



DEPARTMENT OF EDUCATION AND
SPECIAL EDUCATION

PREDICTORS OF EARLY ENTRY TO SPECIAL EDUCATION.

The role of academic self-concept, social anxiety,
and cognitive ability.

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Abstract

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Aim: The purpose of this study is to examine the relationship between psycho-social factors, intelligence and assignment to special tuition in Sweden between 3rd and 4th grade by using the 1972 ETF-cohort (Evaluation Through Follow-up). Academic self-concept, social anxiety, cognitive ability and perseverance were included in the analysis alongside background social variables.

Theory: Horn and Cattell's (1966) theory of fluid and crystal intelligence (G_f and G_c) has been used. Educational psychology has also been applied in order to describe psychosocial factors such as academic self-concept, anxiety and perseverance.

Method: A Zero-Inflated Poisson Model was used to separate the population into two groups, those who did and did not receive special tuition between the 3rd and 4th grades. Two simultaneous regression equations were generated on the basis of these two groups, allowing for the identification of differences between them.

Results: Crystallized intelligence was found to be the strongest indicator of whether a student would attend special education classes at this stage of his or her school career or not, followed by gender, with females being both more likely to attend mainstream classes and less likely to attend special education than males. Academic self-concept was observed to have a significant correlation with attending both special education and non-special education classes.

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Introduction

Since the establishment of a National Curriculum in 1962, special education provision has been a prominent feature of the Swedish education system. Swedish special education “aims to facilitate the child’s learning by delivering an alternative curriculum or alternative teaching strategies” (Persson, 2001). Special education should lead to equal opportunities and is a matter of justice in terms of equal rights to education. While this alternate provision should not lead to the stigmatisation or marginalisation among or of students needing special education resources, Persson (2001) acknowledges that there is a body of research showing that “special education or placement in ‘low-track classes’ is associated with lower self-concept, school deviance and dropping out of school (Stangvik, 1979, Oakes, 1985)” (Persson, 2001).

Assignment to special education classes is a significant event in the academic career of a student. In their study of the mechanisms for identifying students for special education in Swedish schools, Isaksson, Lindqvist and Bergström (2010) found that the identification of students in need of special education could be based on such criteria as disturbing behaviour, poor attendance, and school fatigue, as intimating learning problems:

Many of the regular teachers interviewed had experiences of pupils with school problems including difficulties in specific subjects, behaviour and/or poor attendance at school. Teachers stated that it was not difficult to identify pupils with problems. They intuitively felt when a pupil was in trouble and when they had to be worried about the child. Pupils usually ‘give obvious signals when problems occur’. Boys often are unruly and disturbing, while girls tend to be more introverted, quiet and keep away from school (Isaksson, Lindqvist & Bergström, 2010: 141).

However, their study oversimplifies the process of identifying and classifying pupils with special educational needs by not including medical factors. Difficulties in school could be caused by neurological or neuropsychiatric mechanisms, a phenomenon that is reflected in the use of diagnoses such as Attention Deficit Hyperactivity Disorder (ADHD), and autism (Isaksson et al., 2010).

More broadly, the European Commission notes that the Organisation for Economic Co-operation and Development (OECD) has invited 22 countries participating in its studies of Special Educational Needs to reclassify their national categories into a common three-category framework. This framework consists of:

Category A: disabilities with organic origins where there is substantial normative agreement about the categories (for example, sensory, motor, severe and profound intellectual disabilities).

Category B: difficulties that do not appear to have organic origins or be directly linked to socioeconomic, cultural or linguistic factors (for example, behavioural difficulties, mild learning difficulties, specific learning difficulties and dyslexia).

Category C: difficulties that arise from socio-economic, cultural and/or linguistic factors; some disadvantaged or atypical background that education seeks to compensate for (Source, OECD 2010, cited in European Commission, 2013:10).

This thesis seeks to investigate psycho-social factors in admittance to special education, as observed through questionnaire responses in a longitudinal study, and thus will cover only some parts of categories B and C. However, it is difficult to cover school and learning problems as medical difficulties, since there no such variables in the ETF-data used in the study. The absence of data on

these diagnoses is a limitation in this study. The purpose of this project is to examine the relationship between psycho-social factors, intelligence and assignment to special tuition in Sweden between 3rd and 4th grade by using the 1972 ETF-cohort (Evaluation Through Follow-up). The cohort studied in the project was born in 1972, and the data used in this analysis was collected in spring 1982 when the subjects were in 3rd grade. At this time there were a number of special education programmes in Sweden. EFT data does not specify the type of intervention received by participants, but it is believed that the students recorded as attending special education were taught in groups separate from their non-special education peers.

In this thesis, special tuition and special education are used interchangeably.

Background

In-depth discussion of the indicators of entry to special education will be conducted in the literature review section of this thesis. Nevertheless it is useful to establish some grounding information about the field of special education and one of the psycho-social areas of inquiry in this project: social anxiety.

Special education in Sweden

In 1974, the SIA (Skolans Inre Arbete, in English: The Internal Work of School) investigation coined the term 'action programme'. The investigation proposed that each student would be involved in the analysis of school difficulties that it had emerged that they faced. The pupil would also take part in the decision about what action(s) would be implemented. Subsequently, action programmes were introduced to the National Curriculum in 1980 (Lgr80). Lgr80 stipulated that the local school would describe from an organisational perspective how all these actions would be implemented and monitored. In this way, shortcomings at school level would be identified and corrected once discovered. Bengt Persson comments in his description of Lgr80:

Viktigt i Lgr80 var att det gällde att utgå från varje elevs starka sidor och se programmet i ett utvecklingsperspektiv. Det betonades också att förändringar skulle genomföras på ett sådant sätt att elevens självuppfattning och självtillit stärktes (Persson, 2004: 98). [Important in Lgr80 was that teachers should begin from each student's strengths and see the programme from a developmental perspective. It was also emphasized that the changes would be implemented in such a way that the student's self-perception and self-confidence grew.] (*My translation*).

The Swedish education system saw increased levels of special education provision until the early 1980s, since when it has been "dramatically reduced and most special education now takes place within the comprehensive schools (Emanuelsson & Persson, 1997; Persson, 1998a)" (Persson, 2001). Special education maintains a prominent position within the Swedish education system, but the location of many special education classes within the same physical premises as mainstream groups arguably facilitates greater flexibility of provision, allowing it to be more personalised to an individual's needs.

Social Anxiety

Anxiety is a set of natural responses to threats and dangers, comprising cognitive and behavioural instincts (Zeidner, 2008). Appropriate levels of anxiety are an evolutionary necessity allowing

individuals to make judgements regarding perceived and tangible threats, but when anxiety disorders develop they can have a serious negative impact on an individual's behaviour and quality of life.

A high level of global anxiety is consistently associated with poorer outcomes (Gaudry & Spielberger, 1971). Furthermore, "not only is there a negative relationship between anxiety and school performance, but there is also a moderate but consistent negative relationship between anxiety scales and various measures of intelligence" (Gaudry & Spielberger, 1971: 79). Although it is worth considering that this may also be due to anxious students underperforming on intelligence tests in a similar way to in which they underperform on course exams, it has serious implications for entry to special education, which is often indicated by low intelligence.

Social anxiety differs from general anxiety in that the triggering situations involve interactions with others. Social anxiety disorder can manifest itself in a variety of ways, from irrepressible blushing and crippling shyness to social withdrawal and depression (Lipczynska, 2008). For school aged children, social anxiety can be triggered by daily classroom interactions and activities, and as such it negatively impacts their experiences of schooling and can act as a trigger of behaviours deemed troubling and requiring special tuition outside of the mainstream group.

Literature Study

Achievement (in terms of reading and mathematical ability in this thesis) and special education are inextricably linked. Achievement, or lack thereof, is both an entry criterion to special education programmes and a means of judging whether the outcomes of such programmes can be considered successful. The effects of self-concept on achievement are a well-established area of study within educational psychology, as are, to a lesser extent, the effects of social anxiety on educational outcomes. This literature study aims to outline the fields of academic self-concept, social anxiety, cognitive ability and perseverance; and how these constructs relate to special education. Given that low achievement is frequently a precursor for children being considered for special education, consideration will also be given to the effects that these constructs have on academic achievement.

In this section constructs such as academic self-concept, social anxiety, cognitive ability and perseverance will be described in relation to non-special education persons and special education persons. The reason is that this thesis uses a two process statistical technique (Zero-Inflated Poisson Modelling) to predict those who enter into special tuition programmes and those who never enter.

Academic Self-Concept

Self-concept is a well-established area of study within educational psychology. It is widely acknowledged as a key psychological indicator for multiple outcome measures. Shavelson, Hubner and Stanton's widely accepted definition of self-concept (e.g. Marsh, Abduljabbar, Parker, Abdelfattah, Nagengast, Moller & Abu-Hilal, 2015; Liem, McInerney & Yeung, 2015; Niepel, Brunner & Prekel, 2014; Liou, 2014; Hardy, 2014) gives a broad definition of the construct as "a person's perception of himself. These perceptions are formed through his experience with his environment, perhaps in the manner suggested by Kelly (1973), and are influenced especially by environmental reinforcements and significant others" (Shavelson, Hubner & Stanton, 1976: 411). The self-concept construct is "potentially important and useful in explaining and predicting how one acts. One's perceptions of himself are thought to influence the ways in which he acts, and his acts in turn influence the ways in which he perceives himself" (Shavelson et al., 1976: 411). According to this understanding, Marsh (1993) notes, "evaluations can be made in relation to absolute standards or relative standards such as the accomplishments of peers or the perceived evaluations of significant others, and the evaluative importance placed on different components may differ" (Marsh, 1993: 60).

Self-concept is organised in that self-perceptions are based on a vast quantity of experience, such that “to reduce the complexity of these experiences, a person recodes them into simpler forms, or categories (Bruner, 1958)” (Shavelson et al. 1976: 412). The structure of categories used to organise this data can be viewed as a reflection of an individual’s culture, so a child’s experience is coded around school, friendships and family. The multifaceted aspect of self-concept reflects the categorical system which may be adopted by the individual or may be common across a social group.

As a multifaceted concept, self-concept can be positioned as hierarchical, from “individual experiences in particular situations at the base of the hierarchy to general self-concept at the apex” (Shavelson et al., 1976: 412). As such, it is possible that general self-concept divides into academic and non-academic self-concepts, and from there academic self-concept splits into subject areas and further still into discrete areas within subjects. Likewise, non-academic self-concept branches into social and physical self-concepts, and again into discrete sub-categories.

Academic self-concept is an individual’s self-belief about his or her academic skills and performance. It is a preferred variable when looking at the psychological indicators of school adjustment and scholastic outcomes as it measures how students perceive themselves in a school setting. Within academic self-concept there are multiple aspects; subject specific academic self-concept is distinct from global academic self-concept in that it relates to performance and experience of discrete subject areas such as mathematics or sports performance. Self-concept forms and develops throughout childhood, starting prior to entering the educational system, so that:

Children enter school with a predisposition towards achievement or failure already fertilised by the qualities of parental interest, love and acceptance offered them. This fairly firm picture of its self-worth provides the child with an array of self-expectations about how he will cope in his school work and how others will react to him as a person. Each pupil is already invisibly tagged, some enhancingly by a diet of nourishing interest and affection, and others crippled by a steady downpour of psychic blows from significant others denting, weakening and distorting their self-concepts (Burns, 1982: 201).

Schooling can alter the subsequent trajectory of self-concept development, but the foundations are laid in the home during early childhood. Marsh and Martin (2011) note that “self-concept is regarded as a highly important and influential factor in that it is closely associated with people’s behaviours and various emotional and cognitive outcomes such as anxiety, academic achievement, happiness, suicide, deficient self-esteem, etc. (Branden, 1994)” (Marsh & Martin, 2011: 59-60) and that “self-concept enhancement is seen as a central goal of education and an important vehicle for addressing social inequities experienced by disadvantaged groups (see Marsh & Craven, 2006)” (Marsh & Martin, 2011: 60).

As a measure of self-belief, self-concept is frequently used interchangeably with self-esteem and self-efficacy, but while “theoretically, self-concept, self-esteem, and self-efficacy beliefs share a common emphasis on an individual’s beliefs about his or her attributes as a person” (Valentine, DuBois & Cooper, 2004:112), self-esteem relates to beliefs about evaluations of self-concept, and self-efficacy is one’s belief that one can organise and carry out actions, making them distinct from self-concept.

Shavelson et al. contend that “self-concept is inferred from a person’s responses to situations” (Shavelson et al., 1976: 411), where “the situations and the responses may be physical or symbolic” (Shavelson et al., 1976: 411). They identify seven features key in the definition of the self-concept construct: it is organised, multifaceted, hierarchical, stable, developmental, evaluative, and differentiable.

Self-concept is a stable construct, despite the fact that when descending the self-concept hierarchy “self-concept depends increasingly on specific situations and thus becomes less stable” (Shavelson et al., 1976: 412-413). At the lowest levels, self-concept is highly variable as situations alter, but this effect is minimised by the pyramid structure of the concept, so that “to change general self-concept, many situation-specific instances, inconsistent with general self-concept, would be required” (Shavelson et al., 1976: 413). It is developmental in that infants do not perceive themselves as distinct from their surroundings, while:

As children begin to build concepts, as represented by the words *I* and *me*, they also begin to build concepts for categorizing events and situations [...] with increasing age and experience (especially acquisition of verbal labels), self-concept becomes increasingly differentiated. As the child coordinates and integrates the parts of his self-concept, we can speak of a multifaceted, structured self-concept (Shavelson et al., 1976: 414).

The construct is evaluative as while self-descriptions develop in certain situations (or categories of situations), evaluations of the self are also developed in relation to these situations; evaluations may be made between the self and the ‘ideal’ (absolute standards), or against ‘peers’ (relative standards). It is worth noting that:

The evaluative dimension can vary in importance for different individuals and also for different situations. This differential weighting of the importance of the various evaluative dimensions probably depends upon the individual’s past experience in a particular culture, in a particular society, and so on (Shavelson et al., 1976: 414).

The final feature of self-concept is that it is differentiable, that is, distinct, from the other constructs to which it is theoretically related. Assuming that “self-concept is influenced by specific experiences [...], the more closely self-concept is linked with specific situations, the closer is the relationship between self-concept and behaviour in the situation” (Shavelson, 1976: 415), self-concept in a particular academic discipline would be more closely related to achievement in that discipline than in another discipline.

In summary, Shavelson et al.’s definition of self-concept “emphasized the importance of social influences and self-attributions, and asserted that although self-concept is a hypothetical construct, it can nonetheless be useful in explaining and predicting behaviour” (Marsh & Martin, 2011: 61). While some researchers have attempted to position self-concept as unidimensional, this project takes the view that it is multidimensional, which is in line with the broad acceptance and support which the multidimensional understanding of self-concept receives in the field of “educational psychology with its focus on ASC [Academic Self Concept] and its relation to academic achievement, school grades, student learning, and other academic outcomes” (Marsh & Martin, 2011: 62).

The OECD has asserted that self-concepts are “closely tied to students’ economic success and long-term health and wellbeing” (OECD, 2003: 9), and as Marsh and Martin note, these “play a critical part in students’ interest in and satisfaction at school, underpin their academic achievement, and constitute a very influential platform for pathways beyond school (Ackerman, 2003; Marsh, 2007; Marsh, Hau, Artelt, Baumert, & Peschar, 2006)” (2011: 60), making self-concept a particularly pertinent factor in predicting a number of long term outcomes.

Self-concept and special education

Self-concept in individuals in special education differs from those in mainstream groups, being typically lower. In their study of changes in the self-concept of children in remedial education, Boersma, Chapman and Battle found that for learning disabled students, “full-time placement was accompanied by statistically significant increases in academic self-concept, especially in the areas of reading/ spelling and confidence” (Boersma, Chapman & Battle, 1979: 433). A possible cause for this rise in self-concept among special education students is suggested by Festinger (1954). Festinger proposes that an individual’s self-beliefs have a subsequent effect on his or her behaviour and that the “holding of incorrect opinions and/or appraisals of one’s abilities can be punishing or even fatal in many situations” (Festinger, 1954:117). These self-beliefs are subjective and are formed through comparisons with social peers, and thus an individual’s deviation from the group norm would affect the accuracy of his or her self-perception. Consistent with this theory, Boersma et al. noted that:

Strang, Smith, and Rogers (1978) [...] found that self-concepts of academically handicapped children were influenced by whether special class placement was full- or part-time. Self-concepts tended to be higher when other children with learning problems were the main reference group, and to decline when self-comparisons were restricted to regular class children (Boersma et al., 1979: 434).

Boersma et al. argue that when evaluating the effectiveness of special education programmes in increasing students’ levels of self-concept, this peer-reference group factor should be considered, and that “if remedial programmes include the evaluation of self-concept variables, school personnel should be aware that change or lack of change in academic self-concept may be an artefact of grouping rather than a function of the programme per se” (Boersma et al., 1979: 434).

Boersma et al.’s study comprised three groups of students: Adaptation (students with severe learning disabilities), Opportunity (students who were classed as “educable mentally handicapped” (Boersma et al., 1979: 434)), and Regular (a mainstream group). The study was a two-wave investigation of academic self-concept, and the results showed a “statistically significant gain of 5.94 points ($F = 13.10, p < .01$) occurred for the Adaptation group, and 7.39 points ($F = 7.33, p < .01$) for the Opportunity group” (Boersma et al., 1979: 437), but no noticeable increase in levels of self-concept for the Regular group ($F = .20, p = \text{NS}$) (Boersma et al., 1979: 436).

It was also noted that in the post-testing phase the two special education groups raised their self-concept levels to “a level close to that of the Regular class subjects” (Boersma et al., 1979: 437). Interestingly, the Adaptation group’s children “still obtained scores that were statistically different from the Regular group ($F = 4.60, df = 1,148, p < .01$), but this was not the case for Opportunity children $F = 2.52, df = 1,148, p = \text{ns}$ ” (Boersma et al., 1979: 437). These results suggest that full-time attendance in a special education programme leads to an improvement in academic self-concept. This might best be summarised by Boersma et al.’s conclusion that:

Since increases in academic achievement are frequently followed by commensurate increases in school related self-perceptions (Wells & Marwell, 1976), it seems logical to assume that the improvements observed in this study resulted from achievement gains made by the special class students (Boersma et al., 1979, 439).

The alternate explanation offered for this observed increase in academic self-concept is Festinger’s (1954) theory of self-belief being developed relative to social surroundings; “thus, self-perceptions of ability for Adaptation and Opportunity children may lead to a significant enhancement of academic self-concept, not necessarily because cognitive gains lead to normal academic achievement levels, but

because the academic comparison referent group has been altered” (Boersma et al., 1979: 440), comparing oneself to others of similar abilities may increase one’s self-perception. Also, Girma Berhanu (2010) reports that some Swedish studies have found a positive effect between inclusion and pupils’ self-concept.

Thus, we can hypothesize that children attending receiving special tuition will hold higher levels of academic self-concept than their peers in mainstream classes.

Social Anxiety

Anxiety is an essential human emotion, moderating reactions to a future threat or environmental danger though “a loosely coupled ensemble of cognitive, affective, somatic arousal, and behavioural components” (Zeidner, 2008: 424). It allows us to react in an appropriate way to tangible threats, for example avoiding contact with an item that resembles a snake lest it be a real snake. When we experience anxiety, the emotional response can often be described as “unpleasant feelings of tension and apprehension; worrisome thoughts and self-ruminative cognitions; and perceived emotional arousal, accompanied by heightened activity of the automatic nervous system” (Zeidner, 2008: 423).

While low levels of anxiety are appropriate and are often viewed as an evolutionary necessity, it is pertinent to note that “when anxiety goes awry and becomes excessive, irrational, or leads to a dread of daily routine situations or events, it can cause untold psychic pain and discomfort and develop into a host of disabling and costly anxiety disorders” (Zeidner, 2008: 435). These disorders include generalized anxiety disorders, panic attacks, and social phobia or anxiety and impact on an individual’s mental health and functioning.

However, the role of anxiety in determining academic outcomes is not clear-cut. Much like with self-concept, anxiety can be viewed as a hierarchy of related constructs. Sub-categories of anxiety include general anxiety, test anxiety, academic anxiety and social anxiety. Anxiety, more specifically subject-specific anxiety, has a proven negative impact on attainment in subject-specific areas (e.g. Rosen & Maguire, 1990 and Ashcraft & Ridley, 2005). It has been suggested that anxiety might have a dissuasive effect on a student’s school performance in that it “may explain student feelings of helplessness following failure (Cole et al. 1999), which lead to terminating further attempts at the task (Burhans and Dweck 1995). In the academic environment, a person’s response to failure has enormous implications for one’s ability to learn new material” (Levine, 2008: 63). Academic anxiety and its effect on attainment have been addressed in experimental and educational psychological studies for several decades (e.g. Gaudry and Spielberger 1971, Hembree 1988, and Seipp 1991). It is acknowledged that “academic anxiety interferes with achievement and performance, as well as social and psychological development among children and adults” (Levine, 2008: 62).

A commonly researched aspect of anxiety in education is test anxiety. Test anxiety is anxiety stemming from and relating to academic testing. It has an impact on academic outcomes as it:

Appears to be inversely related to test performance (Mandler and Sarason 1952; Wine 1971), course grades or grade point average (GPA; Hembree 1988), and recall of knowledge (Tyron 1980). That is, the more test anxiety a person experiences, the lower their test performance, and related scores. (Levine, 2008: 69).

It has also been noted that “test anxiety appears to increase as ability level decreases” (Levine, 2008: 69), so it can be observed at higher levels in weaker students than stronger ones, and presents disproportionately in lower ability groups. DiMaria and DiNuovo (1990) found that the nature of test anxiety differs between genders; in female subjects it was found to be facilitating, while in males it was found to be debilitating. These different presentations of test anxiety do not “necessarily reflect differences in worry and/or arousal level; the facilitating or debilitating effect may be due to the

person's expectancy of being able to cope with the situation" (DiMaria & DiNuovo, 1990: 528). While test anxiety is a common manifestation of anxiety in school settings, it is not a condition that colours all aspects of school experience. As this project aims to investigate the determinants of entry to special education, a sub-type of anxiety which affects the daily interactions of individuals within the school system is preferred. For this reason, social anxiety is the construct under consideration.

Unlike self-concept, there is no general consensus in the literature on the link between social anxiety and outcomes. Do socially anxious individuals achieve less well than their non-anxious peers, or does social anxiety have no impact on scholastic outcomes? As a trait of anxiety disorders is an increasing aversion to engaging with the cause of anxiety, it would stand to reason that socially anxious individuals would receive less of an education than their peers. If students cannot or will not engage in group activities or demonstrate their abilities in front of others, they will not be able to meet all the objectives of a lesson and as a result will not succeed as much as their classmates.

Taking a definition of social anxiety as being "characterized by extreme distress and/or avoidance of situations in which the individual fears criticism or embarrassment" (Strahan, 2003: 347), Strahan conducted a two year longitudinal study of the effects of social anxiety on undergraduate students with self-reported social-anxiety, and found that "social anxiety did not emerge as a significant predictor of college persistence or GPA [Grade Point Average]" (Strahan, 2003: 347). Although "trait social anxiety at high (or even clinical) levels is quite prevalent within a college population" (Strahan, 2003: 348), much of the evidence of its effects on students suffering from it and their academic integration is only indirect.

Anxiety and special education

Custodero (2013) writes in his dissertation that students with learning disabilities experience failure on an almost daily basis in school. Consequently, individuals with learning difficulties tend to score higher on anxiety tests or items within a questionnaire than their non-learning disabled peers. Feelings of worry concerning performance situations in school can affect how students perceive themselves. Custodero summarises the experience of testing for learning disabled students with anxiety thus:

Moreover, anxious individuals derive their feelings of distress by focusing on the negative aspects of the testing situation (Vasey, El-Hag, & Daleiden, 1996; Vasey & MacLeod, 2001). For example, a person taking a math exam will think about the problems he or she might get wrong instead of focusing on what he or she is doing correctly. This individual would further catastrophize the testing situation by worrying about his or her sweaty palms or the quarter grade. [...] Test-anxious individuals in Meichenbaum and Butler's study used negative internal dialogue such as "I just can't do this" or "I'm not smart enough to pass this test." [...] Children without learning disabilities who continue to focus on the test-taking events are called anxiety sensitive (Custodero, 2013:13).

Experience of failure in school is also associated with higher test anxiety which manifests itself, for example, when faced with standardized ability tests: subsequently, individuals with a high level of anxiety tend to develop negative attitudes toward testing.

The hypothesis derived from this reasoning is that we can expect that students who receive special tuition worry, while those students who do not enter special education programmes do not worry about things in school.

Cognitive Ability

Cognitive ability can be read as synonymous with intelligence. It is the capacity to understand and

interpret the world around us and includes memory, information processing, reasoning, deduction, decision making, and evaluation skills. Cognitive ability is a crucial measure of ability and has long been used to identify potentially successful individuals. In academically selective school systems, cognitive testing (usually in the form of verbal and non-verbal tests) is used to select students. As a readily measurable concept it is commonly held to be a determinant of outcomes and personality.

Two of the most widely accepted keystones in the development of theories of intelligence are Spearman's (1927) theory of general intelligence and Horn and Cattell's (1966) theory of fluid and crystal intelligence. Spearman's theory posits that there are general (*g*) and specific (*s*) factors to intelligence which underlie all facets of cognitive ability. Spearman placed more emphasis on the *g* factor, as it is pervasive across the full spectrum of intellectual activity. As Bickley, Keith & Wolfe summarise:

Spearman described *g* as “something analogous to an ‘energy’; that is to say, it is some force capable of being transferred from one mental operation to another different one” (reprinted in Anastasi, 1965, p. 27). It is this universality of *g* that explains why all tests of intellectual ability, as well as observations of intelligence, are correlated. Specific and broad abilities are saturated with *g*, and as far as the use of different measurement tools are concerned, they are all measuring essentially the same thing, demonstrating what Spearman labelled “the indifference of the indicator” (p. 27) (Bickley, Keith & Wolfe, 1995: 310).

Thus, with one measure of intelligence it is theoretically possible to estimate all spheres of cognitive ability in a given individual.

Horn and Cattell's (1966) theory of fluid and crystal intelligence (G_f and G_c) “seriously questions the notion that there is a unitary structure which can be designated general intelligence” (Horn & Cattell, 1966: 253). The theory “argues that the primary abilities which can be said to involve intelligence to any considerable degree are organized at a general level into two principal classes or dimensions” (Horn & Cattell, 1966: 253-254). The two dimensions (G_f and G_c) measure two key facets of intelligence. G_f can be seen as “the major measurable outcome of the influence of biological factors on intellectual development—that is, heredity, injury to the central nervous system (CNS) or to basic sensory structures, etc” (Horn & Cattell, 1966: 254), while G_c is “the principal manifestation of a unitariness in the influence of experiential-educative-acculturation influences” (Horn & Cattell, 1966: 254).

Although it originally identified five broad factors forming intelligence, the theory has subsequently been revised so that “in its current representation, there are eight broad factors of cognitive abilities: G_f , fluid reasoning; G_c , comprehensive knowledge; G_v , visual processing; G_a , auditory processing; G_s , processing speed; G_{sm} , short-term memory, G_{lr} , long-term retrieval, and G_q , quantitative ability” (Bickley et al., 1995: 310). It has been argued that the fluid-crystal theory “holds implications for human development and intelligence” (Bickley et al., 1995: 311) as some of the abilities it recognizes have been shown to decline with age, while others increase or remain stable (Horn, 1991, cited in Bickley et al., 1995).

Arguments have been made for the factors of the fluid-crystallised theory loading onto a second-order factor (*g*) (e.g. McGrew, Werder & Woodcock., 1991; Undheim & Gustafsson, 1987), but an alternate structure is the three stratum theory of intelligence. As summarised by Bickley et al., this theory suggests a hierarchical structure of intelligence, with *g* at the apex, a middle stratum of several broad abilities and a first layer comprising many different abilities. What makes this model distinct from other hierarchical models of intelligence is that it “combines dimensions of two well-

established, competing theories into one unified model” (Bickley et al., 1995: 311), namely the g and G_f - G_c models.

In an investigation of the three-stratum theory of intelligence, Bickley et al. (1995) found no indication of age contributing to any significant changes in the structure of intelligence. While other researchers have focused on levels of intelligence and how these might change over time, Bickley et al. suggest that the organisation of intelligence is constant. They also accepted the three-stratum model, noting highly significant standardized factor loadings on g .

Cognitive ability and special education

Diminished cognitive ability is often believed to be a primary cause for admission to special education programmes. However, this is not necessarily the case. For the cohort studied, transfer to special education units was anecdotally used as a form of ‘punishment’ for children who misbehaved or did not conform to expected standards of academic and social behaviour.

Forness, Keogh, Macmillan, Kavale, and Gresham (1998) suggest that, in America at least, low intelligence only accounted for around 11% of learning disabled children. Critics of special education question its effectiveness, but Forness et al. acknowledge that there is “substantial empirical evidence attesting to the impact of special instruction on problem learners” (Forness, Keogh, Macmillan, Kavale & Gresham, 1998: 316): while Detterman and Thompson argue that “special education methods [...] will simply be bad replicas of the standard educational intervention, which are already known to work poorly” (Detterman & Thompson, 1997: 1083), Forness et al. contend that this claim is unsupported by data.

When it comes to the characteristics of students referred to special education programmes, the crucial point to consider is that these students:

Have been failed by general education. It is one thing to debate whether these children ‘really have mental retardation’ or ‘really have learning disabilities’; it is quite another to suggest that these children can be successful in the same general education classes, when they have failed in that setting for 1 or more years (Forness et al., 1998: 318).

Special education programmes offer smaller classes and are a chance for children who have not succeeded in mainstream situations to receive the support they need. As Forness et al. argue the success of special education should not be judged in terms of whether students achieve at the same level as their non-special education peers. The children who attend special education programmes “represent the cases general education could not help. They represent some of the hardest-to-teach children enrolled in the public schools. They come with histories of failure, depreciations of self, low expectations for success, and other debilitating characteristics” (Forness et al., 1998: 318), meaning that they can be expected to have a variety of psycho-social barriers to attainment, in addition to the diagnostic criteria which saw them admitted to such a programme.

Given that low intelligence is not the sole reason for referral to special education programmes, to what extent can we expect participants in these schemes to differ intellectually from the general population?

In their synthesizing study of the nature of learning disability, Kavale and Nye note that “although [learning disability] has been viewed primarily as a problem of underachievement, concern has focused historically on problems associated with oral language, written language, and perceptual-motor processes (Weiderholt, 1974)” (Kavale & Nye, 1985: 443). Their synthesis of 1077 studies looking at the intellectual differences between learning disabled (LD) and non-learning disabled (N) individuals, yielded a mean effect size (ES) of .660 (SD .585 and SE .018), with a range of ES of -2.17 to +3.28, and with a median ES of .720, indicating that “approximately 75% of the LD

population differs from the N group across measures of achievement, neuropsychological, linguistic, and social/behavior characteristics” (Kavale & Nye, 1985: 448). Kavale and Nye found that “about three out of four LD subjects demonstrated deficits across domains that distinguished them clearly from their N counterparts by approximately 25 percentile ranks on the average” (Kavale & Nye, 1985: 448). Students categorised as requiring special education can thus be expected to perform at lower levels than their non-special education peers, but we should also expect to see a level of differentiation between individuals in special education similar to the one observed in mainstream classrooms.

The hypothesis drawn from the literature is that students attending special education will demonstrate lower levels of cognitive ability than their mainstream peers.

Perseverance

Perseverance is the ability to continue with an activity despite discouragement, difficulties or obstacles. In their study of task perseverance among pre-school children, Wyer and Bednar question whether individuals “spend a longer time working at an easy task if they have previously failed, or if they have previously been successful” (Wyer & Bednar, 1967: 255) and whether similar results are observed when a task is difficult. 60 pre-school children were tested in the experiment, using three tasks to determine the effect of success and failure on perseverance. Wyer and Bednar found that in the group studied “success primarily increases the cost of failure, while failure primarily increases the reward value of subsequent success” (Wyer & Bednar, 1967: 263). These results were noted to be consistent with an exchange formulation of motivational behaviour (such as Thibaut and Kelley, 1959) but not with Atkinson’s (1957) achievement motivation theory.

Perseverance and special educational needs

Prior research on the relationship between conscientiousness (e.g., persistence) and school type (special education class as opposed to mainstream class) is lacking. Meijer et al. (2006) conducted an exploratory factor analysis of the social-emotional characteristics and the special educational and pedagogical needs of students in the last grade of primary education. All schools included in the study were located in the south west of the Netherlands and were randomly selected; the final sample size consisting of twenty-four mainstream primary schools with a total of 604 students, and four special primary schools with a total of 80 students (684 students in total). In addition to data gathered from student questionnaires, the teachers in these 28 schools also answered questionnaires.

The results from the teachers’ questionnaire showed that among the teachers, lack of conscientiousness was considered the strongest social-emotional factor identified. The examples given of the items asked were: “Does not find the lessons interesting”, “Does not work accurate”, and “Does not pay attention in class” (Meijer et al., 2006:390). The initial dimensions identified in the analysis were further reduced down to a new factor named “lack of a positive attitude towards school” (Meijer et al., 2006:391). This new factor contained items linked to disagreeableness and lack of conscientiousness. The correlation between disagreeableness and lack of conscientiousness was $r = 0.63$ ($p < 0.000$). However, when conducting a regression analysis for predicting school type (whether a student was referred to special education), IQ was the strongest predictor followed by lack of conscientiousness. Additionally, lack of attention could also imply organizational difficulties, such as not knowing how to work systematically with school related tasks (Mintz, J., 2010).

The hypotheses derived are that students who enter special tuition will not be able to keep concentration when they do mathematics and writing in school, and give up more often when they are faced by a difficult task in school.

Gender and special education

According to a Swedish National Investigation (SOU 2010:99) boys are overrepresented in special educational programmes. This preponderance of boys in special tuition placements comes despite the fact that the boys receive more resources than girls, according to The Swedish National Agency for School Improvement (Myndigheten för Skolutvecklingen, 2003). The gender imbalance of special education provision is not unique to Sweden, with Anderson (1997) citing American figures, whereby:

The US Department of Education reported 72% of the learning disabled population as male, 28% female (Lerner 1993). Other estimates range as high as fifteen to one, males to females, in learning disabilities programmes (Vogel 1990). In 1992, the state of Iowa reported their population of learning disabled to be approximately 70% male, 30% female (Kavale and Reese 1992) (Anderson, 1997: 151-152).

It is therefore reasonable to hypothesize that in the population to be analysed in this project, there will be a higher ratio of boys than girls in special education classes.

Social background and social class

In addition to the psychological factors in determining entry to special education, it is important to consider the effect social background can have. Social background is widely held to affect general educational outcomes, and thus consideration of two elements of this, social class and the influence of significant others is pertinent. Given that low attainment in mainstream teaching is frequently a distinguishing feature of children entering special education, achievement is given a prominent position when discussing the literature surrounding social background and outcomes.

Bourdieu's Theory of Social and Cultural Reproduction (1973) proposes that the educational system has a built-in bias towards children of higher social status. It is well established that children of more economically advantaged backgrounds outperform their less advantaged peers, providing a strong basis for using variables that measure social status and educational capital as mediators in this investigation.

Experiences of education are influenced by sociological, as well as psychological, factors. The educational system is charged with transmitting knowledge and culture from one generation to the next. However, in delivering this, it "puts into practice an implicit pedagogical action, requiring initial familiarity with the dominant culture" (Bourdieu, 1973: 80), and demands from all participants a level of pre-existing knowledge only available to those with prior exposure to culture. Engagement with the arts and cultural institutions is skewed towards those of higher social status (where higher levels of education are understood to be indicative of higher social status).

While strides towards educational and social equality and inclusion have been made by many governments in the four decades since Bourdieu wrote *Cultural Reproduction and Social Reproduction*, the notion that children from lower social backgrounds are effectively 'locked out' of education still holds sway. In her survey of Bourdieu's theory, Sullivan (2002) notes that:

We have evidence that the dramatic fall in the material costs to families of education due to educational reforms, such as the universal provision of free and compulsory secondary education, have not diminished the degree of association between class origins and educational attainment (Shavit and Blossfeld, 1993; Halsey et al., 1980). This suggests that the educational advantage which higher-class parents pass on to their children may not be entirely caused by economic factors, and that the notion of cultural capital is therefore worthy of serious attention (Sullivan, 2002: 146).

We can therefore assume that despite investment in education, cultural capital is a determining factor to attainment.

Measuring the cultural capital of children is outside the scope of this project. If we retain the assumption that children with higher levels of cultural capital will come from families with higher social status, we can effectively position social background and levels of parental engagement (ascertained by parental educational expectations) as mediating factors in the research.

Social status is transferable between generations, and class of origin has an impact on children's future status. As Johnson, Brett and Deary (2010) note, "previous studies have established that family social background and individual mental ability and educational attainment contribute to adult social class attainment" (Johnson, Brett & Deary, 2010: 55). On the relationship between social class and educational attainment, it is pertinent to consider that:

Educational attainment is [unequivocally] directly related to social class attainment if only because many occupations accorded higher social class status such as the practices of law and medicine require specific educational credentials while in many others higher education credentials are so common that those without them have trouble gaining entry and may be limited in opportunity even after entry (Johnson et al., 2010: 56).

Strong educational performance is associated with higher social outcomes, but this leads to a self-perpetuating cycle of educational and social advantage.

In their multigenerational study on the association between ability and social class attainment, Johnson et al. found that:

Social class of origin predicted educational attainment in all three generations, educational attainment fully mediated the associations between social class of origin and social class attainment, childhood mental ability predicted both educational and social class attainment, and educational attainment contributed directly to social class mobility (Johnson et al., 2010: 63).

The study used participants from the Lothian Birth Cohort 1921 Study and tracked the education and social class of the participants' fathers, the participants' education, social class, and childhood mental ability, and the education and social class of their offspring to determine that "education is the fundamental mechanism acting both to hold individuals in the social class to which they were born and to make possible their movement from one class to another" (Johnson et al., 2010: 64).

As Pintrich and Schunk note, "the link between socioeconomic status and children's academic motivation is well established (Meece, 1997). Children from lower socioeconomic backgrounds typically display lower academic motivation and achievement and are at greater risk for school failure and dropout (Borkowski & Thorpe, 1994)" (Pintrich & Schunk, 2002: 389), indicating how social class of origin can impact on outcome measures in a number of different ways. As "innumerable other studies have shown a relationship between achievement in school and social class" (Choppin, 1968: 213), another possible explanation for the differentiation of academic outcomes among different social classes can be the type of school a child attended. The streaming of children into different schools based on ability arguably reached its zenith in England in the mid-twentieth century. Following the 11-plus exam at the end of primary school, children attended grammar, secondary modern or technical schools. A fourth type of school, the public school, was also in operation, but as fee-paying institutions these were economically selective. Choppin noted that the intakes of the different types of school were split along social lines, so that:

The 'blue-collar' workers' children go mostly to modern schools; the 'white-collar' workers' children contain a much higher proportion of grammar school pupils, and the children of the 'professional' classes are to be found almost exclusively in grammar and public schools (Choppin, 1986: 214).

In addition to this social segregation of school populations "the different curricula in grammar and modern schools tend to accentuate the original distinction, so that by the third form we find the enormous gap already noted" (Choppin, 1968: 214), which led to social class having a more marked effect on attainment than in other studies.

The attainment-class gap in mid-twentieth century England was so much more pronounced than in many other countries that Choppin contemplated:

It seems improbable that Germany, Sweden and the rest lack very intelligent pupils or that Israel and Belgium lack unintelligent pupils. There seems no immediate reason to suppose that the correlation between social class and intelligence should be much higher in England than in other countries (Choppin, 1968: 215).

An explanation offered was that large numbers of children in the countries included in Choppin's report on the International Study of Achievement in Mathematics¹ dropped out of school between age 13 and the final year of school. The figure was 88 percent for England, of which the vast majority came from a 'blue-collar' background. Choppin suggests that the link to school completion and social class affects attainment in that:

The traditional expectations of those who stay on at school and those who leave help to determine parental attitudes, student motivation and hence performance at age 13. Conversely, performance at age 13 naturally influences decisions on which children want to stay at school and which want to leave as soon as they can. The traditional pattern tends to repeat itself, which further strengthens the tradition (Choppin, 1968: 216).

Thus, social class fed into a cycle of projected school completion and educational performance, making the tri-partite system a living, breathing example of Bourdieu's social and cultural reproduction in practice.

The influence of social background on experiences of the school system impact psycho-social outcomes further: while social class in itself is not a determinant of self-concept, Eshel and Klein suggest that students belonging to different socio-economic groups develop differently. In lower social-class students, self-concept is:

Likely to be seriously affected as a result of (a) the encounter with cognitive demands that are beyond the child's capabilities, (b) the social comparison process involving the child's more highly achieving peers, or (c) the child's perception of the school and its demands as threatening and conflicting with the values and behavior of home (Ausubel & Ausubel, 1963; Frankenstein, 1972) (Eshel & Klein, 1981: 287).

As such, self-concept in these individuals can be lower than for their more advantaged peers due to a confluence of social pressure and a climate of social and cultural reproduction within the school system. Children from a more advantaged background are better adapted to succeeding in academic

¹ Conducted in 12 countries between 1963 and 1966.

contexts. High achievement and self-perception feed into a cycle of self-determination, further advantaging these students. Similarly, low performance and low self-concept combine to disadvantage students with low social status further.

The influence of significant others

The influence of significant others should not be overlooked when considering factors affecting school performance. Significant others include parents and family, peers, and teachers. Students with supportive home environments receive encouragement in their studies; they are praised for successes, school work (both in class and at home) is valued, and parents engage with teachers to facilitate learning. In such a positive environment, students are likely to achieve better results and value their academic endeavours more. According to this conception of the effect of significant others, one would expect that students who received positive feedback would have higher self-concept and stronger academic performance.

The actions of significant others can have an impact on a student's performance. These actions are, to a certain extent, informed by the economic circumstances of the student. For example:

Poor families have fewer resources to support their children's learning outside of school compared with families higher in socioeconomic status (Meece, 1997). The resources issue is a critical one, because lower socioeconomic students often display learning problems and require extra assistance. Families that cannot provide that [...] place the child at a disadvantage (Pintrich & Schunk, 2002: 389).

The attitudes and actions of significant others can benefit a student and positively influence his or her attainment only in as far as they have the capital, both cultural and economic, to do so. Low cultural capital manifests itself through the actions of significant others in that "socialization influences in lower-class homes often do not match or prepare students for the middle-class orientation of schools and classrooms" (Pintrich & Schunk, 2002: 389), and parents cannot provide adequate support for academic development.

Research Questions and Hypotheses

The purpose of this study is to examine the relationship amongst psycho-social factors, intelligence, and assignment to special tuition in Sweden between 3rd and 4th grade by using the 1972 ETF-cohort (Evaluation Through Follow-up). This aim will be fulfilled by answering the following two research questions:

1. Which predictor(s) contribute(s) significantly to explain early entry into special tuition programmes between 3rd and 4th grade?
2. Which predictor(s) contribute(s) significantly to account for those pupils who did not receive special tuition between 3rd and 4th grade?

In accordance with the body of previous research examined in the literature study section of this thesis, the following hypotheses have been formed, which the project aims to answer by testing the associated null hypotheses.

1. Students who receive special tuition will hold higher levels of academic self-concept than their peers in mainstream classes.

- H1a.₀: Students who enter a special tuition programme will have high academic self-concept.
- H1b.₀: Students who do not enter a special tuition programme will have low academic self-concept.
2. Students who receive special tuition worry, while those students who do not enter special education programmes do not worry about things in school.

H2a.₀: Students who enter a special tuition programme will worry about things in school.

H2b.₀: Students who do not enter a special tuition programme will not worry about things in school.
 3. Students attending special education will demonstrate lower levels of cognitive ability than their mainstream peers

H3a.₀ Students who enter a special tuition programme will display low levels of fluid intelligence.

H3b.₀ Students who do not enter a special tuition programme will display high levels of fluid intelligence.

H3c.₀ Students who enter a special tuition programme will display low levels of crystalized intelligence.

H3d.₀ Students who do not enter a special tuition programme will display high levels of crystalized intelligence.
 4. Students who enter special tuition will not be able to keep concentration when they do mathematics and writing in school, and will give up more often when they are faced by a difficult task in school.

H4a.₀: Students who enter a special tuition programme will not be able to keep concentration when they do mathematics and writing in school.

H4b.₀: Students who enter a special tuition programme will give up more often when they are faced by a difficult task in school.

H4c.₀: Students who do not enter a special tuition programme will be able to keep concentration when they do mathematics and writing in school.

H4d.₀: Students who do not enter a special tuition programme will seldom give up if they get a difficult task to do in school.
 5. Girls are less likely to attend special education than boys.

H5a.₀: Students who enter a special tuition programme will be less likely to be female than male.

H5b.₀: Students who do not enter a special tuition programme will be more likely to be female than male.

Methodology

This project utilised Zero-Inflated Poisson Modelling (ZIP) to identify predictors of attending and not attending special tuition. The choice of method was based on the highly skewed distribution with a strong floor effect, namely the preponderance of zeros, that is to say, students not receiving special education. Approximately 77 percent (6964 students) within the 1972 cohort received no special tuition between 3rd and 4th grade. The ZIP technique separates the zeros from the rest of the distribution. Taking the log of such a variable will not transform it into a normally distributed variable. At the same time, I wanted to take advantage of the ZIP modelling ability to separate the distribution into two parts: one with all those pupils that do not enter special tuition and another with those that enter, thus, allowing the predictors to vary across both of these two processes. A

multinomial logistic regression (since I have three values representing years spent in special education: 0, 1, and 2 in my dependent variable) would be limited, for example, to conclude that 'worry about things in school' has a certain significant effect on decreasing the log-odds of entry into special tuition compared with those who do not worry. The ZIP model could indicate that this variable is significant for predicting those who enter into special tuition programme, but not significant for those who do not enter into a special tuition programme.

I tried to model entry into special tuition between 3rd and 6th grade, but that became impossible to run on a laptop computer due to insufficient memory and CPU capacity. Therefore, I had to limit the analysis to include only 3rd and 4th grade. 3rd and 4th grade were the first years of registered special tuition for the students in the 1972 ETF-cohort.

Two statistical computing packages were used in this project: Mplus and SPSS. The choice of these programmes was motivated by the researcher's existing familiarity with them and, in the case of Mplus, the programme's capacity to process large amount of data and execute complex model commands.

Data source and sampling

The data used in this analysis comes from the Evaluation through follow up (ETF) project, a long term sequential survey study of nine cohorts. ETF was formed at the University of Gothenburg in 1990 by merging the Individual Statistics (IS) project (based at the University of Gothenburg) and Evaluation through follow-up of students (ETF) project (based at the School of Teacher Education in Stockholm). The 1972 cohort was chosen for analysis as it had a lower drop-out rate than other cohorts in the database. The retention rate of the 1972 cohort was some 80% of the original sample in 1987 and 1988 when data relating to standardized tests administered in grades 8-9 was collected, and 75% in 1989 when follow-up surveys were completed by students one year after the completion of compulsory schooling (Giota, 2006).

The 1972 cohort comprised pupils sampled from grade 3 of Swedish compulsory school (ages 10-11)². The sample was generated using a two-step method, with a stratified sample of municipalities followed by systematic sample of classes within the selected municipalities, providing a total cohort size of 9504. (Giota, 2006). Administrative data was collected by Statistics Sweden, while self-reported data was collected by the Stockholm Institute of Education. The collected data includes results of three aptitude tests and standardised achievement tests, and answers to questionnaires given to the pupils in grade 3 and in grade 6. The questionnaire given to the subjects in grade 3 focused on how they perceived their competence in different academic areas, their attitude toward schoolwork and motivation, and their leisure activities. In grade 6 subjects answered an almost identical questionnaire, although the rubric was slightly different allowing for the children's lower age in the first data collection (i.e. in grade 3). The participants' scores on national standardised achievement tests were also collected by Statistics Sweden when the pupils were in grades 8 and 9, and parents answered questionnaires when their children were in grade 3 (Giota, 2006).

Ethical considerations

Permission for this project was sought from the University of Gothenburg to access information held in the ETF database. Only data for the variables included in the analysis corresponding to the investigated time period were made available to the researcher. The dataset obtained for analysis contained no identifying information, and permission for data to be used in secondary analysis was

² The subjects were born in 1972, and were in 3rd grade in spring 1983.

given at the time of collection, so there were no ethical issues encountered in the undertaking of this project.

Definitions of key terms

The concepts investigated in this project have been discussed in earlier sections of this thesis. They can be briefly summarised thus:

Academic self-concept: the self-perception of academic ability;

Social anxiety: how students feel about their relationships with others in the school context;

Cognitive ability: the cognitive ability of the participants as measured by four tests of ability in the third grade; and

Perseverance: how students perceive their ability to focus and how they react to challenges and difficulties in the classroom.

Model estimation

The estimation method employed in the analysis was MLR - maximum likelihood parameter estimates with standard errors, and a chi-square test statistic robust to non-normality. Two regression equations were specified in the model statement. The first of these equations was a Poisson model, predicting the number of years an individual attended special tuition between 3rd and 4th grades; while the second equation was a logit model predicting membership to the zero group, in this case those who received no special tuition within the aforementioned timeframe.

Poisson Modelling

In order to separate out the longitudinal data and account for students receiving special tuition a Poisson model was used. A Poisson model is appropriate in this analysis as special tuition frequency, how many years a student has been registered in special education classes, is a count variable and therefore requires a count model. The variable in a Poisson model is measured on a discrete ratio scale, such as the number of accidents, the number of late arrivals to class, the number of absences, or, as in this case, the number of years a student attended special tuition (Greene, 2011). Thus the model is separated into two parts: the first estimating whether an individual enters a special tuition stream at all; the second part, being conditional on that decision, then estimates the frequency of how many years are spent in special tuition. This is known as a hurdle Poisson model (Bohara & Krieg, 1996).

The Poisson distribution is described as:

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!} \quad (1)$$

In this equation, lambda (λ) is the mean count of occurrences within the specified time frame (in this case between 3rd and 4th grade). In the numerator we have the mean count to the power of x , multiplied by e (e is a mathematical constant, approximately 2.71828) to the power of negative mean. In the denominator we have x factorial. In Poisson models, the variance (σ^2) is equal to lambda.

However, this model does not provide a good fit to data when there are a frequent or excessive number of zero counts. Diagram 1 illustrates the high number of zeros in the distribution of the 1972 cohort for the outcome variable (total years of special tuition between 3rd and 4th grade).

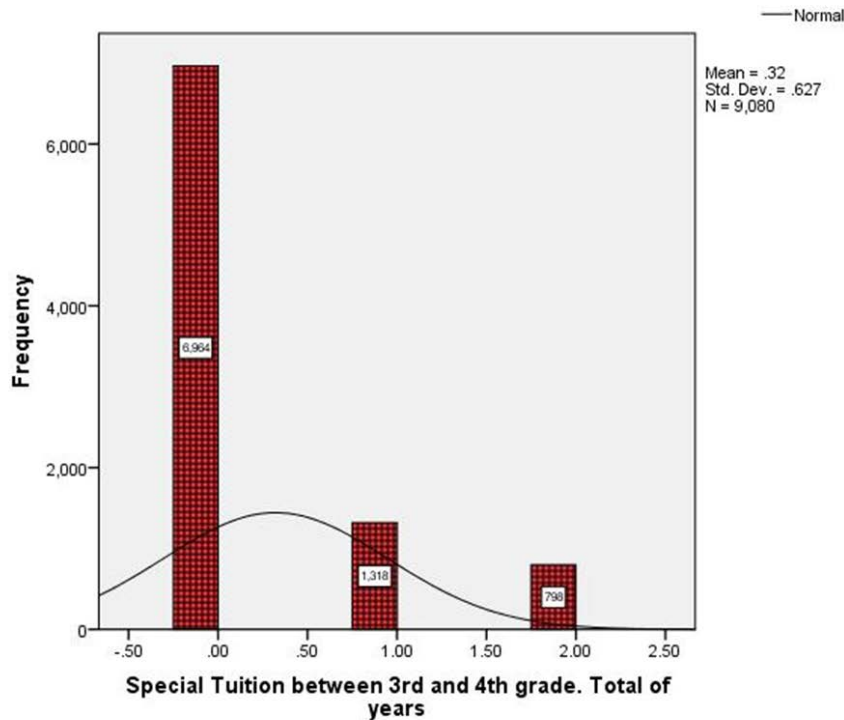


Diagram 1. Number of years spent in special tuition class between 3rd and 4th grade.

The diagram illustrates that approximately 77 percent (6964 students) within the 1972 cohort received no special tuition between 3rd and 4th grade; some 23 percent (2113 students) did receive special tuition for one or two years between 3rd and 4th grade. In this case the data are over-dispersed, as the variance is greater than the mean. Therefore, a zero-inflated Poisson distribution model is more appropriate for analysing the dependent variable in this thesis (Xie et al., 2001).

The Zero-Inflated Poisson Model

The zero-inflated Poisson (ZIP) distribution is generalized from the Poisson distribution (Johnson et al., 1992; Lambert, 1992). They noted the ZIP model as following:

$$f(y; p, \mu) \begin{cases} 1 - p + p \exp(-\mu), & y = 0, \\ p P_0(y, \mu), & y = 1. \end{cases} \quad (2)$$

A ZIP regression is appropriate for count data with excess zeros in that it can estimate special tuition frequency. Non-special tuition students fall into two categories: those who are truly in no need of special tuition and are unlikely to ever receive special tuition, and those who have special tuition characteristics. This second group may have difficulties and are likely to move eventually into the special tuition group; hence, they are potential special tuition students. It should also be noted that uptake of special education is decided on an individual basis and experiences can vary widely: it is possible, for example, that students may have been registered to attend to special tuition, but after two or three weeks it emerged that they no longer needed special tuition. For this reason, I have not used multinomial logistic regression analysis, a statistical technique to model a dependent categorical variable with three or more categories, in the analysis.

When using Mplus software, the zero and the count part estimates can be interpreted in terms of odds and log odds.

$$\text{Odds} = \frac{p(\text{zero class})}{1-p(\text{zero class})} \quad (3)$$

The intercept for the zero part of the model, as shown in table 5, is -3.253 (unstandardized). Thus, the odds of being in the zero class are:

$$e^{-3.253} = 0.039 \quad (4)$$

The odds of being in the zero class are 0.039 when all covariates in the model are 0. These odds can be converted into a probability:

$$\text{Probability} = \frac{0.039}{1+0.039} = 0.037$$

The probability of being in the zero class when all covariates are 0 is 3.7%. That is to say, when an individual has low concentration while doing maths and writing, gives up often when given a difficult task, and the individual's parents have no educational expectations beyond secondary school this is the probability that the individual will be in the non-special education group.

As by default Mplus computes standardized coefficients, it is easier to interpret the effects between the independent variables and the two-fold dependent variable (those who never enter special tuition and those who do) in such terms. Standardized effects are measured on a common scale that range from -1 to +1, and show variable importance tied to log-odds. The most common argument for using standardized coefficients is that they provide a means of comparing the effects of variables measured in different metrics. This is true here as well; as most of the independent variables in this analysis are dichotomous, it makes no sense to think about a one standard deviation increase in a dummy variable like gender. Anxiety could be thought of, even though it is dichotomized in this case, as an underlying continuous variable, and thus this variable could be thought of in standardized terms. Furthermore, the latent variables that measure cognitive abilities (fluid and crystallized) are continuous, and could be interpreted in terms of one standard deviation increase or decrease.

I have chosen to interpret only significant effects when assessing whether or not the independent variables increase or decrease the log odds (if they increase, then we have a positive effect of the independent variables on the dependent variable, and the opposite if they decrease the log odds).

Use of standardized beta coefficients

In linear regression, standardized beta weights are often used to compare strength of prediction across all independent variables; variables which have larger standardized beta weights (in absolute value) are considered to be stronger predictors in the equation. When variables are measured on an arbitrary scale, standardized beta weights are especially useful. It is also possible to obtain standardized coefficients in logistic regression (Long, 1997). These coefficients are provided when conducting statistical analysis with Mplus. The interpretation of variable importance using standardized coefficients is typically tied to log-odds.

Data handling procedure

The data for this analysis was taken from the ETF database relating to participants in the ETF study born in 1972. The data was cleaned using SPSS and exported in .dat format. The analysis was conducted using Mplus. Some 5757 cases were included in the analysis once cases with incomplete data were excluded.

The population

As previously mentioned, the population was divided into two groups, those who had received no special education tuition, and those who had received between one and two years of special education between grades 3 and 4 (the count group). Diagram 1 shows the distribution of students between these groups across the whole sample. By dividing the population in the subsequent analysis, it was possible to see how the variables affected attendance in special education programmes. The non-special education (zero) group comprised students who had received no special education tuition between third and fourth grade. 79.1% of students fell into this group once cases with insufficient data across the analysed variables were excluded.

Descriptive statistics

The analysis included both variables that were theoretically justified by the literature review and variables reflecting student backgrounds, all of which are summarised in table 1.

Table 1. Independent variables in the analysis

Variable	Abbreviation	Variable	Abbreviation
GF (Fluid Intelligence)		Social Anxiety	
Total points spatial test in 3 rd grade	TPSP3	Are you scared about having to answer questions in school?	SANX31
Total points mathematical test in 3 rd grade	TPMA3		
GC (Crystallized Intelligence)		Do you worry about things that happen in school?	SANX33
Total points verbal opposite test in 3 rd grade	TPOA3		
Total points reading test in 3 rd grade	TPREAD3		
Persistence		Academic Self-Concept	
Keep concentration when you do maths and writing in school?	PERSI31	Do you think that you do well in school?	GS34
Do you seldom give up if you get a difficult task to do in school?	PERSI32		
Background variables			
Parental Educational Expectations	EDUEXP		
Socio-economic status	SBACKGR		
Both parents Swedish vs all others	BOTHPSW		
Female	RSSEX		

Comment: The background variables have used as control variables in the analysis.

TPOA3, TPMA3, TPREAD3, TPSP3 were measures of cognitive performance (total verbal opposite ability, total mathematics ability, total reading ability and total spatial ability respectively); PERS31 and PERS32 measured perseverance; SANX31 and SANX33 were measures of social anxiety; and GS34 was a measure of academic self-concept. The background variables in the analysis were RSSEX (gender), EDUEXP (parental educational expectations), SBACKGR (social-economic background), and BOTHPSW (whether both parents were Swedish). PERS31, PERS32, SANX31, SANX33, GS34, RSSEX, and BOTHPSW were dichotomous variables, while those variables measuring cognitive ability were continuous. TPOA3 had a range of 1-40, TPMA3 0-15, TPREAD3 1-32, and TPSP3 0-30. SBACKGR and EDUEXP were both categorical variables.

A preliminary analysis of the variables for the whole cohort using SPSS revealed that many of the categorical and continuous variables were negatively skewed. There was a slight negative skew to SBACKGR (-.043), indicating a slight tendency for the subjects to be from the higher of the four social class categories. EDUEXP had a large negative skew of -1.146 which implies that across the whole population parents had high expectations of the levels of schooling their children would complete. TPOA3 demonstrated a positive skew (.110), as did TPSP3 (.078), while TPMA3 and TPREAD3 both had negative skews (-.118 and -1.311 respectively). Of these variables, only SBACKGR had a non-significant skew ($-.043 < 2 \times \text{S.E.}$). However, although several of the variables were skewed between 1 and 2 and would thus be expected to have an effect on parameter estimates, the large sample size in this analysis should mitigate against these effects (Miles & Shevlin, 2001). The use of maximum likelihood parameter estimates with standard errors in the analysis is robust to the effects of any non-normality in the data (Brown, 2006) and was employed to manage these effects. The estimator used in the analysis also managed the effects of kurtosis in the data. The variables measuring cognitive ability all exhibited significant kurtosis (TPOA3 -.531, TPMA3 -.802, TPREAD3 2.440, and TPSP3 -.876) as did EDUEXP (1.864) and SBACKGR (-.593).

In running the regression analysis, Mplus generated estimates of the sample means for the variables in the model, which are summarised in table 2. The regression estimates of the included variables for the non-special education and special education group (as computed by Mplus) are summarised in tables 5 and 6 respectively.

Table 2. Estimated Sample Means

TPOA3	TPMA3	TPREAD3	TPSP3	PERS31	PERS32	SANX31
19.74	8.363	26.357	15.955	0.714	0.913	0.09
SANX33	GS34	RSSEX	EDUEXP	SBACKGR	BOTHPSW	
0.229	0.758	0.492	3.287	1.805	0.862	

Comments: TPSP3 = Total points spatial test in 3rd grade, TPMA3 = Total points mathematical test in 3rd grade, TPOA3 = Total points verbal opposite test in 3rd grade, and TPREAD3 = Total points reading test in 3rd grade.

Intelligence

As noted in the literature study section of this project, intelligence is a key issue in determining whether an individual receives special education or not. While intelligence is not the sole determinant in whether an individual participates in special education, it is acknowledged that those requiring special education are expected to perform at lower levels than their peers in mainstream groups.

In line with the structure of intelligence discussed in the literature study, a two stratum model of intelligence was considered in the data analysis. Confirmatory factor analysis (CFA) was used to establish this theorised structure of intelligence. CFA requires strong theoretical and empirical foundations for the model it is used to test (Brown, 2006), making it an appropriate technique in this inquiry as the assignation of indicator variables to the two factors is grounded in established theory about the composite parts of intelligence.

Two latent variables were identified: fluid intelligence (GF) and crystallized intelligence (GC). Mathematics ability and spatial ability loaded on to GF with completely standardized factor loadings of .775 and .547 respectively, while verbal opposite ability and reading ability loaded on to GC with completely standardized factor loadings of .788 and .659 respectively. All factor loadings were significant ($p=.000$). Factor loadings are summarised in table 3, while residual variances are displayed in table 4.

Table 3. CFA: Fluid and crystalized intelligence

Factor loadings			Estimate	T-Value	P-Value
GF3	by	TPSP3	0.547	45.986	0.000
GF3	by	TPMA3	0.775	61.017	0.000
GC3	by	TPOA3	0.788	78.848	0.000
GC3	by	TPREAD3	0.659	58.894	0.000

Comments: The by statement is used in Mplus syntax, which means that GF is defined by TPSP3 and TPMA3. GF = fluid intelligence, GC = crystallized intelligence, TPSP3 = Total points spatial test in 3rd grade, TPMA3 = Total points mathematical test in 3rd grade, TPOA3 = Total points verbal opposite test in 3rd grade, and TPREAD3 = Total points reading test in 3rd grade.

Table 4. Completely Standardized Residual Variances

	Estimate	T-value	P-value
TPOA3	0.378	24.004	0.000
TPMA3	0.399	20.265	0.000
TPREAD3	0.566	38.38	0.000
TPSP3	0.701	53.836	0.000

Comments: TPSP3 = Total points spatial test in 3rd grade, TPMA3 = Total points mathematical test in 3rd grade, TPOA3 = Total points verbal opposite test in 3rd grade, and TPREAD3 = Total points reading test in 3rd grade.

Reliability and validity

As a secondary analysis of a survey study, the use of test-retest reliability as a measure of reliability was inappropriate; therefore the principle measure of the reliability of the research was internal reliability.

Conducting tests of internal reliability was challenged by the nature of the variables included in the analysis. As many of the variables were dichotomous or categorical they were unsuitable for testing internal reliability, and showed weak internal consistency. For example, persistence in 3rd grade showed a Cronbach's alpha of 0.18. We should bear in mind that traditional regression technique assumes that all variables are measured without error. This is certainly not the case, which is one of the advantages in the application of structural equation modelling with latent variables. Thus, ordinary multiple regression analysis uses raw or standardized scores without taking the measurement error of the variables into consideration in estimation of the regression coefficients. Ignoring the measurement error causes the regression estimates to attenuate even though a good reliability of the indicators is reported (Bollen, 1989; McCoach, Black & O'Connell, 2007).

However, it was possible to test the reliability of the two latent concepts and their identifiers. Cronbach's alpha was calculated for the items measuring crystalized intelligence (total verbal opposite ability and total reading ability) and fluid intelligence (total mathematics ability and total spatial ability). Cronbach's alpha was calculated to be .615 for crystalized intelligence and .506 for fluid intelligence. While it is held as a rule that a value of Cronbach's alpha greater than 0.7 indicates strong internal reliability, a Cronbach's alpha value that is below this level is not necessarily indicative of weak internal reliability when factor analysis has confirmed that items load onto the same latent variable (Bryman and Cramer, 2011). In the analysis Mplus generated information about the completely standardized residual variances of the four indicator variables of intelligence. As displayed in table 4, all four indicators had estimates greater than .30, with significant p-values ($p=.000$) making them reliable measures.

However, by using the two-process technique (ZIP modelling), the dependent variable was measured more accurately. Allowing for a separation of the true zeros (those who never enter special

tuition) from those who enter, increases the validity in this study by sorting out the heterogeneity in the variable. This sorting process would have been neglected if I had used Multinomial logistic regression analysis instead, which would decrease the validity of the study.

Results

The analysis generated two multiple linear regression models, the first for students in the zero group (receiving no special education between grades 3 and 4), the second for students in the count group (those who received special education during this time frame). The results of these models are summarised in tables 5 and 6 respectively.

Table 5. Standardized coefficients predicting those who never receive special tuition between 3rd and 4th grade

Variable	No Special tuition, std.est	(unstd.est)	Est./S.E. std.est	P-value
GF (Fluid Intelligence)	0.26	(0.21)	4.478	0.000
GC (Crystallized Intelligence)	0.48	(0.24)	2.326	0.020
Are you scared about having to answer questions in school?	0.05	(0.46)	1.621	0.105
Do you worry about things that happen in school?	-0.003	(-0.02)	-0.080	0.937
Keep concentration when you do maths and writing in school?	0.14	(0.90)	3.379	0.001
Do you seldom give up if you get a difficult task to do in school?	0.01	(0.11)	0.332	0.740
Do you think that you do well in school?	0.09	(0.57)	2.363	0.018
Educational expectations	0.11	(0.41)	2.053	0.040
Socio-economic status	0.23	(0.09)	0.609	0.543
Both parents Swedish vs all others	0.05	(0.43)	1.213	0.225
Female	0.20	(1.11)	5.184	0.000
Intercept	-1.14	(-3.253)	-3.569	0.000

Comments: The first column shows the standardized coefficients and the second column displays the unstandardized coefficients. Since the p-values are very similar, with small differences, for both the standardized and unstandardized coefficients, only Estimate / Standard Errors for the standardized values are shown. The ratio of the estimate to its standard error (Estimate / Standard Error) can be used as a Z-test, where values greater than 2 are considered to be statistically significant.

Abbreviations: std.est = standardized estimates, unstd.est = unstandardized estimates, Est. = Estimate, S.E. = Standard Error.

The regression analysis revealed that cognitive ability (both fluid and crystallized), maintaining concentration, academic self-concept, parental educational expectations, and gender are all significant

predictors of the count part (the excess zero-generating process of the model). These predictors all increase the log odds of being in the zero class, that is to say, not receiving special tuition between 3rd and 4th grade. The results showed that crystallized ability is the most important aspect of the model in predicting those who never receive special tuition, followed by fluid intelligence and gender; for each increase in the score in the latent crystallized variable, the log odds of membership to the excess zero-generating process increases by 0.24 in unstandardized terms. Girls were shown to be more likely than boys to avoid special tuition. In changing the gender of an individual from male to female, the log odds increased (by 0.20 in standardized terms or 1.11 in unstandardized terms), indicating that boys are more likely not to belong to the zero class (those students not receiving special tuition).

The second part of the equation (see table 6 on following page), representing students who received special tuition between 3rd and 4th grade, showed that crystallized intelligence is the most influential predictor. The negative relationship of -.82 in standardized terms, indicates that lower GC increases the log odds of receiving special tuition. It is notable that fluid intelligence appears to have little importance in predicting whether an individual receives special tuition (indeed, the effect is not significant). The data also revealed that students receiving special tuition tended to be afraid of having to answer questions in school, to have low academic self-concept, and to be boys.

A possible interpretation of these results is that the identification of students in need of special tuition is based on reading rather than mathematical ability. Perhaps it is easier to observe that a student has difficulties in reading than doing mathematics? Is identification of children needing additional support influenced by a heavier cultural valuing of literary than numeracy? Suggestions for the causes of these results will be discussed in a later section of this thesis.

An additional interesting finding in table 6 was that neither of the persistence variables were significant. According to the literature, we could expect that students who do not concentrate in class, who are noisy and interfere with the teaching, would be sent to special tuition class. Effort, in terms of not giving up upon receiving a difficult task, did not contribute to any part of the model. We might also expect that students receiving special tuition would also give up easier when dealing with difficult tasks in school, compared with those receiving no such intervention, but this was not borne out in the data.

Contrary to expectations, the students who found themselves in special tuition groups between 3rd and 4th grade had low academic self-concept. The model showed that parental educational expectations did not have any significant effect on students receiving special tuition; socio-economic status and ethnicity had no effect on either part of the model, while girls were less likely receive special tuition than boys. Social status, parental educational expectations and parental ethnic background were not significant predictors in part of the model.

Comparison of the two parts of the model showed that crystallized intelligence predicted both entry and non-entry to special tuition. Scoring highly on reading and vocabulary tests (GC) in 3rd grade increases the log odds of not receiving special tuition, while achieving low scores on GC tests increases the log odds of receiving special tuition between 3rd and 4th grade. Among the variables included in this analysis, GC had the strongest predictive power as to whether or not students will receive special tuition (.48 for no special tuition entry and -.82 for entry into special tuition programme).

GF was a predictor for students that did not receive special tuition, but it had no significant effect among students who entered special education. Fear of answering questions in school, which is a measure of social anxiety, was stronger among special tuition students than their mainstream peers; for the latter group, this effect was weaker and not significant. Anxiety about what is happening in school had no effect on either predicting zero membership (not having special tuition) or the count part of the model (years of special tuition). Furthermore, students who never received special tuition

tended to report that they concentrated when doing mathematics and writing in school. Conversely, this aspect did not predict those who receive special tuition (the coefficient was around zero).

Table 6. Standardized coefficients predicting those who receive special tuition between 3rd and 4th grade

Variable	Special Tuition		Est./S.E.	P-value
	std.est	(unstd.est)	std.est	
GF (Fluid Intelligence)	-0.17	(-0.02)	-1.859	0.063
GC (Crystallized Intelligence)	-0.82	(-0.07)	-10.000	0.000
Are you scared about having to answer questions in school?	0.09	(0.16)	2.293	0.022
Do you worry about things that happen in school?	0.005	(0.006)	0.110	0.913
Keep concentration when you do maths and writing in school?	-0.001	(-0.001)	-0.013	0.990
Do you seldom give up if you get a difficult task to do in school?	-0.02	(-0.03)	-0.478	0.633
Do you think that you do well in school?	-0.11	(-0.13)	-2.378	0.017
Educational expectations	-0.09	(-0.06)	-1.553	0.120
Socio-economic status	0.05	(0.03)	0.771	0.441
Both parents Swedish vs all others	0.004	(0.006)	0.078	0.938
Female	-0.20	(-0.20)	-3.205	0.001
Intercept	-1.11	(-0.548)	-3.447	0.001

Comments: The first column shows the standardized coefficients and the second column displays the unstandardized coefficients. Since the p-values are very similar, with small differences, for both the standardized and unstandardized coefficients, only Estimate / Standard Errors for the standardized values are shown. The ratio of the estimate to its standard error (Estimate / Standard Error) can be used as a Z test, where values greater than 2 are considered to be statistically significant.

Abbreviations. std.est = standardized estimates, unstd.est = unstandardized estimates, Est. = Estimate, S.E. = Standard Error.

Accepting and rejecting hypotheses, and conclusions

The study aimed to investigate hypotheses generated around two research questions:

1. Which predictor(s) contribute(s) significantly to explain early entry into special tuition programmes between 3rd and 4th grade?
2. Which predictor(s) contribute(s) significantly to account for those pupils who did not receive special tuition between 3rd and 4th grade?

A total of fourteen null hypotheses were tested. The data analysis revealed that cognitive ability was lower in children attending special education than their mainstream peers, but that this is not a simple relationship. It was hypothesised that children in special education will display low levels of fluid intelligence. We must reject this hypothesis, as the analysis showed that children attending special education had low fluid intelligence but this is not significant ($-.17, p=.063$). Conversely, we can accept the hypothesis that children in special education will display low levels of crystallized intelligence, with attendance in a special education programme correlating with crystallized intelligence at $-.82$, which is significant ($p=.000$). We must then accept both the hypothesis that children who do not attend special education have high fluid intelligence and the hypothesis that they have high crystallized intelligence as both these factors were found to be significant (with completely standardized estimates of $.26, p=.000$ and $.48, p=.020$ respectively).

Attendance in special education has a significant relationship with academic self-concept, with responses to the question 'Do you think that you do well at school?' correlating negatively ($-.11, p=.017$), causing us to reject the null hypothesis that children in special education will display high levels of academic self-concept. For the zero group, there was a significant ($p=.018$) positive correlation ($.09$) with self-concept, leading us to reject the null hypothesis that children who do not attend special education will display low levels of academic self-concept

We can accept the null hypothesis that children in special education will worry about school. There was a significant positive correlation between attendance in special education and the question 'Are you scared about having to answer questions in school?' ($.09, p=.022$). For students in the zero group, the items 'Do you worry about things that happen in school' was non-significant for the zero group ($-.003, p=.937$) leading us to reject the hypothesis that children who do not enter special education do not worry about school.

When it comes to perseverance, enrolment in special education correlates negatively but weakly with both the questions 'Do you keep concentration when you do maths and writing in school?' and 'Do you seldom give up if you get a difficult task to do in school?' ($-.0001, p=.990$ and $-.02, p=.633$ respectively). Levels of perseverance are not a significant precursor of attending a special education programme, and thus we must reject the null hypothesis that children in special education will display lower levels of perseverance.

Among children not attending special education, there was significant positive correlation with the questions 'Do you keep concentration when you do maths and writing in school?' ($.14, p=.001$), so we can accept the null hypothesis that students who do not enter a special tuition programme will be able to keep concentration when they do mathematics and writing in school. There was non-significant correlation with the question 'Do you seldom give up if you get a difficult task to do in school?' ($.01, p=.740$), so we must reject the null hypothesis that students who do not enter a special tuition programme will seldom give up if they get a difficult task to do in school.

Finally, we can accept the null hypothesis that there students who enter a special tuition programme will be less likely to be female than male, as being female correlated negatively with special education with high significance ($-.20, p=.001$). In addition, we can accept the null hypothesis that students who do not enter a special tuition programme will be more likely to be female than male, as being female correlated highly significantly ($-.20, p=.000$) with not attending special education.

It was expected that students in the count part of the model (those attending special education) would have higher self-concept than their peers in the zero part (those not attending special education). This expectation was drawn from a consideration of the literature. Given the findings of Boersma et al.'s (1979) study, in which self-concept increased for special education students taught separately from their mainstream peers, and the evaluative nature of self-concept, whereby individuals evaluate their performance to ideal standards and the standards of their peers, it was hypothesized that

special education students would have higher levels of self-concept than non-special education students.

While this remains a theoretically valid assumption, given the structure of the model evaluated in this project, this hypothesis was flawed. The model used a single item measuring self-concept which came from a single instance of data collection. Data pertaining to the number of years students spent in special tuition programmes was collected at a later stage. As a cross-sectional model, it was not possible to use the model to evaluate whether levels of self-concept among special education students were increased after attending special education placements. Additionally, 3rd grade was the first opportunity for students to be removed for special tuition, which implies that when questioned the special tuition group were evaluating their performance against their mainstream peers.

Having examined the null hypotheses, it is possible to state that the answer to the first research question is that GC, being scared to answer questions in school, academic self-concept, and gender are significant predictors of early entry into special tuition programme between 3rd and 4th grade. The answer to the second research question is that GF, GC, keeping concentration while doing writing and mathematics, academic self-concept, parental educational expectations, and gender are significant predictors of NOT entering into special tuition programme between 3rd and 4th grade. However, most of the variables (except for the cognitive ability variables) were used as observed variables. From a reliability point of view, such variables are afflicted by measurement errors which have an attenuating effect on the coefficients. This could maybe explain why several of the coefficients were low in combination with the character of the variables in terms of being measured as dichotomous. Reducing a continuous variable into a dichotomous also attenuates the effect size. If the dataset had contained several items of each construct, and thus allowed for the formation of latent variables, and these were measured on a Likert scale, maybe we could have had somewhat higher estimates. This was not possible in this thesis based on the 1972 ETF data. However, intelligence and gender seem to be good predictors of early entry in special tuition programme.

Discussion

As a society, we send children to school to learn the knowledge and skills (both hard and soft) that we deem key for economic and social engagement and success. But the process of learning is complicated, making identifying difficulties in learning a necessary challenge.

The data used in this analysis is over thirty years old, which may lead some to question its utility in contributing to an understanding of how students are currently assigned to special education. It is worth considering that the cohort studied represent one of the first groups of students to have been eligible for action programmes when addressing difficulties they may have faced in school, and thus their experiences of being selected for special education programmes differs to previous generations of students.

Reflecting on the changing nature of the educational system and the social pressures faced by children provides an interesting perspective when considering the relevance of this study. Children in contemporary classrooms face far more pressure than previous generations. The assessment system in Swedish schools has fundamentally shifted from having few if any tests, to a more intensive regime of testing. This, combined with the unique social and technological pressures faced by young people, would suggest that levels of anxiety among current students would be higher than in previous generations.

In addition, the population of Sweden has become more heterogeneous in recent decades, introducing the possibly of further factors influencing assignment to special education. By examining the predictors of early entry to special education in the context of the 1972 birth cohort, it is possible

to evaluate the impact of the various psycho-social measures in a more homogeneous population. The knowledge that has been developed during the course of this study can be used to generate hypotheses in further analyses of assignment to special education.

For an educational system to help individuals to reach their best possible outcomes, provision of special education for those needing additional support is essential. Equally essential is the requirement that additional support is targeted to those who have a genuine need for it; special education should not be a repository for the bored and badly behaved, as reported by Isaksson, Lindqvist and Bergström (2010). The results from this study showed that this was not the case. Instead, crystallized intelligence and gender were the most powerful indicators of being placed in a special education or non-special education class, followed by academic self-concept. It is likely that a student attending special education will demonstrate lower literacy skills and will have a poorer opinion of his or her performance in school: not only are these children less capable than their peers, they are most likely aware of the discrepancy and this is informing how they feel about their performance.

As mentioned above, the analysis revealed that the most important predictor of whether an individual receives special tuition or not is crystallised intelligence. In the model, levels of crystallized intelligence were indicated by two observed variables, verbal opposite ability and reading ability. Crystallized intelligence is thus, in the context of these findings, indicated by competence in language arts and literacy related activities. Noting that crystallized intelligence is significant while fluid intelligence is not significant in determining likelihood of entering special education, the interpretation drawn is that reading rather than mathematical ability is used to identify students in need of special tuition.

Using a two-stratum model of intelligence has been justified by both the theory and the analysis. As noted in the literature, low intelligence is not the sole determinant of a student being referred to special education. With this in mind, the question must be how crystallized intelligence can play such a vital role in entry to special education. A point of consideration comes from Kavale and Nye (1985), who note that concern in identifying students with learning difficulties has long focused on problems with oral and written language. Thus, language development and competency is an established identifier of whether a student requires special tuition or not. Once we take this historical tendency into consideration, the next step must be to consider why it is the case.

Two suggestions for this that I will discuss are that a stronger cultural value is placed on literacy and that it is easier to identify students who struggle with literacy. I will turn to the cultural value of literacy first.

Students who struggle with mathematics can sometimes be excused by a cultural tendency for 'being bad at maths' being dismissed as not particularly important. Indeed, a cursory internet search for 'being bad at maths' reveals dozens of newspaper articles and think pieces, some discussing national standards (such as Holden, 2013) and others questioning cultural assumptions about mathematics ability. In a column in *The Guardian*, Orr summarises a prevailing cultural perception whereby "ineptitude at maths is presented as an endearing foible, rather than a fundamental failing" (Orr, 2012). McKevitt (2013) notes in *The Huffington Post* that:

[Innumeracy is] a curious admission - for example you definitely wouldn't hear anyone proudly extol the fact that they were unable to read [...] Many people seem happy to announce that they are no good at maths, often doing so in a manner which suggests they are actually delighted to admit it (McKevitt, 2013).

He offers a possible argument why numeracy is perceived as less important than literacy in everyday life:

As long as we can count, we can get by. We can tell the time, see how fast we're driving and work out how much to pay, whether or not we have enough money, and how much change to expect. For many people only these basic numeracy skills are necessary to get through the day to day and they are easier to pick up than basic literacy skills (McKevitt, 2013).

Illiteracy, by contrast is less sociably acceptable, as it has much stronger penalties in terms of the daily activities that become impossible and the extreme narrowing of employment options when an individual has a low level of literacy.

These examples from media are neither grounded in theory nor research, but they serve a useful illustrative purpose in indicating some of the popular perceptions of the value of numeracy and literacy. Given this cultural tendency to place a lower value on numeracy than literacy it is reasonable to assume that more attention is paid as to whether a student is performing poorly or struggling with reading than mathematics.

The cultural insistence on literacy does not, however, account for why it is easier to identify students who have problems with language arts than those struggling with mathematics. Perhaps the difficulty lies in the curriculum? Literacy skills pervade the curriculum; almost all subject areas require literacy skills, therefore evidence and evaluation of these is not confined to language arts lessons, whereas numeracy skills are generally more evidenced in mathematics lessons than other areas. Thus, more opportunities are provided for identifying students who struggle with reading.

A combination of a lack of opportunities for identifying problems with mathematics and lack of parental awareness might account for fluid intelligence's non significance in determining entry to special education. A lack of parental familiarity with the curriculum and the grade appropriate skills that children are expected to demonstrate, or a lack of parental mathematical skills may mean that they find it harder to identify whether or not their child is underperforming in mathematics. If a child is not recognised to be struggling with mathematics, parents are not able to raise concerns with the school and ask for additional support.

Reflecting on Forness et al.'s (1998) previously mentioned statement that students in special education are those who have "been failed by general education" (Forness et al., 1998: 318), we could argue that lower levels of crystallized intelligence are both an indicator and a predictor of failing general education, and therefore needing special education.

A shortcoming in this thesis was the lack of latent variables used as predictors. As mentioned previously, if it were possible to extend the analysis to identify a latent perseverance variable, it would maybe be possible to ascertain the mechanisms of perseverance in indicating entry to special education. Having two observed dichotomous variables as indicators of persistence with its measurement errors, we could expect low estimates. Such knowledge would be of use to teachers by providing them with statistically justified criteria which could be used to assist in making judgements, based on observed behaviour, as to whether a student required special tuition or not.

As a secondary data analysis, the project encountered difficulties with the dataset, with the items in the analysis which measure social anxiety proving problematic. The EFT data collection process designated the items SANX31 and SANX33, "Are you scared about having to answer questions in school?" and "Do you worry about things that happen in school?" as measures of social anxiety. The questions themselves are concerned more with school anxiety than social anxiety. However, in as far as the triggering factors of anxiety measured by the items relate to interaction with other people, they could be weakly termed as measures of social anxiety. A limitation of using data collected by a previous generation of researchers is that it does not always align with the secondary researcher's understanding or desired interpretation of the theory.

The findings of this study are also limited by the restricted age range of the students included in the analysis. Students in 3rd and 4th grade in Sweden are between 9 and 11 years old and are taught by a single teacher for all subject areas. It is possible that the results of the regression would differ with older students. The ability to self-evaluate develops with age and it is arguable that measures of self-evaluation can be more nuanced and thus become more accurate for older youths and adults. The structure of elementary school education is likely to play a role in the significance of the investigated concepts. A wider secondary school curriculum, with specialised teachers for each subject, would suggest that problems with literacy take longer to identify. It is possible that having a variety of teachers, who themselves teach a greater number of students, has a camouflaging effect and allows students with mild or moderate literary deficiencies to go unidentified.

The model included several background variables: socio-economic status, parental ethnic background, parental educational expectations and student gender. As mentioned earlier in this thesis, the relationship between social background and academic outcomes has been consistently shown in the literature, and thus variables pertaining to this were included in the analysis. Of the four background variables, only gender was given its own set of hypotheses. While all the background variables could reasonably be theorised to have an impact on the achievement outcomes, which are themselves an indicator of inclusion in special education programmes, parental educational expectations, socio-economic status, and parental ethnic background were not anticipated to have an impact on predicting entry to special education.

Gender was given special consideration, as there is a widely acknowledged gender imbalance in admittance to special education, with boys making up a greater proportion of the special education population. In addition, while the EFT data did not include any information about medical diagnoses leading to learning difficulties, it would be irresponsible to exclude gender from the analysis, given that diagnoses associated with learning difficulties can be highly gendered, such as autistic spectrum disorder.

One area for further investigation is to use structural equation modelling to investigate possible interaction effects and correlations between the independent variables, which was not used in this thesis. Such an approach demands strong computational power, e.g., a computer with at least eight cores and 16 GB of internal memory. By having a strong computational capacity the analysis could also extend the total number of years spent to include more than two years in special tuition, which was the case in this thesis. Further, it would be really interesting if a dataset could be used that included information about medical diagnosis (and thus covered Category A as described on page 3), a factor that I could not investigate since the ETF database did hold this information.

Implications for special education

The fact that academic self-concept, GC and gender are the only significant effects on entry to special education implies that the system of identifying students in need of special education works as it is supposed to. While the significance of gender in the analysis might suggest that there is an underlying problem in the mechanics of assigning children to special education programmes, given the previously mentioned gender imbalance in special education and the limitations of the ETF dataset, this significance is acceptable. The children in the study who attended special education programmes had a demonstrable academic need for such an intervention. These results should come as a reassurance for practitioners.

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