meg
  - Ikke typisk meg
  - Ikke meg i det hele tatt
- 

**19** Jeg setter meg ofte et mål, men bestemmer meg så for et annet isteden.

- Veldig typisk meg
  - Ganske typisk meg
  - Litt typisk meg
  - Ikke typisk meg
  - Ikke meg i det hele tatt
- 

**20** Jeg har vansker med å beholde fokus på prosjekter som tar mer enn et par måneder å fullføre.

- Veldig typisk meg
  - Ganske typisk meg
  - Litt typisk meg
  - Ikke typisk meg
  - Ikke meg i det hele tatt
- 

**21** Jeg fullfører alt jeg påbegynner.

- Veldig typisk meg
  - Ganske typisk meg
  - Litt typisk meg
  - Ikke typisk meg
  - Ikke meg i det hele tatt
- 

**22** Jeg er flittig.



- Veldig typisk meg
  - Ganske typisk meg
  - Litt typisk meg
  - Ikke typisk meg
  - Ikke meg i det hele tatt
- 

I de neste kjappe spørsmålene skal du svare hvor godt du opplever setningen passer for deg.

---

**23** Jeg utsetter ting så lenge at det skaper unødige problemer for meg.

- Stemmer veldig sjelden eller ikke i det hele tatt
  - Stemmer sjelden
  - Stemmer noen ganger
  - Stemmer ofte
  - Stemmer veldig ofte eller hele tiden.
- 

**24** Livet mitt ville vært bedre om jeg hadde gjort ting tidligere.

- Stemmer veldig sjelden eller ikke i det hele tatt
  - Stemmer sjelden
  - Stemmer noen ganger
  - Stemmer ofte
  - Stemmer veldig ofte eller hele tiden.
- 

**25** Når jeg burde gjøre noe, gjør jeg gjerne noe annet i stedet

- Stemmer veldig sjelden eller ikke i det hele tatt
  - Stemmer sjelden
  - Stemmer noen ganger
  - Stemmer ofte
  - Stemmer veldig ofte eller hele tiden.
- 

**26** Når jeg ser tilbake på dagen, vet jeg at jeg kunne utnyttet tiden bedre

- Stemmer veldig sjelden eller ikke i det hele tatt
- Stemmer sjelden
- Stemmer noen ganger
- Stemmer ofte
- Stemmer veldig ofte eller hele tiden.

---

**27** Jeg venter med å gjøre ting mer enn hva som er fornuftig.

- Stemmer veldig sjelden eller ikke i det hele tatt
- Stemmer sjelden
- Stemmer noen ganger
- Stemmer ofte
- Stemmer veldig ofte eller hele tiden.

---

**28** Jeg utsetter ting

- Stemmer veldig sjelden eller ikke i det hele tatt
- Stemmer sjelden
- Stemmer noen ganger
- Stemmer ofte
- Stemmer veldig ofte eller hele tiden.

---

Omtrent hva slags snittkarakter har du?

PS: Du trenger ikke å svare...

1

2

3

4

5

6

F

A

---

**Send inn**

## Appendix B

### Norwegian Grit-S

Although the Grit-S has previously been validated, and further validation was not a primary objective of this thesis, we nonetheless wanted to include results from a CFA analysis since it may benefit future research, and results were somewhat counter-intuitive. Namely, CFA demonstrated a poor fit when assuming a one dimensional construct ( $RMSEA = 0.136$ ,  $CFI = 0.80$ ,  $SRMR = 0.077$ ), as Duckworth and Quinn (2009) already expressed, however testing the suggested two-factor model they describe, did not lead to a satisfactory fit either ( $RMSEA = 0.090$ ,  $CFI = 0.92$ ,  $SRMR = 0.067$ ). Fit only improved substantially when the errors of item four and eight were allowed to correlate, as suggested by modification indices ( $RMSEA = 0.072$ ,  $CFI = 0.95$ ,  $SRMR = 0.046$ ). Inspection of items four and eight revealed that in Norwegian, these items essentially have the same meaning (Item four; “Jeg er arbeidsom” and item eight; “Jeg er flittig”). Overall, this indicated that the best fit for the Norwegian Grit-S can be achieved if items four and eight are allowed to correlate, or simply by removing item eight ( $RMSEA = 0.072$ ,  $CFI = 0.95$ ,  $SRMR = 0.046$ ), which is probably the best option.

