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The economics of childhood: Are childhood and upbringing conditions related to high school performance? Evidence from a Norwegian high school.

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1. Introduction

This thesis explores the process of human capital and skill formation, or in Gary Becker´s words, "the imbedding of resources in people" (Becker, 1962:9). Human capital, or labour productivity, can be defined as the product of labour in total output. As an intertemporal and interdependent process, human capital and skills are not the result of an instantaneous investment, but of a series of investments over time subject to events and shocks. Cunha et al (2006) refer to this formation process as a multistage technology. These investments are not necessarily monetary, but can also be affective, relational and simply time-consuming investments.

Of fundamental importance is the difference between cognitive and non-cognitive skills/abilities, their intertwined impacts on human capital and labour productivity, and their respective formation technology processes. Cognitive skills closely relate to what is defined as "Spearman´s g", that is the "general capacity for inferring and applying relationships drawn from experience" (Herrenstein & Murray, 1994:4). This concept is also referred to as IQ (Intelligence Quotient). Non-cognitive skills are emotional and personality traits that also affect the productivity of labour such as self-esteem, motivation, persistence, determination, charm, risk and time preferences and stress.

Childhood and early childhood are thought to be of critical importance to the technology of human capital and skill formation. Within these periods, families and the upbringing environments play a fundamental role in shaping both cognitive and non-cognitive skills through genetics, parental investments, through the choice of child environments and through the occurrence of family related traumas (Cunha & Heckman, 2007). Even though the effect of families and upbringing environments over cognitive skills is quite subtle and unclear, the effect over non-cognitive skills seems more straightforward. Children with stable, nurturing families which devote considerable investments (both monetary and non-monetary) to the development of healthy and warm relations with their children seem to, *ceteris paribus*, exhibit higher levels of productivity. On the contrary, children from unstable and broken families, marked by high levels of conflict, trauma and violence, seem to, *ceteris paribus*, exhibit lower levels of productivity. Disadvantaged family backgrounds could exert a

considerable risk on the high school performance of children subject to these backgrounds.

High-school performance is thought to be the result of, among others, two major factors: cognitive and non-cognitive skills. According to my own experience as a high school teacher and through conversations with colleagues, teachers might often encounter students who exhibit a high mental capacity, a low high-school performance and a troubled home environment. In contrast, teachers might also encounter students who do not appear to have a high mental capacity, but nevertheless exhibit good high-school performance and a nurturing home environment. These considerations prompt the hypothesis that families and upbringing environments affect high-school performance, and therefore, productivity.

This thesis puts these observations to the test. Through a cross-sectional anonymous survey with 154 students from a Norwegian high-school, information on academic performance, both cognitive and non-cognitive skills, as well as family and upbringing conditions was gathered. Cognitive skills were measured by a six-question achievement test constituted by a combination of the Cognitive Reflection Test (Frederick, 2005) and three random IQ-exercises (Cater, 2016). Non-cognitive skills were measured by an adapted version of the Rotter´s Locus of Control. High-school performance was measured by the grade-point average of the 6 compulsory and common subjects in the first year of high school. With this data, the thesis intends to provide evidence to answer the following questions:

- Are family and upbringing conditions related high school performance?
- If so, is this effect on performance independent, or is it through the effect of non-cognitive skills on high-school performance?
- Do cognitive skills affect high-school performance?
- Are the effects of cognitive and non-cognitive skills independent?

The findings of this investigation are in line with many of the previous studies. Not only are both cognitive and non-cognitive skills found to be positively correlated with high-school performance, but a series of variables related to the family and upbringing conditions are also found to have a statistically significant correlation with high-school performance.

2 Theoretical framework and literature review

The theoretical and evidence-based academic literature on the effects of family and upbringing conditions on school performance is vast and multidisciplinary. The fields of psychology, sociology and medicine have been traditionally interested in this subject. Economists have lately become interested in this relationship in an effort to quantify and understand how and when human productive capital and human skills are formed. Human and physical capital are thought to be the cornerstones of economic growth. Even though economists greatly understand how physical capital is formed and its influence on productivity, the complexities of human capital are to a lesser extent understood.

2.1 Sociological and psychological perspectives

2.1.1 Baumrind´s theory of parenting

Baumrind (1966) systematized three different parenting styles and their effects on different social outcomes of children subject to these in a very influential article. The article was one of the first to systematically relate parenting styles with various forms of congnitive and non-cognitive skills of the child (schoolroom efficiency, emotional disturbance, hostilty and aggression, dependency, personality problems, nervousness, etc). Baumrind (1966) categorized parenting into three types: authoritarian, permissive and authoritative. Authoritarian parents use psycological and fisical power to shape and control the behaviour of the child rigourously. Any self-initiative of the child is repressed and rejected. Religious or absolute moral standards guide the upbringing of these children, leaving no place for rationality or affective reasoning. Authoritarian parents establish typically cold and weak affective relations with their children. Permissive parents, on the other hand, offer no restrictions to the will, impulses or desires of the child. They can have close and warm relations, but psycological and fisical power are never used. The synthesis of these two parenting styles is the authoritative parenting. The authoritative parent uses reason and non-abusive verbal and fisical power to control and guide the child while leaving also room for will, desire and self-exploration.

Interestingly, the article finds that hostile, severe and nonempathetic punishments such as those more frequently utilized by authoritarian parents are associated with cognitive and emotional disturbances, hostile withdrawal and acting out, dependency, personality problems, nervousness and reduced schoolroom efficiency in the child (Baumrind, 1966). Moreover, children of rationally coercive parents, yet permissive of high autonomy parents (authoritative parents) were associated with higher academic success, successfull influence of peers, group leadership, friendliness. There is also some evidence of a relationship between the quality of the maternal parenting and the degree of verbal skills of the child.

Baumrind´s categorization of parenting styles kick-started theoretical and evidence-based research. With considerable similarity to the current investigation, Dornbusch et. al (1987) put Baumrind´s parenting styles to the test by issuing a questionnaire on parenting styles, self-reported school grades and other control variables to more than 7.000 adolescents. While authoritarian and permissive parenting was associated with a negative and statistically significant effect on school grades, authoritative parenting was associated with a positive and statistically significant effect on school grades. The article also investigated other variables such as parental education, gender (female), single parent parenting and having a stepparent. They find that being a female and having parents with better (longer) education is associated with better grades, while family configuration such as those with a single parent or stepparent have a negative effect on school grades. An important drawback from the Dornbusch study is that controls for formal cognitive and non-cognitive skills are missing, which could mean that these results are biased.

2.1.2 Bronfenbrenner´s bioecological model of human development

Bronfennbrenner (1979) theoretically systematized human development as a result of a multilevel system of interconnected and interrelated effects (micro-, meso-, exo- and macrosystems). The model was not limited to the formation of human skills, abilities and capital, but these were certainly an important part of it. It´s central hypothesis was that the effects on human development were greater the closer they were to the microsystem. The microsystem included mainly the family structures and close human relations.

In a recent article, Bronfenbrenner & Morris (2006) found interesting empirical results that to a certain extent support Bronfenbrenner´s original model. A particularly important effect on child development was found in the quality of the mother-infant interaction and relation. For example, they found that children subject to low levels of mother-child relations exhibited more behavioural problems at age 2 – 4 than otherwise. Furthermore, they evaluated high-school academic performance (GPA) in a sample of more that 2500 cases controlling for family structure (mother/father, single-parent mother, mother and stepfather), education level of the mother, parental monitoring and gender. Growing up in a two-parent family was associated with higher grades in comparison with growing un in a single (mother) parent family. As well, they found that strong parental monitoring was associated with both a higher mean school performance and a smaller variance. This could be evidence of parental monitoring acting as a "buffer" against other effects. In relation to this last finding, Bronfenbrenner & Morris (2006) highlighted the difference between cognitive and non-cognitive skills. They said that parental monitoring could ensure more stability of time and place so that learning can occur, but this did not assure superior school achievement since this would requiere also high motivation levels and focussed attention of the child. Moreover, gender seemed also to have an effect on high-school performance: girls had higher mean high-school performance than boys.

2.1.3 "The Bell Curve", a controversial book

In the beginning of the 1990´s, Richard J. Herrnstein and Charles Murray published their controversial book "The Bell Curve: Intelligence and Class Structure in American Life". Their fundamental hypothesis is that cognitive skills and abilities (which can be accurately measured by an IQ test) are *the* most important determinant of most of the socio-economical differences between human beings. Socioeconomic outcomes such as education and schooling, income and socioeconomic classes, job type and performance, crime, poverty, racial differences, parenting, among others, are a result of the natural (and racial) distribution of intelligence in society. This distribution of intelligence is hereditable, making these social differences hereditable and very difficult to modify. The book also addresses the issue of parenting. They do not deny the effect of parenting on social performance, but they link parenting styles to the intelligence level of the parents. "Good parenting" is, according to them, associated with high IQ

parents, while "bad parenting" is associated with low IQ parents. The cognitive skills of the mother seem to have a more direct impact on the socioeconomics outcome of the child than the cognitive skills of the father. The books main hypothesis is that, once cognitive skills and abilities are controlled, socioeconomic differences are, on average, very small.

2.2   Economic theory, models and evidence

Much of the work of economically theorizing and modelling the theories and evidence from psychologists and sociologists was (and still is) pioneered and driven by James J. Heckman. The difficulties to measure the existence and effects of non-cognitive skills, parenting and family backgrounds on performance measures had resulted until then in a complete neglect of these relations Heckman & Rubinstein (2001).

2.2.1 The GED test

In an effort to obtain a measure of the effect of non-cognitive skills, Heckman & Rubinstein (2001) examined the differences in work performance between regular high-school graduates and those with a certified GED (General Educational Development) test. The GED test certified equal cognitive abilities as a regular high-school education, but was taken only by high-school dropouts. Results were ground-breaking for the field of economics. Even though GED recipients earned more, had higher hourly wages and obtained more years of education than other high-school dropouts who did not obtain the GED, when controlling for cognitive abilities through the Armed Forces Qualifying Test, GED recipients earned less, had lower hourly wages and obtained lower levels of schooling than other high-school dropouts. Moreover, GED recipients earned statistically less than high-school graduates even though their cognitive abilities were comparable. GED recipients are therefore "wise guys" with low levels of non-cognitive abilities Heckman & Rubinstein (2001) and these low non-cognitive abilities are penalized by the market.

2.2.2 The Perry Preschool Program

The Perry Preschool program was an intensive preschool educational program administered between 1962 and 1967 and followed up over 40 years. It provided quantitative evidence of the effect of non-cognitive abilities and mother-child relations on human performance. Cunha et al. (2006) review this program and highlight the most important findings.

Following Cunha et al (2006), the program ramdomly assigned 123 children (afroamerican) wih mean age of 42 months and low measured IQ into two balanced groups (treatment and control). The treatment group recieved a 2,5 hour classrom session on weekday mornings and a weekly ninety minute home visit by a certified preschool teacher over 30 week school year periods (Cunha et al, 2006). The differences between treatment and control groups evidenced that the preschool program had significant effects on educational performance. Even though it did not sustainably affect the cognitive skills measured by IQ tests, achievement tests scores of those subject to the preschool program were statistically higher at age 14 in relation to the control group. Moreover, high school grades and graduation rates were higher among the treatment group. As the young children moved into adulthood, they were more likely to be employed, earn more income, not depend on state-driven welfare programs and be less involved in crime. The Perry preschool program is considered an important evidence of the effect of non-congnitive skills on performance.

2.2.3 The National Longitudinal Survey of Youth 1979 (NLSY79)

The NLSY79 is a popular and widely used database on wages, schooling and employment collected from a sample of 12.686 men and women aged 12-22 years old. Heckman, Stixrud, & Urzua (2006) find interesting results on the effects of cognitive and non-cognitive skills on wages using this data. The cognitive skills were measures by the Armed Services Vocational Aptitude Battery (ASVAB), while the non-cognitive skills were measured by the Rotter Locus of Control Scale and the Rosenberg Self-Esteem Scale.

An important statistical and methodological problem is pointed out by Heckman, Stixrud, & Urzua (2006). They find that schooling (years of scholling, for exempel) affects both cognitive and non-cogntinve achievment test scores as measured for

example by the ASVAB and the Rotter Locus of Control Scale. That is to say that schooling affects both wages directly, and indirectly through its effect on non-cognitive and congitive skills. This creates a potential reverse-causality problem. Since the cognitive and non-congitve test scores depend in some degree to the years of schooling, the OLS coefficients of the effect cognitive and non-cognitive skills on performance could be upward biased. With advanced statistical methods and modelling, Heckman, Stixrud, & Urzua (2006) find evidence of an upward bias in the coeficients of 65% for congnitive abilities and a upward bias of 27% for non-cognitive abilities.

2.2.4 Evidence from the Swedish military enlistment: Lindqvist & Westman (2009):

Lindqvist & Westman (2009) estimated the effects of cognitive and non-cognitive skills on labor perfmormance (wage earnings and employment status) using data from the Swedish military enlistment. Cognitive skills were measured by achievment tests administered by the Swedish military, while non-cognitive skills were measured by professional psychologists. In contrast to the thesis in Herrenstein & Murray (1994), non-cognitive abilities were more strongly associated to both wage earnings and employments status. Their results indicated that a one standard deviation increase in the non-cognitive skills was associated with a 9 % increase in wages, compared to a 5 % increase in the case of cognitive sills. They argue that non-cognitive skills measured through non-cognitive acchievement tests are poor measures of the actual non-cognitive skills valued by the market, and that this poor measure of non-cognitive skills could have overestimated the real effect of cognitive skills on performance.

2.2.5 Evidence on the effects of family context on cognitive development in early childhood: Barreto et al. (2017)

Even though most of the empiric studies were aimed at proving the effects of both congitive and non-cognitive abilities on performance, few studies address the role of family characteristics and context in determining both ability and general performance. Barreto et al. (2017) conducted a longitudinal study in which different family charachterisics are regressed against the cognitive skills of young children from Spain. They find statistically positive significant associations between the general cognitive

skills of the young children and the education level of the mother, the exposure to a bilingual environment and the status of "first born".

2.2.6 Economic modelling of skill formation: Cunha & Heckman (2007)

In an effort to model these evidence based results, Cunha & Heckman (2007) developed a multistage model of (childhood) skill formation. They introduce key concepts such as "sensitive" and "critical" periods, self-productivity and dynamic complementarity. The concepts of sensitive and critical periods come from the idea that some stages of the childhood´s skill-formation technology may be more productive in producing some skills than other stages (Cunha & Heckman, 2007). In the same way, certain inputs may be more productive at some stages than at other stages (Cunha & Heckman, 2007). A developmental stage becomes sensitive if it is more productive in the aquisition of certain skills, and becomes critical if it is the only stage that delivers certain skills (Cunha & Heckman, 2007). The concept of self-productivity embodies the idea that skills are not lost at the end of each stage, but stocked and transfered to the next stage. Finally, the concept of dynamic complementarity means that skills acquired in different stages often complement each other and raise the productivity of skill formation. The dynamic complementarity of skill-formation shows that early investments and skills have to be followed up with later investments and skills to deliver its full productive potential.

Their model is based on an overlapping-generations model framework where individuals live for 2T years, being a child for the first T years, and finally being an adult from year T+1 to year 2T. The model was simplified by assuming that T = 2, so that individuals are children in years 1 and 2, and adults in year 3 and 4. Allowing for more than one stage in childhood (even though they recognize that childhood has more than two stages) allows the model to explain the dynamic effects of different investments patterns in childhood on the final stock of skills in adulthood. Successive childhood investments are done exclusively by parents, and are denoted by I_t, where t = 1, 2. Parental characteristics are denoted by *h.*

The core of the model is the following dynamic description of the stock of skills in childhood, Ø.

$$\emptyset_{t+1} = f_t(h, \emptyset_t, I_t) \quad \text{, for t = 1, 2} \tag{1}$$

or,

$$\emptyset_{t+1} = m_t(h, \emptyset_1, I_1, I_2) \quad \text{, for t = 1, 2} \tag{2}$$

The equation by Cunha & Heckman (2007) states that the stock of skills at the end of childhood depends on the initial skills of the child (genetics), $\emptyset_1$; the "quality" of parents or parental characteristics, h; and the childhood investments made by parents on periods 1 and 2, I_1 and I_2. Moreover, given any genetic and parental "endowments", a low investment in period 1 will not only affect the stock of skills in period 2 directly, but indirectly through the effects of self-productivity ($\partial f_t(h, \emptyset_t, I_t)/\partial \emptyset_t > 0$) and dynamic complementarity ($\partial^2 f_t(h, \emptyset_t, I_t)/\partial \emptyset_t \partial I_t > 0$).

Cunha & Heckman (2007) specifically model the effects of I_1 and I_2 on the stock of skills at adulthood (h') through a CES production function.

$$h' = m_2(h, \emptyset_1, (\gamma(I_1)^{\emptyset} + (1-\gamma)(I_2)^{\emptyset})^{1/\emptyset})$$

where γ is defined as a skill multiplier. Figure 1 shows the crucial effect of γ on the the optimal ratio of early to late investments (I_1/I_2).
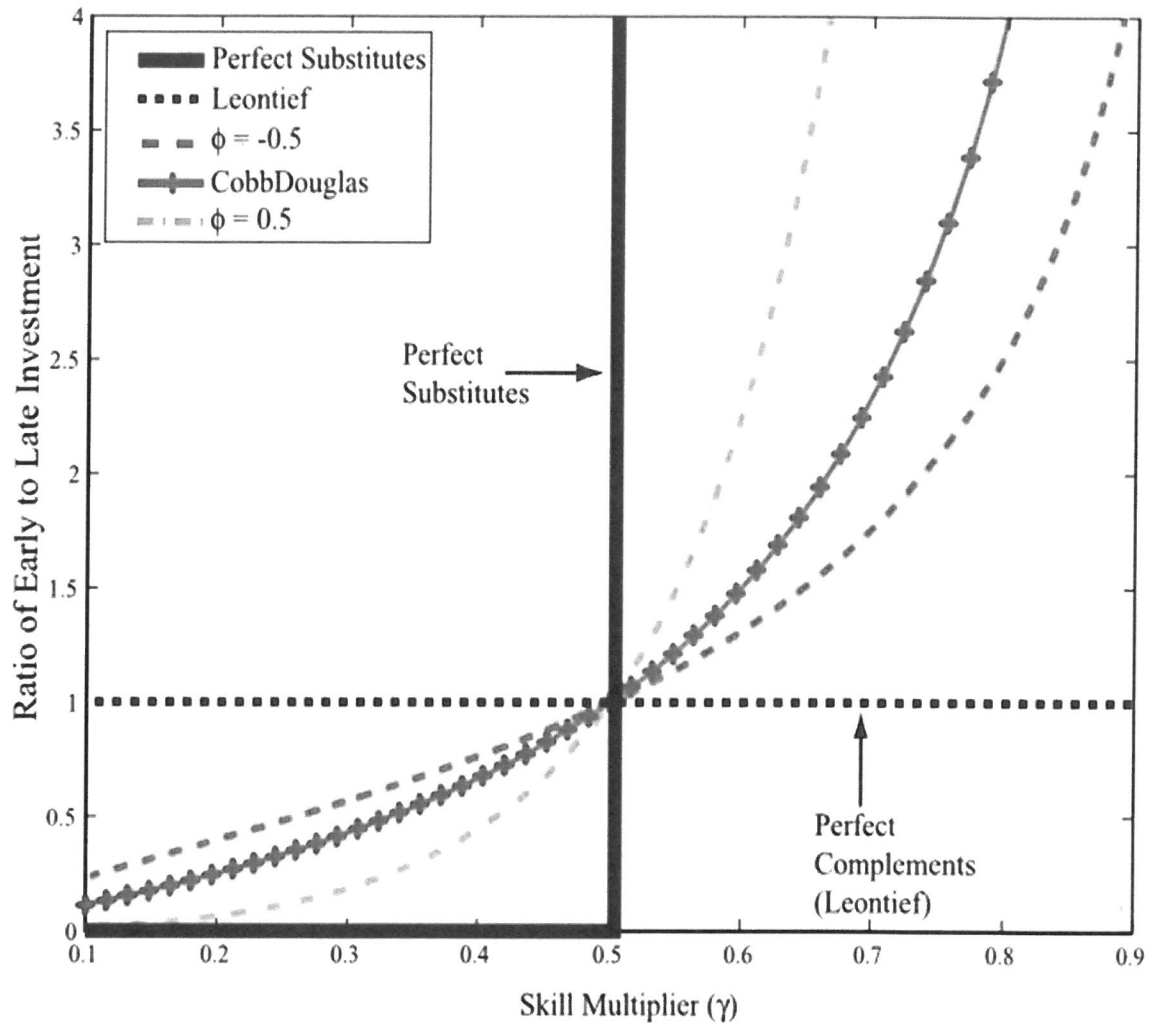
Figure 1. Source: Cunha & Heckman (2007)

A high skill multiplier implies an increased relative importance of the initial investment on the total stock of skills. Much of the evidence points out towards the fact that γ is in fact high. In line with this argument, Heckman J. (2011) has estimated that the annual rate of return of initial investments is between 7% and 10%.

Even though Cunha & Heckman (2007) mention the posibility of incorporating both cognitive and non-cognitive skills in the model through enhanced vectors $\emptyset_t = (\emptyset_t^C, \emptyset_t^{NC})$, $I_t = (I_t^C, I_t^{NC})$ and $h = (h^C, h^{NC})$, the interactions between cognitive and non-cognitive skill formation and performance output is far from clear in this paper.

2.2.7 Economic modelling of skill formation: Cunha, Heckman & Schennach (2010)

Cunha, Heckman & Schennach (2010) research is two-fold: they firstly theoretically advanced the research of Cunha & Heckman (2007) by incorporating both cognitive and non-cognitive skill in the analysis, and secondly, they econometrically test the funtional form and parameters of their proposed skill production function by using a sample of 2207 children from the NLSY79 database.

The model incorporates the vectors $\emptyset_1 = (\emptyset_{C,1}, \emptyset_{NC,1})$, $\emptyset_t = (\emptyset_{C,t}, \emptyset_{NC,t})$, $\emptyset_P = (\emptyset_{C,P}, \emptyset_{NC,P})$. The vectors incorporate the two dimensions of skills to the initial conditions, the parental qualities and the final stock of skills. The dynamics of skill (cognitive and non-cognitive) accumulation is denoted by

$$\emptyset_{k,t+1} = f_{k,s} (\emptyset_t, I_{k,t}, \emptyset_P) \, ,$$

where t = 1,...,T ; k = (C, NC) = (cognitive, non-cognitive); and S = 1,...,S ≤ T

Since they have incorporated both cognitive and non-cognitive skills, the ideas of self-productivity and dynamic complementarity require further analysis. Cunha, Heckman & Schennach (2010) introduce the parameters $\emptyset_{s,k}$ to measure the relations between current and past levels cognitive and non-cognitive skills to produce a given level of skill, so that

$$\emptyset_{C,t+1} = (\gamma_{s,C,1}\emptyset_{C,t}^{(\emptyset_s,C)} + \gamma_{s,C,2}\emptyset_{N,t}^{(\emptyset_s,C)} + \gamma_{s,C,3}I_{C,t}^{(\emptyset_s,C)} + \gamma_{s,C,4}\emptyset_{C,P}^{(\emptyset_s,C)} + \gamma_{s,C,5}\emptyset_{N,P}^{(\emptyset_s,C)})^{1/\emptyset_s,C}$$

and

$$\emptyset_{N,t+1} = (\gamma_{s,N,1}\emptyset_{C,t}^{(\emptyset_s,N)} + \gamma_{s,N,2}\emptyset_{N,t}^{(\emptyset_s,N)} + \gamma_{s,N,3}I_{N,t}^{(\emptyset_s,N)} + \gamma_{s,N,4}\emptyset_{C,P}^{(\emptyset_s,N)} + \gamma_{s,N,5}\emptyset_{N,P}^{(\emptyset_s,N)})^{1/\emptyset_s,N}$$

Their empirical results are based on the NLSY79 database. They divide childhood in 2 developmental stages (each with different periods): the first stage covers the ages of 0 to 6, while the second stage covers the ages of 6-14. Their results are impressive. They estimate that self-productivity for both cognitive and non-cognitive skills increase in the second stage. This could be mean that children need a sufficient level of skills before these skills can produce even more skills, or that the "skill" to produce even more skills with their own skills is not acquired before the second stage. Interestingly, they find that cognitive skills do not produce non-cognitive skills. On the contrary, they find that non-cognitive skills foster cognitive skills in the first stage, but not in the

second stage. This result is evidence of the importance of fostering the acquisition of non-cognitive skills in the first stage (through parental investments) since they will produce also cognitive abilities. Finally, they estimate that parental non-cognitive skills are especially productive in the first stage of childhood, while parental cognitive skills are reasonably productive throughout both stages.

2.3　Summary

In sum, previous research has found that both cognitive and non-cognitive skills affect performance. Even though studies differ on their relative importance, recognizing the role of non-cognitive abilities on performance has policy-related consequences. Focusing exclusively on fostering the cognitive abilities of people would neither be enough nor cost-effective. Childhood seems to be the period in which these skills are most heavily determined, especially in early childhood.

On the other hand, the role of families, parenting and home environment is not understood to the same extent. Even though theory suggests that families play a fundamental role in shaping both cognitive and non-cognitive skills, not much empiric evidence has been found. Neither has the channels and timing through which family and family-related variables affect performance been fully understood. That is to say that it is yet not proven if family conditions affect performance either directly, or through the effect of these on both cognitive and non-cognitive abilities, or both. Many studies point out the important role of the mother in determining performance. It is unclear whether the qualities of the mother affect either the cognitive or the non-cognitive skills. It is also unclear if it is the education or IQ of the mother which exerts this considerable effect, or if it is related to other non-cognitive characteristics of the mother.

3. Research method, data collection and hypothesis testing

3.1 Data and methods

Finding public data on high-school performance, on cognitive and non-cognitive skills and on family related conditions of a singular population which could be used in this investigation was challenging. Existing data on the subject is scarce. Collecting data on the issue seemed also quite challenging, but the fact that the author works as a teacher in a high-school meant the "competitive advantage" of the strategy of collecting primary data from this school.

The data collection strategy was subject to a series of constraints that made the preferred data collection strategy a 100% anonymous, non-digital, voluntary and self-reporting survey. The first constraint was the disposable time of a master's thesis. As a result, a panel data collection strategy was disregarded for this investigation since it would have meant a longer data collection period. Nevertheless, a panel data collection could have delivered interesting results since the analysis could have focused on change variables. The second constraint was that the school authorities could not release any information on the grades of the students. Consequently, data on school performance had to rely exclusively on self-reported grades. Data on family and upbringing environment was also based on self-reporting. Investigations based on self-reporting could potentially deliver biased results because of measurement errors.

3.1.1 Anonymity and self-reported data

There is some evidence that self-reported data could result in biased results even under the presence of anonymity (Roseman, Tennekoon, & Hill, 2011). There are many reasons why the variable of interest could be misrepresented by the respondents. Bertrand & Mullainathan (2001) theorize three ways by which subjective reports could be a source of bias: cognitive problems, social desirability and attitudes. Cognitive problems arise when the subjects don't understand or misunderstand the question. Framing, wording, order of the questions or the mere cognitive inability can greatly affect the answers. Social desirability bias occurs when the subject is affected by what society deems desirable. This often means that respondents want to "appear socially good" in the results. Another source of potential self-reported bias is when

subjects recall events that took place in the past. Subjects may have "forgotten" or "repressed" a fact from the past, but that doesn´t mean that it has not occurred.

Many of the sources of self-reported bias are difficult to control. Nevertheless, self-reported bias due to social desirability could be potentially affected by anonymity. If subjects are sure that the survey is 100% anonymous and their answers cannot by any means be traced back to them, their incentives to "look socially good" should, in principle, be eliminate. Therefore, the survey did not include personal information which could be used to identify a respondent. In that way, the survey deliberately avoided asking about personal information such as ID number, name or surname, address (physical or electronic) or date of birth. Moreover, the survey was conducted in physically printed surveys (not web-based). In this way, any possible electronic identification of the respondent was ruled out. Students received all this information prior to the decision of acceptance/rejection of the survey.

Moreover, of importance to this investigation is the potential self-reporting bias due to the fact that students fail to recall events from the past. Incentivizing the students could, in theory, affect their effort level in the survey, and ultimately reduce the response bias due to the failure to recall past events due to lack of effort. This theory supposes that student´s ability to recall is affected by their effort level and that their effort level is affected by incentives (non-performance incentives), assumptions which are not trivial. Bolstein & James (1990) find evidence that using incentives increases the effort of respondents measured by the number of words, comments and short answers. In a more recent study, Teisl, Roe, & Vayda (2006) regress the survey responses against the personal characteristics of the respondents and the type of incentive used. They find no significant differences in effort-related measures (non-response, response time, item non-response and quality to open-ended questions) to different levels of positive incentives.

Even though self-reporting bias cannot be ruled out, the use of incentives and anonymity in the data collection are expected to decrease this bias as much as posible.

3.1.2 Measurement errors and self-reported data

Measurement errors can affect both the dependent variable and the independent variables. The dependent variable in this investigation is the high-school performance

of the students (grade point average-GPA). The Ordinary Least Squares (OLS) estimator will be unbiased and consistent if the measurement error is uncorrelated with the independent variables (Wooldridge, 2014). In this investigation, correlation between the measurement error in GPA and the independent variables Cog.Skill and Non.Cog.Skills would render biased estimators. That situation would be, for example, if those over-reporting their grades where those who had the lowest cognitive and/or non-cognitive skills. There is no *a priori* evidence of that.

Measurement error in the independent variables can also be a source of bias estimators. Again, following Wooldridge (2014), OLS estimators will be unbiased if the measurement error is uncorrelated with the self-reported variable. For example, in this investigation, Cog.Skills and Non.Cog.Skills could be subject to measurement errors.

3.1.3 Strategies to elicit and measure cognitive and non-cognitive abilities/skills

The problem with "ability" variables is that there are not directly observable. The researcher will "observe" another variable which is theoretically assumed to be sufficiently correlated with the unobserved "ability" variable. In this investigation, the "ability" variables are the cognitive and non-cognitive skills of the students.

Following (Wooldridge, 2014),

Cognitive.Skills = Cognitive.Skills* + error1

and

Non.Cognitive.Skills = Non.Cognitive.Skills* + error2

where Cognitive.Skills* and Non.Cognitive.Skills* are the observed measurements of the unobserved Cognitive.Skills and Non.Cognitive.Skills.

There are two major ways of eliciting measures of the cognitive abilities of an individual: a formal IQ Test or an achievement test. Other possibilities include the use of proxy variables such as height of the person (Schick & Steckel, 2010) or "non-answers" from a questionnaires/achievement test (Kassenboehmer, Schurer, & Leung, 2015). Even though these two last measures could potentially reduce the bias from the unobserved ability, the author considers that an actual cognitive achievement test will be reduce this bias even more. Furthermore, although professionally performed IQ tests tend to

be highly correlated with cognitive abilities, they are prohibitively costly for the budget of this investigation. Achievement tests, on the other hand, have the advantage of being accessible and cheap, but could potentially not be as correlated with the unobserved variable as a professionally administered IQ test. Even more, achievement test could be greatly affected by incentives, morality, opportunity cost of time and non-cognitive skills. Although imperfect, an achievement test is considered the best feasible strategy to elicit the cognitive skills of the students in the context of this investigation. Moreover, time exerted a big constraint on the format of the achievement test. Since the survey had to elicit also other variables such as non-cognitive skills, high-school performance and family background, the achievement test could not demand more than around 15 minutes. Thus, the Cognitive Reflection Test (CRT) from Frederick (2005) was a good alternative. The CRT consists of three trick questions that, even though they are easy when explained, require that the student cognitively identify that the "seemingly easy" answer is the incorrect one (Frederick, 2005). To add more explanatory power to the achievement test, three "IQ style" exercises from Cater (2016) were chosen randomly. In total, the achievement test consisted of six exercises.

Eliciting non-cognitive abilities is also challenging. Merging all the elements of this variable into a single cuantitative index seems daunting. Psycologists have come up with a series of psycological and personality tests which pick up valuable information on non-cognitive abilities such as motivation, perseverence, self-esteem, determination, etc. Two examples of these tests are the "Rotter´s Locus of Control scale" (Rotter, 1966) and the "Big 5 personality traits" test (Goldberg, 1990). The "Rotter´s Locus of Control scale" is a test of 29 questions which resumes the information into a single index of internal (low score)/external control (high score). Trice (1985) elaborates the Academic Locus of Control Scale for College Students (ALC). More recently, Curtis & Trice (2013) revise and simplify the 1985 ALC to 21 questions. The result was the ALC-21. Again, time contraint favoured greatly the strategy of eliciting non-cognitive abilities/skills with an adapted version of the ALC-21 for high-school students.

3.1.4 Potential endogeneity of the measures of cognitive and non-cognitive skills

Following Heckman, Stixrud, & Urzua (2006), a potential upwards bias in the estimates of the effect of the cognitive and noncongnitive skills on school could exist if past

schooling or age have an effect on achievment tests such as the ACL-21 or the cognitive test used as a measure of congnitive skills.

3.2   Data collection and selection bias

The data collection was done in a Norwegian high-school located in Østfold. 189 students from the second and third year of high-school were the targeted population in the survey. The data was collected in the months of March and April in 2018. A total of 157 students participated in the survey. Two students declined to participate in the survey, whereas three responses were excluded. The exclusion criteria were: missing data on more than 2 subjects or missing data on more than 3 items of the non-cognitive test. The final sample was therefore reduced to 154 students.

The recruitment strategy was ethically challenging. The most ethical recruitment strategy would have been to have the data collection sessions as an extra-curricular activity. In this way, students would not have missed valuable curricular activities to perform the survey. Nevertheless, the biggest drawback of this strategy would be that only those with high non-cognitive skills or interested in the research would be willing to participate. As a consequence, both a smaller and biased sample could have been the result.

Therefore, the chosen alternative strategy was to have the data collection session as a part of the curricular activity. Authorization from the school authorities was granted. Since the students of this high-school are divided in classes (for example class A, B, C, D, E, etc.), and since each student is part of one and only one class, the chosen strategy was to agree with the teachers of the different classes a date and time where the author could "interrupt" a regular class in order to perform the survey. Students did not receive any previous information. Every student had in theory the same probability of participating in the survey. An important caveat deserves to be mentioned. If students who have low non-cognitive skills have a greater probability of being absent to class, so a selection bias in the sample could have occurred. 15,8% of the target population was absent. If students with low non-cognitive skills are overrepresented in these students, so the sample would not be random. Therefore, sample selection cannot be completely ruled out, even though participation was high.

3.3   Incentives and compensation

Since participation in the survey was voluntary, and since the survey could have been emotionally costly and time/effort intensive for the students, a compensation scheme was established to incentivize participation. Each student who handed in the survey had a 25% chance of winning a gift card which could only be exchanged for one ticket in the cinema. Each gift card had a monetary value of NOK 135 (approximately USD 16). A random number generator computer program was used. The gift cards were shown to the students before they started the survey, so that every student knew that they were real.

Incentives can affect different instances of the decision-making process. For example, and since participation is voluntary, a monetary/non-monetary incentive can affect the decision of participating in the experiment/survey or not. Moreover, an incentive could affect performance or effort if the payments should vary in response to different levels of effort/performance. An incentive could also affect both.

Much of the literature has focused on evaluating if monetary incentives affect performance under risk and uncertainty. For example, Holt & Laury (2002) found that increasing incentives affect the level of risk aversion. Similar results are found by Kachelmeier & Shehata (1992). They found that subjects become more risk averse as stakes become increasingly higher. Nevertheless, other studies have found that monetary incentinves in gamble-like situation did not alter behaviour, and even if it did, the differences were very small (Tversky & Kahneman, 1992).

Since the survey did not involve prospects with risk and/or uncertatinty, the use of an incentive was directed exclusively towards maximizing the participation/response rate. The incentive appears to have had some effect on the decision of participating or not (participation rate of 99%), although contra-factual evidence is not available. Studies show that monetary incentives positively affect the response rate in surveys. Yu et al. (2017) found that a USD 10 monetary incentive was effective in increasing response rates in a medical investigation regarding on people subject to the 9/11 terrorist attacks in New York. Moreover, in a meta analysis, Church (1993) found that those surveys that included monetary and non-monetary rewards yielded an increase in the response rates of 19.1 % and 7.9 %, respectively.

3.4   Hypothesis

The following theoretical model is tested.

H.school perf. = const. + ß₁Cog.Skills* + ß₂Non.Cog.Skills* + ß₃(Family/Upbringing) + u

where

Cog.Skills* = ß₄ Non.Cog.Skills* + ß₅(Family/Upbringing) + u

Non.Cog.Skills* = ß₆Cog.Skills* + ß₇(Family/Upbringing) + u

Hypothesis 1: The cognitive skills of the students are, on average, positively associated to their grade point averages.

H_0 : $\beta_1 = 0$

H_A : $\beta_1 > 0$

Hypothesis 2: The non-cognitive skills of the students are, on average, positively associated to their grade point averages.

H_0 : $\beta_2 = 0$

H_A : $\beta_2 > 0$

Hypothesis 3: The family and upbringing conditions of the students are, on average, positively associated to their grade point averages. This is to say that, better family and upbringing coditions are associated to higher grade point averages.

H_0 : $\beta_3 = 0$

H_A : $\beta_3 > 0$

Hypothesis 4: Cognitive skills and non-cognitive skills are not associated with each other.

H_0 : $\beta_4 \neq 0$; $\beta_6 \neq 0$

H_A : $\beta_4 = 0$; $\beta_6 = 0$

Hypothesis 5: Family and upbringing characteristics are positively associated to both cognitive and non-cognitive skills of the students. This is to say that better family and

upbringing coditions are associated with higher cognitive and non-cognitive skills. Nevertheless, it is hypothesized that the former is greater than the latter.

H_0 : $\beta_5 = 0$; $\beta_7 = 0$

H_A : $\beta_5 > 0$; $\beta_7 > 0$; $\beta_5 > \beta_7$

4. Variable description and results

4.1 Variable description

Data was collected on the following variables, as displayed in Table A.

| Table A: Variable description			
Variable	Variable name	Type of variable	Description
Grade point average	GradeAv		Grade point average of the 6 "common subjects" in the first year of high-school. Scale: 1 (min) – 6 (max).
Cognitive skills	IQCRTTEST		Amount of correct answers in the IQCRTTEST. Scale: 0 (min) – 6 (max).
Non-cognitive skills	ALC-21		Total score in the ALC21 test. Scale: 0 (min) to 21 (max). Originally, a high score in the ALC21 indicates low non-cognitive abilities. The scores were reverted on order to allow a high score in the ALC21 indicate high non-cognitive skills.
Gender	Gender	Dummy	Variable which takes the value of 1 if female, 0 if male.
Income	Income	Categorical	Low income
			Middle income
			Good income
Caregiver	Caregiver	Categorical	Main caregivers are mother and father
			Main caregiver is either the mother or the father
			Main caregiver is a foster caregiver
Residence	Residence	Categorical	Has mainly resided with mother and father
			Has mainly resided with either mother or father
			Has mainly resided with foster caregivers.
Number of siblings	Siblings		Number of siblings
Place amongst siblings	PlassSiblings		Place amongst group of siblings.
Residence relocations	Move	Categorical	Has relocated up to 4 times in childhood
			Has relocated more than 4
Marital status of the parents	Married	Categorical	Parents are married
			Parents are divorced
			Parents are not married
Education of the mother	Educmother	Categorical	Not completed high school
			Completed high school
			Practical vocational studies
			Completed college / university education
Education of the father	Educfather	Categorical	Not completed high school
			Completed high school
			Practical vocational studies
			Completed college / university education

| Languages	Languages		Quantity of languages spoken often at home
Psychological violence	Psycoviol	Dummy	Variable taking the value of 1 if the student has experienced psychological violence during his upbringing.
Psychological violence between family members	Psycoviolfam	Dummy	Variable taking the value of 1 if the student has experienced familiar psychological violence (not directed to him/her) during his upbringing.
Physical violence	Fisviol	Dummy	Variable taking the value of 1 if the student has experienced physical violence during his upbringing.
Physical violence between family members	Fisviolfam	Dummy	Variable taking the value of 1 if the student has experienced familiar physical violence (not directed to him/her) during his upbringing.
Abuse of alcohol and drugs	Substabuse	Dummy	Variable taking the value of 1 if the student has experienced abuse of substances (alcohol or drugs) during his upbringing.
Warning	Warning	Dummy	Variable taking the value of 1 if the student has received a warning from the school. Warnings are issued when the student is at risk of not receiving a grade in the subject because of more than 10% undocumented absences or not enough evaluations in the course.
Degree of control exerted by the mother.	Controlmother	Categorical	Mother has no control on the student.
			Mother has little control on the student.
			Mother has significant control on the student
			Mother has more than significant control on the student
Degree of control exerted by the father.	Controlfather	Categorical	Father has no control on the student.
			Father has little control on the student.
			Father has significant control on the student
			Father has more than significant control on the student

4.2 Descriptive statistics

Table 1 includes basic descriptive statistics of three key variables of this study: GradeAv (Grade Point Average), IQCRTTEST (Cognitive Skills) and Noncognitive (Non-cognitive Skills).

Table 1					
Variable	Variable Name	Mean	Standard dev.	Min	Max
Grade Point Average	GradeAv	3.99	0.78	1.8	5.5
Cognitive Skills	IQCRTTEST	1.17	1.36	0	5
Non-cognitive Skills	Noncognitive	10.82	3.61	2	19

A simple scatter plot (Figure 1) seems to illustrate that higher cognitive skills tend, on average, to be associated with higher grade point averages. This relation seems to be more accurate for higher levels of cognitive skills. Higher cognitive skills seem also to be associated with decreased variances in the grade point averages, which suggests the presence of heteroskedasticity.

Figure 1: Grade Point Average vs Cognitive Skills
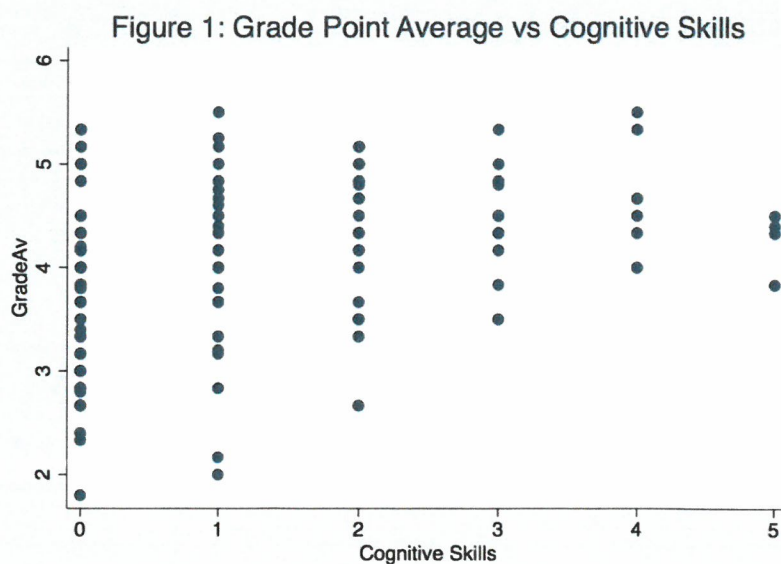
Moreover, Figure 2 seems also to point to the idea that students who have higher non-cognitive skills tend, on average, to display better grade point averages.

Figure 2: Grade Point Average vs Non-cognitive skills
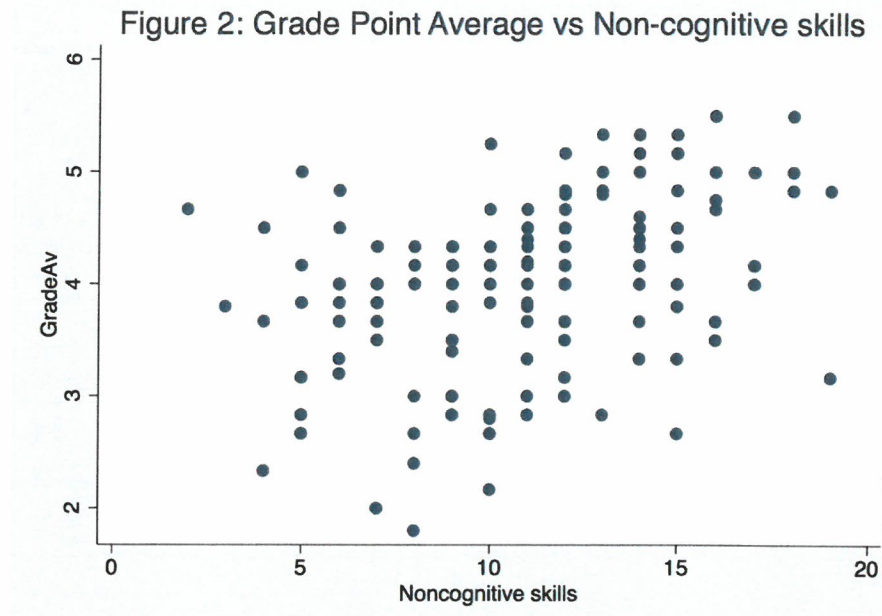
Lastly, the different types of skills do not seem to be related with each other (Figure 3).

Figure 3: Non-cognitive vs Cognitive skills
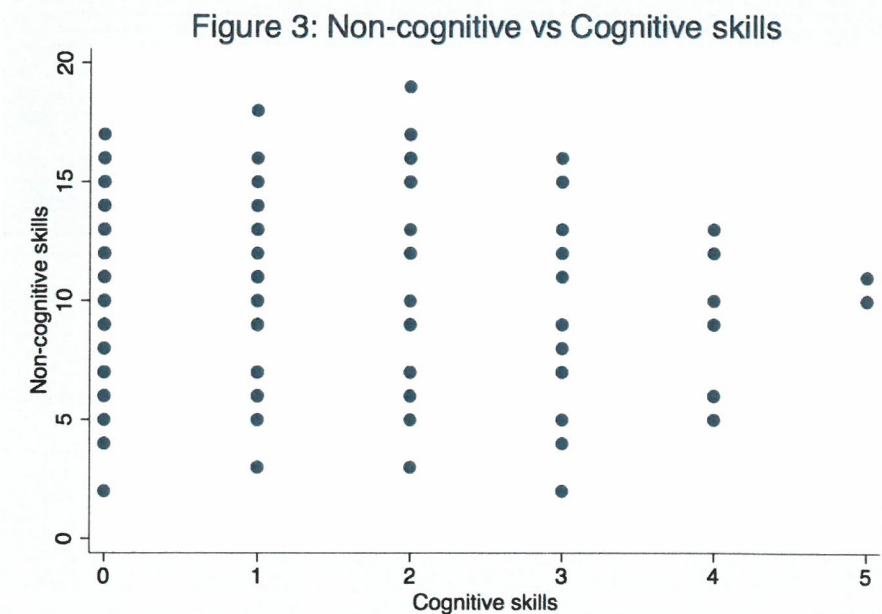
4.3 Results

4.3.1 Determinants of non-cognitive skills

Family background and upbringing conditions are suspected of influencing the non-cognitive abilities of students. Data on a wide range of family and upbringing indicators were collected and regressed against the non-cognitive abilities of the students. The analysis found statistically significant associations between the non-cognitive skills of the students and the following variables: education level of the mother, education level of the father, the abuse of substances (alcohol/drugs) and living with both a mother and a stepfather. The results are shown in Tables 1.

An important result is that the cognitive skills of the students were not related to the non-cognitive skills of the students. That is to say that students are not more hard-working, dedicated and responsible just because they are more intelligent. Moreover, the effect of gender was only marginally significant, not giving conclusive results.

Students who had experienced the abuse of substances like alcohol and drugs at home had, on average, 2.87 points less in their non-cognitive achievement tests relative to those who did not experience the abuse of substances. This association was highly significant. Moreover, as expected, both the education level of the mother and the father are significantly associated with the non-cognitive skills of the students. Students of parents with no high-school education obtain lower scores in their non-cognitive achievement test relative to those with university educated parents. Students with a mother with no high-school education scored, on average, 2.35 points less in their ALC21 achievement test relative to the scores of students with university educated mothers. In the case of students with a father with no high-school education, their scores were, on average, 2.63 points lower than the scores of students with university educated fathers. Receiving a high-school education had a statistically significant association in the case of the mothers but not in the case of the fathers. Even though having a mother with a high-school degree improved the non-cognitive scores relative to students with a mother with no high-school education, these students scored 1.34 less points in the ALC21 test relative to those students with a university educated mother. In the case of the fathers, obtaining a high-school degree gave no statistically significant results, but obtaining a certificate of vocational studies did.

The marital status of the parents lost significance when regressed together with the Residence variable. Consequently, having divorced or not married parents was, relative to students who have married parents, not significantly related to the non-cognitive skills of the students. Surprisingly, students that lived mostly with a mother and a stepfather scored, on average, 2.40 points less on the non-cognitive test relative to those students who had mostly lived with their both biological parents.

Table 1					
OLS regression results					
Dependent variable: Non-cognitive skills – ALC21					
Independent variables: Cognitive skills, gender, residence, marital status, substance abuse, education of the mother, education of the father					
Independent variables		Coefficient	Standard error (robust)	Coefficient (standardized)	p-value	t
IQCRTTEST – Cognitive skills		0.07	0.183	0.03	0.706	0.38
Gender		0.91	0.540	0.25	0.095	1.68
Residence	Single-parent	-0.08	0.977	0.02	0.931	-0.09
	Foster	-0.86	1.51	0.24	0.568	-0.57
	Mother and stepfather	**-2.40**	**1.14**	**-0.66**	**0.038**	**-2.10**
Marital status	Divorced parents	-0.87	0.723	-0.24	0.234	-1.20
	Not married	1.23	1.10	0.34	0.264	1.12
Substance abuse		**-2.87**	**0.752**	**-0.80**	**0.000**	**-3.82**
Mother education	**(no high school)**	**-2.35**	**1.21**	**-0.65**	**0.054**	**-1.94**
	(high school)	**-1.34**	**0.667**	**-0.37**	**0.046**	**-2.02**
	(vocational studies)	-0.90	0.729	-0.25	0.217	-1.24
Father education	**(no high school)**	**-2.63**	**0.967**	**-0.73**	**0.007**	**-2.72**
	(high school)	-0.03	0.790	-0.009	0.966	-0.04
	(vocational/ practical education)	**-1.52**	**0.699**	**-0.42**	**0.031**	**-2.18**
Constant		12.17	0.684	0.40	0.000	17.79
Observations				140		
R^2				0.26		

4.3.2 Determinants of cognitive skills

The relationship between cognitive skills and family and upbringing conditions is quite contested. Some claim that cognitive abilities are already determined at a young age (6-10), limiting many of the effect of family and upbringing conditions on it. The cognitive skills of the students were regressed against the different indicators of family and upbringing conditions. The results are shown in Table 2.

Table 2						
OLS regression results						
Dependent variable: Cognitive skills - IQCRTTEST						
Independent variables: Residence, Control of the parents, month born, education of the parents						
Independent variables		Coefficient	Standard error (robust)	Coefficient (standardized)	p-value	t
Residence	Single-parent	-0.55	0.259	-0.41	0.035	-2.14
	Foster / Adoptive	-1.15	0.294	-0.84	0.000	-3.90
	Mother and stepfather	-0.57	0.377	-0.42	0.136	-1.50
Month of birth		-0.14	0.065	-0.10	0.036	-2.11
Mother education	(no high school)	-0.08	0.583	-0.06	0.893	-0.14
	(high school)					
	(vocational studies)	-0.20	.033	-0.15	0.535	-0.62
Father education	(no high school)	-0.75	0.478	-0.55	0.119	-1.57
	(high school)	-0.23	0.332	-0.17	0.497	-0.68
	(vocational studies)	-0.08	0.331	-0.06	0.798	-0.26
Mother control	No control	0.70	0.503	0.52	0.164	1.40
	Little control	0.55	0.402	0.41	0.168	1.39
	Hard control	-0.23	0.377	-0.17	0.545	-0.61
Father control	No control	-0.46	0.354	-0.34	0.194	-1.31
	Little control	-0.07	0.370	-0.05	0.861	-0.18
	Hard control	0.47	0.395	0.35	0.233	1.20
Observations		140				
R^2		0.15				

The results show, as expected, that the cognitive skills of the students are less influenced by familiar and upbringing conditions. An exception to that seems to be the residence configuration. Students living mostly in single parent houses scored, on

average and relative to students who had mostly lived in two-parent houses, 0.55 points less in the cognitive skills test. Moreover, students who had mostly lived in a foster/adoptive home had an even greater negative effect. Such students scored, on average and relative to those students who had mostly lives in a two-parent house, -1.15 points less in the cognitive achievement test. Finally, students born earlier in the year had, on average, better cognitive skills.

4.3.3 Determinants of high-school performance (Grade Point Average)

The high-school performance of the students is regressed against their cognitive skills, non-cognitive and family and upbringing conditions. The results are shown in Table 3.

Table 3					
OLS regression results					
Dependent variable: Grade Point Average					
Independent variables:					
Independent variables	Coefficient	Standard error (robust)	Coefficient (standardized)	p-value	t
IQCRTTEST – Cognitive skills	0.16	0.034	0.28	0.000	4.67
ALC21 - Non-cognitive	0.07	0.016	0.34	0.000	4.57
Gender	0.45	0.108	0.58	0.000	4.17
Mother education (no high school)	-0.59	0.315	-0.77	0.062	-1.89
(high school)	-0.41	0.129	-0.53	0.002	-3.20
(vocational /practical education)	-0.50	0.119	-0.65	0.000	-4.20
Residence Single-parent	-0.32	0.17	-0.41	0.070	-1.83
Foster / Adoptive	-0.23	0.289	-0.29	0.429	-0.79
Mother and stepfather	-0.07	0.226	-0.10	0.742	-0.33
Mother control No control	0.65	0.191	0.84	0.001	3.39
Little control	-0.16	0.147	-0.20	0.298	-1.07
Hard control	-0.05	0.138	-0.06	0.726	-0.35
Constant	2.91	0.308		0.000	9.42
Observations			144		
R^2			0.51		

As expected, the estimated coefficient of cognitive abilities is positive and highly significant. Higher cognitive abilities measured by the IQCRTTEST was statistically associated with a higher grade point averages. Nevertheless, the coefficient is relatively small. An increase of one correct answer in the ICQCRTTEST was associated, on average, with an increase of 0.16 in the average grade point.

In the same way, non-cognitive abilities enter, as expected, negatively and highly significant in the regression. Non-cognitive abilities were measured by the ALC-21 Rotter´s Locus of Control Scale. As expected, the estimated coefficient of non-cognitive abilities is negative and highly significant. Nevertheless, the coefficient is relatively low. An increase of 1 point in the ALC-21 Rotter´s Locus of Control scale was associated, on average, with an increase of 0.07 average grade points.

In line with other similar studies, gender is also found to be associated with high-school performance. Being a female was associated with an average increase in 0.44 in the grade point average relative to being a male. This result was highly significant.

Even though the education level of the mother was found to be statistically associated with higher non-cognitive abilities, and these ultimately were associated with the high-school performance, it appears that the education levels of the mother exerts an additional direct effect on the performance of the students. For example, students with a mother with only a high-school education had, on average and in relation to students with a mother with a university degree, a decrease in the grade point average of 0.41. The coefficient increased in absolute terms to 0.59 in the case of students with mothers with no high-school education, but remains only marginally significant.

4.3.4 Summary of results

Table 4 summarizes the result of this investigation. The education level of the mother has shown to exert an important effect on the grade point average of the students. Students with a mother with no high-school education had, on average and relative to those students with a mother with university education, 0.75 grade points less in their grade point averages. Moreover, students with a mother with a high-school education showed an increase of 0.25 in the grade point averages relative to the previous case.

The education level of the father was also associated with the grade point averages of the students, but this association was weaker in absolute terms than the case of the education level of the mother. Students with a father with no high-school education showed, relative to those students with fathers with a university education, a decrease in their grade point averages of 0.18.
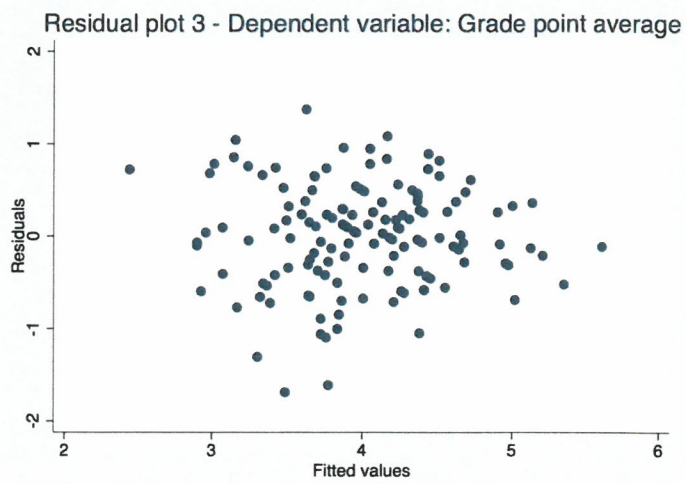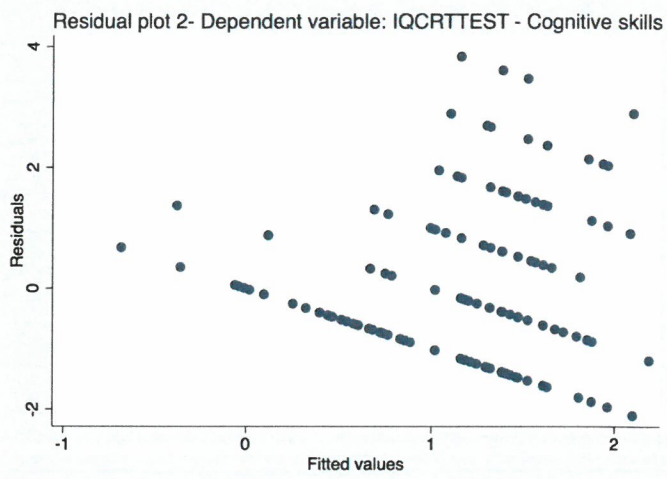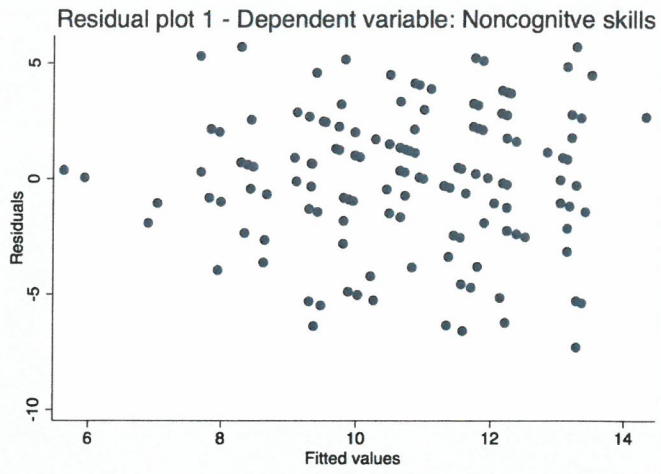
Gender was also related to high-school performance. Being a female was associated, on average, with an improvement in the grade point averages of 0.45 points, relative to being a male. The abuse of substances like alcohol and drugs at home was associated with a decrease in average grade points of 0.2.

The residence configuration under which the students have mostly lived in has also showed to be associated to their high-school performance. Living mostly in a single-parent household was associated, on average and relative to those students living in two-parent households, with a decrease in their grade point averages of 0.41. Living under "foster" conditions was also associated with a decrease in their grade point averages of 0.18. The investigation also finds that living mostly with a mother and a stepfather was associated with a decrease in their grade point averages of 0.17.

Table 4				
Summary of results				
Dependent variable: Grade Point Average				
Significance level: <0.07				
Variable	Indirect effect		Direct effect	Total effect
	Non-cognitive skills	Cognitive skills		
Substance abuse	-2.87	-	-	-0.20
Gender	-	-	0.45	0.45
Month of birth	-	-0.14	-	-0.02
Mother education — No high-school	-2.35	-	-0.59	-0.75
Mother education — High-school	-1.34	-	-0.41	-0.50
Mother education — Vocational educ.	-	-	-0.50	-0.50
Father education — No high-school	-2.63	-	-	-0.18
Father education — High-school	-	-	-	-
Father education — Vocational educ.	-1.52	-	-	-0.11
Residence — Single-parent	-	-0.55	-0.32	-0.41
Residence — Foster/adoptive	-	-0.15	-	-0.18
Residence — Mother + stepfather	-2.40	-	-	-0.17

4.3.5 Residual analysis

The analysis of the residuals is often used to check that the assumptions of the linear regression model hold. The residual plots of the three performed regressions are shown below. The linear regression assumptions seem to hold when the variables related to the family context of the student were regressed against their non-cognitive skills. On the contrary, the cognitive skills of the students seem to be better represented by a non-linear model. The final regression, when the performance of the students was regressed against their family/upbringing conditions, cognitive and non- cognitive skills, seems to fit to a certain extent the linear assumptions. Nevertheless, the constant variance assumption does not seem to hold for higher values of x.

Residual plot 1 - Dependent variable: Noncognitve skills

Residual plot 2- Dependent variable: IQCRTTEST - Cognitive skills

Residual plot 3 - Dependent variable: Grade point average

5 Discussion and conclusions

From different fields of the social sciences, theory and evidence has pointed to the fact that human skill or ability has to facets, cognitive and non-cognitive, and that both are important determinants of human performance or productivity. The results of this investigation are in line with these theories and evidences. Both cognitive and non-cognitive skills have been found to be statistical determinants of high-school performance. Therefore, hypothesis 1 and 2 hold. These results seem to contradict the quite contested hypothesis from Herrenstein & Murray (1994). Moreover, both types of skill seem to be unrelated with each other at this point in time. Therefore, hypothesis 4 also holds. This result seem to be in line with the results of Cunha, Heckman, & Schennach (2010) in the sense that correlations between cognitive and non-cognitive skills fade away as the child grows out of the initial fase of childhood.

This investigation goes a bit further and evaluates how family and upbringing conditions enter this equation. Statistically significant results were found for the following variables related to family and upbringing conditions: substance abuse, gender, education level of the mother, education level of the father, residence configuration and month of birth. Other family related variables such as income, type of caregiver, amount and order amongst siblings, amount of home relocations, marital status of the parents, control exerted by the parents, amount of languages and physical and psychological violence were not found to be significant.

Baumrind´s (1966) categorization of the parenting styles seem to be not fully significant in this investigation. The associations lost significance once other important variables such as the education of the parents and residence configuration were controlled. The only exception was the case of mothers exerting low (negligent) control over the students. This last results is not understood.

In line with many of the past research, the education level of the parents has an important effect on grades, specially the education level of the mother. Both the education of the mother and father exert an important effect on the non-cognitive skills of the students. Nevertheless, and especially in the case of the mothers, much of the effect was not captured by the cognitive and non-cognitive achievement tests. An important finding is that, even though the associated effect is relatively low, the education level of the father exerts a significant influence on the performance of the

high-school students. Other studies such as Barreto (2017) find only significant results for the education level of the mother.

The results also show evidence that females have a statistically higher school performance than males, and that this relation is not mediated by the effects of cognitive or non-cognitive abilities. That is to say that, independent of the cognitive and non-cognitive skills, high-school girls have, on average, a higher school performance relative to boys. Even though other researches have also found this "phenomenon", a straight forward explanation of these findings has not been yet found. Similar results are found in Bronfenbrenner & Morris (2006).

Many of the effects of *a priori* important variables such as marital status of the parents, type of caregiver and control of the parents lost significance when the residence configuration of the students was controlled. These results point to the idea that traumatic events such as the divorce of the parents exert their influence not through the divorce itself, but through reconfiguration of the residential configuration. Significant associations were found for students who had mostly resided with foster or adoptive parents, students who had mostly lived with a mother and a stepfather, and students who had mostly lived in a single-parent environment. Surprisingly enough, an important part of these association was mediated by the effect of these on the cognitive skills of these students.

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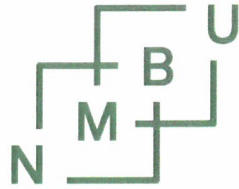
Hei!

Denne undersøkelsen er knyttet til David Goldschmidt sin masteroppgave (samfunnsøkonomi) ved NMBU, som skal se på hvordan elevers oppvekst kan påvirke skoleprestasjon i videregående opplæring. Veilederen er Arild Angelsen ved NMBU.

All informasjon er **100% anonym**, og undersøkelsen **innhenter ikke personidentifiserende opplysninger**. Det betyr at **ingenting vil kunne spores tilbake til deg eller et enkelt elev.** Innhentingen av informasjonen skjer kun i fysisk form (ikke digitalt). Undersøkelsen kan røre ved sensitive tema i ditt liv. Du må ha fylt 16 år for å kunne delta. Spørreskjemaet består av tre deler.

Du har mulighet til å takke nei til undersøkelsen. Dersom du ønsker å avbryte underveis, har du mulighet til det uten å gi videre forklaring. Når du er ferdig, vennligst sett spørreskjemaet inn i konvolutten.

Alle som er med i undersøkelsen er med i **trekningen om gavekort på kinobillett**. Du har 25% sjanser til å vinne en kinobillett. Etter at du har fullført spørreskjemaet, så brukes det en digitalt program som trekker tilfeldig tall mellom 0 og 100. Hver elev har en sjanse. Tallene mellom 25 og 49 vinner.

På forhånd, tusen takk for din deltakelse.
Vennlig hilsen,
David Goldschmidt

Del 1

1) Et balltre og en ball koster til sammen $1.10 . Balltreet koster $1.00 mer enn ballen. Hvor mye koster ballen?

Kilde: Fredrick, S. (2005). "Cognitive Reflection and Decision Making". Journal of Econ. Perspectives.

2) Hvis det tar 5 maskiner 5 minutter å lage 5 gjenstander, hvor lang tid vil det ta for 100 maskiner å lage 100 gjenstander?

Kilde: Fredrick, S. (2005). "Cognitive Reflection and Decision Making". Journal of Econ. Perspectives.

3) I en innsjø, finnes det et område med vannliljer. Hver dag dobles dette området. Om det tar 48 dager for at området dekker hele innsjøen, hvor lang tid tar det for at området dekker halvparten av innsjøen?

Kilde: Fredrick, S. (2005). "Cognitive Reflection and Decision Making". Journal of Econ. Perspectives.

4) Bruk 6 ulike tall for å fullføre kvadratet slik at alle radene, kolonnene og store diagonalene summerer til det samme tallet. Tallene skal tilsammen utgjøre en tallrekkefølge.
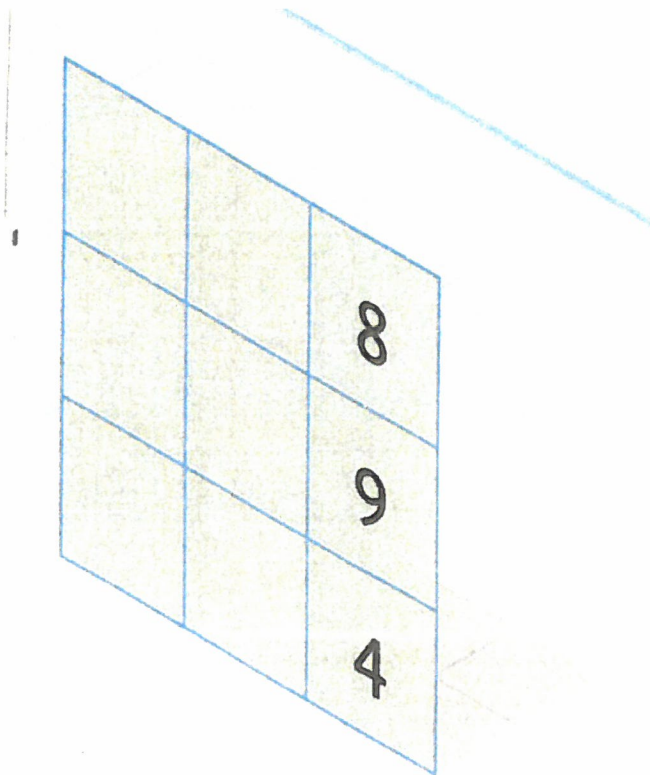
Kilde: Cater, R. (2016). IQ Tests .Carlton Books.

5) Når denne 6 x 6 x 6 kuben er fullstendig, så består den av 216 individuelle blokker. Hvor mange blokker gjenstår for at hele kubben blir fullstendig?
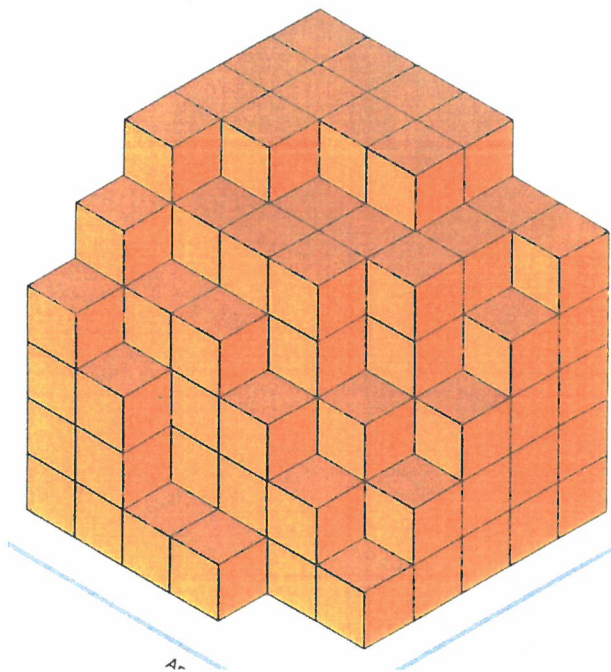
Kilde: Cater, R. (2016). IQ Tests .Carlton Books.

6) Hvilket tall bør erstatte spørsmålstegnet?
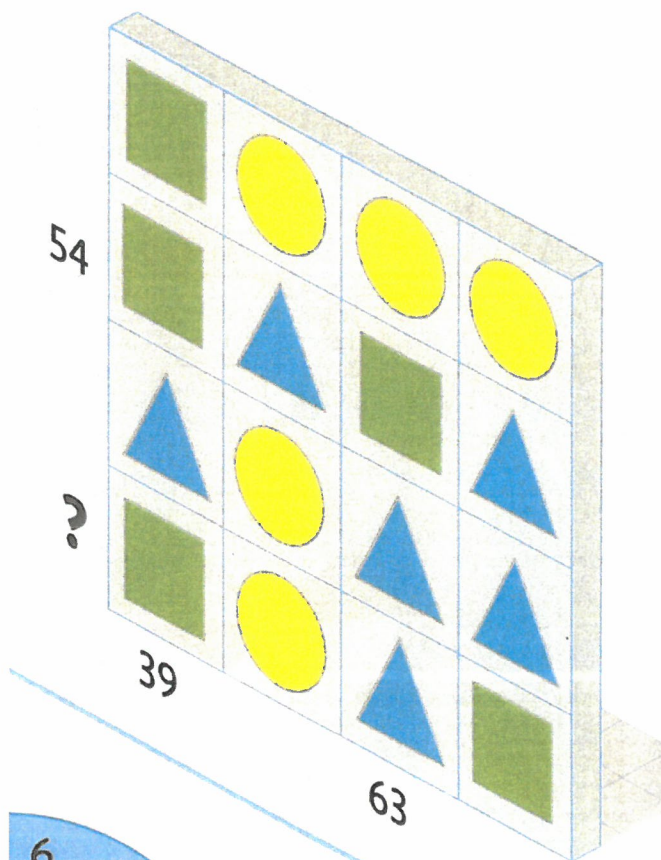
Kilde: Cater, R. (2016). IQ Tests .Carlton Books.

Del 2

1. Marker med "riktig" eller "galt".

	Riktig	Falsk
Jeg går på videregående skole, fordi det var forventet av meg.	○	○
Jeg har i stor grad bestemt mine egne mål for skolearbeidet.	○	○
Noen har talent for skriving, mens andre aldri vil skrive bra uansett hvor mye de prøver.	○	○
Det finnes noen fag som jeg aldri vil gjøre det bra i.	○	○
Noen ganger føler jeg at det ikke er noe jeg kan gjøre for å forbedre min situasjon.	○	○
Jeg føler meg aldri håpløs - det finnes alltid noe jeg kan gjøre for å forbedre min situasjon.	○	○
Jeg ville aldri la sosiale aktiviteter påvirke mine studier.	○	○

	Riktig	Falsk
Å studere hver dag er viktig.	○	○
For noen fag det ikke er viktig å være i klassen.	○	○
Jeg er i høy grad motivert til å oppnå suksess i livet.	○	○
Jeg skriver bra.	○	○
Å gjøre jobben innenfor fristen er alltid viktig for meg.	○	○
Jeg blir lett distrahert.	○	○
Jeg kan lett bli "pratet ut" av skolearbeidet mitt.	○	○
Jeg kan bli deprimert noen ganger, og da er det vanskelig å få gjort det som jeg egentlig skulle gjøre.	○	○
Det vil mest sannsynlig gå galt med meg på et tidspunkt i den nære fremtiden.	○	○
Jeg endrer ofte mine (skole) mål.	○	○

	Riktig	Falsk
Jeg føler at jeg vil bidra positivt til verden hvis jeg jobber hardt for det.	◯	◯
Det har hendt minst en gang at sosiale aktiviteter har hemmet min måloppnåelse i skolen.	◯	◯
Jeg vil gjerne bestå videregående skole, men det finnes viktigere ting i livet mitt.	◯	◯
Jeg planlegger ting bra og jeg holder til planen.	◯	◯

1. Vennligst sett inn dine karakterer på fellesfag i VG1

	1	2	3	4	5	6	IV
Engelsk	◯	◯	◯	◯	◯	◯	◯
Kroppsøving	◯	◯	◯	◯	◯	◯	◯
Kristendom	◯	◯	◯	◯	◯	◯	◯
Norsk	◯	◯	◯	◯	◯	◯	◯
Naturfag	◯	◯	◯	◯	◯	◯	◯
Matematikk	◯	◯	◯	◯	◯	◯	◯

2. Kjønn

◯ Hankjønn

◯ Hunkjønn

3. En primær omsorgsgiver er den/de person/er som er hovedansvarlig/e for å ta vare på deg og forsørge deg gjennom oppveksten. Hvem føler du var din/dine primære omsorgsgivere?

◯ Mamma og Pappa

◯ Mamma (alene)

◯ Pappa (alene)

◯ Besteforeldre

◯ Stemor / stefar

◯ Mamma og Pappa (adoptive)

◯ Fosterforeldre

◯ Andre

4. Hva karakteriserer best din boforhold gjennom oppveksten din?

- ◯ Jeg har bodd stort sett med mamma og pappa.
- ◯ Jeg har bodd stort sett med mamma.
- ◯ Jeg har bood stort sett med pappa.
- ◯ Jeg har bood stort sett med mamma og stefar.
- ◯ Jer har bood stort sett med pappa og stemor.

- ◯ Jeg har stort sett bodd med besteforeldrene.
- ◯ Jeg har stort sett bodd med mamma og pappa (adoptive)
- ◯ Jeg har stort sett bodd med fosterforeldre.
- ◯ Andre

5. Hvor mange søsken har du?

- ◯ 0
- ◯ 1
- ◯ 2

- ◯ 3
- ◯ 4 eller mer

6. Hvilken plass i søskenflokken har du? (eldst til yngst)

- ◯ første
- ◯ andre
- ◯ tredje
- ◯ fjerde eller mer

7. Hvor mange ganger har du flyttet i løpet av oppveksten din?

- ◯ 0-2
- ◯ 2-4
- ◯ 4 eller mer

8. Foreldrene dine er

- ◯ Gift
- ◯ Skilt
- ◯ Ikke gift, men bor sammen
- ◯ ikke gift og ikke bor sammen

9. Hva er den høyeste fullført utdanning til moren din?

○ ikke fullført videregående skole

○ fullført videregående skole

○ fagbrev

○ bachelorgrad

○ mastergrad

○ profesjonsutdanning (lege, psykolog, lektor, etc)

10. Hva er den høyeste fullført utdanning til faren din?

○ ikke fullført videregående skole

○ fullført videregående skole

○ fagbrev

○ bachelorgrad

○ mastergrad

○ profesjonsutdanning (lege, psykolog, lektor, etc)

11. Har du opplevd fysisk vold mellom familiemedlemmer dine gjennom oppveksten?

○ Ja

○ Nei

12. Hvis du svarte "Ja" på spørsmålet 11, hva er din oppfatning av volden du opplevd mellom familemedlemmer dine?

○ Ganske alvorlig

○ Alvorlig

○ Svært alvorlig

13. Har du opplevd fysisk vold rettet mot deg gjennom oppveksten?

○ Ja

○ Nei

14. Hvis du svarte "Ja" på spørsmålet 13, hva er din oppfatning av volden du opplevd rettet mot deg?

◯ Ganske alvorlig

◯ Alvorlig

◯ Svært alvorlig

15. I det året du ble født, hvor gammel var moren din?

◯ <20

◯ mellom 21 og 25

◯ mellom 26 og 30

◯ mellom 31 og 35

◯ mellom 36 og 40

◯ >40

16. Hvor mange språk har du ofte snakket hjemme gjennom oppveksten din?

◯ 1

◯ 2

◯ 3 eller mer

17. Gjennom oppveksten din, hvordan vil du beskrive økonomien i din familie?

◯ god

◯ middels-god

◯ middels

◯ middels-dårlig

◯ dårlig

18. Har du opplevd psykisk vold rettet mot deg gjennom oppveksten?

◯ Ja

◯ Nei

19. Hvis du svarte "Ja" til spørsmål 18, hva er din oppfatning av den psykiske volden rettet mot deg gjennom oppveksten din?

◯ Lite alvorlig

◯ Alvorlig

◯ Svært alvorlig

20. Har du opplevd psykisk vold mellom familiemedlemmer dine gjennom oppveksten?

◯ Ja

◯ Nei

21. Hvis du svarte "Ja" til spørsmål 20, hva er din oppfatning av den psykiske volden du opplevd mellom familiemedlemmer dine?

◯ Lite alvorlig

◯ Alvorlig

◯ Svært alvorlig

22. I hvilken grad har du opplevd tilstedeværelse og oppmerksomhet av foreldrene dine?

	I null grad	I liten grad	I vesentlig grad	I stor grad
Tilstedeværelse av faren din	◯	◯	◯	◯
Oppmerksomhet fra faren din	◯	◯	◯	◯
Tilstedeværelse av moren din	◯	◯	◯	◯
Oppmerksomhet fra moren din	◯	◯	◯	◯

23. Har du opplevd misbruk av alkohol eller stoff hjemme?

◯ Ja

◯ Nei

24. I det skoleåret august 2016 / juni 2017, har du blitt varslet at du er i fare for å overstige den 10% udokumentert fraværsgrense?

◯ Ja

◯ Nei

25. Hvor motivert har du følt med videregående skolen? (1 er lite motivert, og 4 er svært motivert)

○ 1

○ 2

○ 3

○ 4

26. Skriv tallet av måneden du ble født. For eksempel, Januar er 01 og Desember er 12.

27. I hvilken grad føller du at moren din har vært engasjert i de følgende aspekter av din utdanning?

	I null grad	I liten grad	I vesentlig grad	I stor grad
Hjemmelekse	○	○	○	○
Foreldremøter	○	○	○	○
Valg av skole eller studieretning/valgfag	○	○	○	○

28. I hvilken grad føller du at faren din har vært engasjert i din utdanning?

	I null grad	I liten grad	I vesentlig grad	I stor grad
Hjemmelekse	○	○	○	○
Foreldremøter	○	○	○	○
Valg av skole eller studieretning/valgfag	○	○	○	○

29. Hva beskriver best relasjonen mellom deg og foreldrene dine?

	En varm og nær relasjon	En lite varm og lite nær relasjon
Pappa	○	○
Mamma	○	○

30. Hva beskriver best relasjonen mellom deg og foreldrene dine?

	Slapp kontrol	Svak kontrol	Fast kontrol	Sterk kontrol
Pappa	◯	◯	◯	◯
Mamma	◯	◯	◯	◯