

Class Socioeconomic Composition and Low-SES Children's Academic Achievement

What is the Role of Personality?

Author : Rafael Martins Resende

Thesis Director : Prof. Catherine Guirkinger

Thesis Joint Director and Reader : Prof. Trudie Schils

Academic Year 2022-2023

In order to obtain the Double Degree

Master 120 en Sciences économiques, Orientation générale, Finalité spécialisée (UCL/UNamur)

and

Master of Science in Economic Studies (Maastricht University)

ABSTRACT

Moving low socioeconomic status (SES) students from classrooms predominantly composed of low-SES peers to classrooms with a higher concentration of high-SES peers can enhance their academic achievement. However, this transition can also create adverse psychological effects that negatively impact these students. Moreover, students' different personality traits introduce variations in their susceptibility to different socioeconomic environments. Moving beyond a one-size-fits-all approach, this study grasps the complex relationship between class socioeconomic composition and academic achievement among low-SES students, considering the mediative role of personality traits. Using a sample of 1803 6th grade students with low-SES attending primary schools in the Dutch province of Limburg, a Propensity Score Matching is employed to compare low-SES students' performance across four different class compositions: low-, middle-, high-, and mixed-SES classes. A non-linear relationship is identified between class socioeconomic composition and low-SES students' academic achievement. Specifically, low-SES students in middle-SES classes exhibit better academic outcomes compared to what they would have exhibited in low-SES or high-SES classes. Additionally, within low-SES environments, the study suggests the creation of heterogeneous classes instead of homogeneous classes. Among the Big-Five Traits examined, only Openness to Experience and Neuroticism stand out as significant predictors of academic performance and as mediators of the main relationship here studied across the four different class types. The study also shows that, when low-SES children are surrounded by a majority of middle- and high-SES students, Conscientiousness is also found to be a negative predictor of their academic achievement, potentially explained by the Big-Fish-Little-Pond effect. However, once these kids are a minority, Conscientiousness is neither beneficial nor harmful for those in middle-SES classes instead of high-SES classes, and vice-versa.

Keywords: Educational Economics, Class Composition, Academic Achievement, Personality Traits, Propensity Score Matching

JEL-Codes: I21; I24

The long journey throughout this master's thesis made me revisit my roots and understand that all my educational accomplishments would have not been possible without a very strong support that deserves a very special final word.

First and foremost, I would like to thank Prof. Catherine Guirkinger and Prof. Trudie Schils for their amazing guidance, words of motivation that pushed me to go the extra mile, and enthusiasm shown in my research topic. Beyond supervisors, their passion for their job is truly an inspiration.

I would also like to express my gratitude to Université Catholique de Louvain, Université Namur, Maastricht University, and NOVA School of Business and Economics for the diverse knowledge and experiences that have shaped my thoughts and provided different perspectives to this work.

A very special word to Andrea Galea, Andrea Mallardo, Francesco Gjoka, Calvin Vella, and Gonçalo Leão for the extremely useful discussions about my thesis and for making my life abroad much easier.

Last but not least, a word of gratitude to my Mother, Brother, Luís, and Matilde. Making you proud has always been the engine of my accomplishments. Thank you for believing in me more than I could ever believe in myself.

Obrigado.

Table of Contents

1	Introduction.....	5
2	Literature Review	7
2.1	Class composition effects on Cognitive Outcomes	7
2.2	Class composition effects on non-Cognitive Outcomes	9
2.3	Balancing Cognitive and non-Cognitive Outcomes	10
2.4	The Role of Personality Traits	11
2.4.1	Personality Traits Theory	12
2.4.2	The Five-Factor Model and Academic Achievement	12
2.4.3	Adverse Psychological Effects in Class and Personality Traits of Poor Students	13
3	Dutch Educational System	14
3.1	Implications for the Study	15
4	Data and Methodology	15
4.1	The Dataset.....	15
4.2	Conceptualisation of the main Independent Variable	17
4.3	Conceptualisation of the Dependent Variable.....	19
4.4	Conceptualisation of Personality Traits	19
4.4.1	The Dutch International Personality Item Pool	20
4.4.2	Index Construction - Principal Component Analysis	20
4.5	Other Variables	22
4.6	Descriptive Statistics	23
4.7	The Endogeneity Issues	25
4.7.1	In Class Composition	25
4.7.2	Sorting into Schools	26
4.7.3	In Personality Traits.....	28
4.8	The Propensity Score Matching	30
4.8.1	Propensity Score Matching and Personality Traits	32
5	Results	33
5.1	Comparison 1: Low-SES vs Middle-SES classes.....	36
5.2	Comparison 2: Low-SES vs High-SES classes	37
5.3	Comparison 3: Low-SES vs Mixed-SES classes	39
5.4	Comparison 4: Middle-SES vs High-SES classes	40
5.5	Comparisons 5, 6, and 7: Middle vs Mixed, High vs Mixed, Concentrated vs non-Concentrated	41
6	Discussion	42
6.1	Implications for Educational Policy	46
6.2	Limitations and Further Research.....	46
7	Conclusion	48
8	References.....	49
9	Appendix.....	54

1 Introduction

In elementary school, students spend half a day at school with the same classmates. Considering the holidays, this translates into approximately 25% of their annual time around the same peers. On top of this, students spend the rest of the day with their parents, and very likely their free time with their friends. What if we consider a student from a low socioeconomic background? Although education is crucial to fight intergenerational poverty, one can argue that a student growing up in predominantly low-SES backgrounds is more likely to be confronted with numerous challenges compared to children from higher socioeconomic contexts. In addition to generally less educated parents, limited parental support, and fewer financial resources to seek external help, the classroom's socioeconomic environment - where this low-SES student spends 25% of the year - can play an important role in shaping his/her attitudes towards school, academic success, and ultimately life outcomes.

What if policymakers move this low-SES kid to a richer class environment? On the one hand, integrating this student with peers from a higher socioeconomic status may positively influence school attitudes and expectations. This phenomenon, potentially explained by the labelling theory, can positively impact academic achievement. On the other hand, this integration may increase within-group comparisons, negatively impacting some non-cognitive outcomes such as school well-being or self-efficacy. This phenomenon, known as the Big-Fish-Little-Pond effect, can negatively affect academic achievement. Being both arguments extensively studied, it is increasingly necessary to go beyond a one-size-fits-all approach to a complex relationship between socioeconomic context and academic achievement, understanding how individuals with different personalities are impacted.

This study addresses an existent gap in the literature by balancing the positive effects but also the risks of class composition. While most studies show the direct effect of class composition on academic achievement, the role of risks is understudied. As the strength of these effects and risks may depend on individual characteristics, some students tend to benefit from peers with generally higher academic expectations, while others are more prone to suffer from adverse psychological effects from being a minority or simply comparing themselves with higher-ability peers. Accordingly, Lazear (2001) theoretically points out that integration may be beneficial up until a certain point where the proportion of high-ability students can no longer transform the low-ability into high-ability ones. Empirically, this idea is explored by Crosnoe (2009) who finds that an increase in the percentage of students from higher socioeconomic backgrounds may negatively contribute to disadvantaged students' academic achievement through psychosocial problems.

Therefore, the aim of this study is to first grasp the relationship between class socioeconomic composition and low-SES students' academic achievement, departing from the idea that the percentage of low-, middle-, and high-SES students in a classroom may play an important role to explore this

association in greater detail. Secondly, to understand who faces a higher risk when placed in a specific SES class instead of another, this study not only aims at examining how personality traits influence academic achievement but also how these traits mediate the relationship previously identified, as students with different levels of personality traits may be more or less impacted by peer effects in different socioeconomic contexts.

The surveys conducted by the Dutch Onderwijsmonitor Limburg (OML) were the primary source of data used in this research. Using parental education and parents' labour market status, students were categorised by SES (low-, middle-, and high-SES), and four types of class SES were identified based on the percentage of students from each SES within classes (low-, middle-, high-, and mixed-SES classes). Dropping middle- and high-SES students, a repeated cross-sectional dataset composed of a sample of 1803 6th-grade low-SES students attending schools in the province of Limburg was created. These students are distributed across 6 years (2011, 2013, 2015, 2016, 2017, 2019).

Employing a Propensity Score Matching framework to remove the potential endogeneity inherent to class composition, the study first tries to understand the relationship between Class Socioeconomic Composition and low-SES Children's Academic Achievement, comparing the academic performance of students between the following groups: 1) Low-SES vs Middle-SES Classes; 2) Low-SES vs High-SES classes; 3) Low-SES vs Mixed classes; 4) Middle-SES vs High-SES classes; 5) Middle-SES vs Mixed classes; 6) High-SES classes vs Mixed classes; and 7) Concentrated vs non-Concentrated classes. Furthermore, given the potential role of personality traits in explaining the strength of the risks of being in a specific class SES environment, Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism are included in the model as possible mediators of the previous relationship, building on the Five-Factor Model (FFM) developed by McCrae and Costa (1996). Even though psychological literature extensively explores the impact of each of these traits on academic achievement, I have no knowledge of a study which explores how their relevance may differ across the different class environments to which low-SES children are being exposed in our schooling systems.

The first set of results concerns the existence of a non-linear relationship between class socioeconomic composition and low-SES students' academic achievement. While students in middle-SES classes instead of low-SES classes are better off in terms of academic achievement, the ones in high-SES classes instead of middle-SES classes are not. In addition, by finding that homogeneous low-SES classes have a significantly negative treatment effect when compared to heterogeneous mixed-SES classes, this research weakens the argument that mixing students from different socioeconomic backgrounds within a class primarily serves social equity and integration purposes rather than academic performance. The second set of findings indicates that Openness to Experience and Neuroticism are not only predictors of academic performance but also mediators of the relationship between class socioeconomic composition and achievement, suggesting that while students with higher levels of Openness to

Experience tend to be less affected by lower-SES classes, those with higher levels of Neuroticism are generally more impacted by such class compositions. Moreover, although Conscientiousness is generally found to be a positive predictor of academic achievement, this study reveals the opposite for low-SES children in classrooms where they are a minority. However, if they are a minority, this trait does not have a heightened negative effect on students in middle-SES classes instead of high-SES classes, and vice-versa.

The remainder of this thesis is organised as follows: Section 2 reviews the literature on class composition, cognitive and non-cognitive outcomes, and personality traits; Section 3 provides an overview of the Dutch educational system with implications for this study; Section 4 describes the data and methodology used, including a conceptualisation of the main variables, descriptive statistics, and a discussion on the potential endogeneity issues and empirical challenges; While Section 5 presents the main results; Section 6 discusses them, the implications to educational policy, the main contribution to science, limitations, and indications for further research; Section 7 concludes.

2 Literature Review

The peer- composition has been consistently shown to directly impact individual students' cognitive outcomes, particularly academic achievement. However, the way composition affects academic achievement considering the potential risks on non-cognitive outcomes seems to be understudied. As the strength of these associations may depend on individual characteristics, individual personality traits may help fill part of the existing gap in the literature if they are shown to be significant mediators of the relationship here studied. On top of this, understanding this association in the context of disadvantaged students becomes increasingly relevant as these may be more prone to suffer from adverse non-cognitive effects that may hinder the benefits of higher-SES peers. Hence, this literature review aims to provide a comprehensive and interdisciplinary discussion on the impact of the classroom socioeconomic structure on academic achievement, including cognitive and non-cognitive outcomes. In addition, it examines the influence of personality traits on this association.

2.1 Class composition effects on Cognitive Outcomes

The literature extensively examines the relationship between class composition and cognitive outcomes, considering factors such as socioeconomic status (SES), ability, gender, and ethnic composition. While the focus of this research is on SES composition, reviewing the literature on other composition types is also relevant. First, they may be correlated with SES composition (Opdenakker & Damme, 2001). Second, they help understand the mechanisms behind the relationship here studied.

In terms of ability, a descriptive study by Dar and Resh (1986) reinforces the idea that class-level composition is more effective than school-level composition. Additionally, while it shows that

intellectual composition significantly affects academic achievement, its importance is more pronounced for low-resource students. In line with this, Sørensen and Hallinan (1986) empirically test a theory of growth in academic achievement to show the importance of ability composition, suggesting that groups with higher-ability students provide more opportunities for learning than groups with low-ability students. Accordingly, Hanushek et al. (2003) found positive significant effects of high-achieving students on all classmates' achievement growth using a fixed effects model. Recent developments agree with this association but find that class heterogeneity has overall no significant effects on achievement (Hattie, 2002; Scharenberg, 2012). Hoffer (1992) reinforces this idea in the context of ability grouping, reasoning that the decrease in achievement caused by low-ability grouping cancels the higher achievement of high-ability groups in middle school. Theoretically, the idea of mixing different ability students was extensively explored by Lazear (2001), who states that integrating low-ability with high-ability students is only efficient in maximising educational production if it is possible to transform the low-ability students into high-ability students around them. In case this effect is not strong enough due to the large relative number of low-ability students in class, segregation by academic ability is efficient.

Dumay and Dupriez (2008) use a multi-level analysis to find significant effects on between schools' academic achievement variance by ethnic and SES composition, suggesting that French-speaking Belgian 6th-grade individuals in higher-SES environments are expected to outperform their peers in lower-SES environments, or schools with a larger number of students from ethnic minorities. In another longitudinal multi-level study conducted with Dutch elementary schools, Van der Slik et al. (2006) also find that a high concentration of ethnic minorities leads to worse results in language performance. Yet, parental income, which is strongly correlated with SES, seems to have a stronger effect than the percentage of minorities.

Similarly, empirical studies using identification strategies (e.g.: Propensity Score Matching), have shown that class SES composition and school climate play a significant role in students' achievement, particularly in mathematics (Belfi et al., 2016; Rizzotto & França, 2022). Accordingly, Scharenberg (2012) found that high-SES classes in secondary schools were effective for student development. Yet, Crosnoe (2009), one of the main sociological studies in the field, point out the percentage of higher-SES students as a potentially negative contributor to low-SES students' academic achievement. Using a propensity score approach, the study causally finds that as the proportion of students from middle- to high-income families increases, the progress of low-income students in math and science tends to decrease.

From an empirical perspective, the main challenge when estimating the causal effects of class composition regards the potential selection bias in class formation. Given its implications in this research, a specific discussion about this issue is presented in Section 4.7.

2.2 Class composition effects on non-Cognitive Outcomes

Class composition affects students' non-cognitive outcomes, such as school well-being, self-efficacy, intrinsic motivation, or stress, which in turn may influence students' academic performance.

The impact of ability grouping on low-ability students' school well-being can be understood through the lens of the labelling theory from sociology (Becker, 1963). This theory suggests that the way people describe or categorize individuals can shape their self-identity and influence their behaviour. As so, low-ability students in low-ability classes may form negative perceptions of those who lead them to feel this way (Hallinan & Sørensen, 1985), negatively contributing to their academic achievement. Another potential channel through which class and school composition can affect students' school well-being is explained through the Differentiation-Polarization theory, which is a sociological perspective, empirically supported by Van Houtte (2006), that posits that as social groups become more differentiated, they can also become more polarized, leading to increased conflict and social inequality. This, according to Hargreaves and Hargreaves (2006), leads to adverse achievement effects, especially for low-ability classes. In the same direction, a longitudinal study by Hallinan and Sørensen (1985) suggests that polarised low-track students may develop negative school well-being, which in turn affects academic performance (Gang et al., 2019). Accordingly, descriptive psychological studies reinforce this idea. While Turashvili and Japaridze (2012) find that students with a high level of well-being tend to have medium to high academic performance, Tabbodi et al. (2015) reported a positive relationship between happiness and achievement motivation.

The effects of ability grouping on academic self-efficacy can be explained in light of the Reference-Group Theory (Richer, 1976). In the presence of ability homogeneous classes, high-ability students in high-ability classes may feel better when they compare themselves with the low-ability classes (across-group comparison with the low-ability class as the reference group). However, they may feel relatively more insecure if they compare themselves with their own high-ability class peers (within-group comparison with the high-ability class as the reference group). The magnitude of these effects depends on each individual characteristics - if the individual across-group comparison is stronger than the within-group comparison, a high-ability student is better in a homogenous high-ability class. The opposite goes for low-ability students – they are better off in low-ability homogeneous classes if the individual across-group comparison is weaker than the within-group comparison. In line with this, if low-ability students are integrated with a high-ability class and the within-group comparison is strong enough, it may have detrimental effects on self-efficacy (Schwabe et al., 2019; Seaton et al., 2009), also known as the Big-Fish-Little-Pond effect (Marsh, 1987). In addition, numerous descriptive psychological studies have found self-efficacy to be a significant predictor of students' success (Lane & Lane, 2001; Pintrich & De Groot, 1990; Schunk, 1984).

In line with academic self-efficacy, psychology literature indicates intrinsic motivation to be positively correlated with learning achievement and self-perception of competencies (Ames, 1992; Pokay & Blumenfeld, 1990). Furthermore, the Yerkes-Dodson law suggests that while moderate stress levels can lead to optimal performance, low- and high-stress levels can negatively affect performance.

While the literature about gender composition effects on cognitive outcomes is not extensive, the effects of gender grouping on non-cognitive outcomes have been more studied. According to Brutsaert and Van Houtte (2004), in heterogeneous schools and classes, girls not only face the challenge of fighting for better grades but also for gender acceptance, which in turn jeopardizes their ability to focus on their studies. Eder (1985) found that in heterogeneous classes, girls' popularity is associated with male attention, while in single-sex classes, personality is a more relevant factor, allowing girls to be fully focused on school. Warrington and Younger (2003) emphasized the importance of a safe learning environment for students, stating that gender-segregated classes can provide a safe space for students to speak up and be free from harassment and violence.

These findings suggest that class composition impacts non-cognitive outcomes. As these may somehow affect academic achievement, it is important to consider them when establishing a relationship between class composition and academic achievement.

2.3 Balancing Cognitive and non-Cognitive Outcomes: A non-Linear

Relationship Between Class Composition and Academic Achievement?

The one-size-fits-all approach to the impact of grouping students by ability, gender, ethnicity, or socioeconomic status (SES) is limited, and the individual benefits of being placed in a particular group appear to be contingent upon, among others, the representation of one's own group within the classroom (Crosnoe, 2009).

On the one hand, extensive literature suggests a positive relationship between the percentage of high-background students in a specific class and the individual academic outcome of disadvantaged students (Bouchard Jr, 1997; Duncan & Magnuson, 2003; Shonkoff, 2003). In addition, Van Houtte and Stevens (2010) find that the low concentration of ethnic minorities in Belgian schools has a favourable impact on these minority students' aspirations to pursue higher education.

On the other hand, *The Economist* released an article called "*The Paradox of the Ghetto*"¹ pointing out that children from low-income backgrounds tend to have better academic outcomes in low-income neighbourhoods. Although not proposing segregation, the findings of this article are relevant enough to suggest a more in-depth study of the apparent non-linear relationship between the degree of class

¹ Article available here: <https://www.economist.com/britain/2015/01/29/the-paradox-of-the-ghetto>

concentration and low-SES students' academic achievement. Accordingly, Boonen et al. (2014) point out that the proportion of minority students appears to have a significant effect on performance.

Concentration may also be beneficial for different types of students. Ability-based concentrated classes generally benefit high-ability students while hindering low-ability students, suggesting that heterogeneous classes may be more advantageous for the latter (De Fraine et al., 2011). Although different, ability and SES are correlated. Therefore, it is not surprising that schools with a larger concentration of high-SES students proved to be the most favourable for the class average math development (Belfi et al., 2016). However, mixed-SES schools showed the least benefits compared to low- and high-SES schools. In addition, this study confirms the idea of differential effects of composition by individual students' SES, showing that mixed-SES schools have stronger negative effects on higher-SES students.

From a sociological perspective, Crosnoe (2009) suggests that while high- or middle-income schools may benefit poor students' academic achievement, they also result in increased psychosocial problems for low-income students as the proportion of students with middle- or high-income or college-educated parents increases. This frog pond perspective, first introduced by Marsh (1987) and further developed by Marsh and Hau (2003), suggests that poor students are at a disadvantage in middle- to high-class schools due to greater competition and risks of stigmatization arising from the within-group comparison. Together, these factors may mitigate the potential academic benefits of low-income students attending middle- to high-class schools. In parallel with this, it can be argued that poor children (especially minorities) may suffer from adverse psychological effects when studying in high-income communities, which would lead them to worse academic performance (Marsh & Parker, 1984).

Therefore, the relationship between the degree of SES concentration and low-SES children's academic performance seems to be very complex and both cognitive and non-cognitive aspects need to be balanced to accurately disentangle this association. In this study, personality traits are hypothesized to be a significant driver of the heterogeneous effects of class socioeconomic composition.

2.4 The Role of Personality Traits

The influence of the aforementioned non-cognitive predictors on academic achievement is contingent upon the individual characteristics of students. The argument that individual qualities are the biggest predictor of academic success (Bergold & Steinmayr, 2018) allied with the finding that intelligence, although the most important predictor (Von Stumm & Furnham, 2012), never accounts for more than 25% of the variation in academic achievement (Bergold & Steinmayr, 2018) makes the study of personality traits relevant.

Intuitively, the hypothesis that individual personality traits may mediate the relationship here studied seems to be valid. On the one hand, poor individuals with higher conscientiousness, openness, and

agreeableness may be less susceptible to suffering from the above-mentioned adverse psychological effects of class composition. On the other hand, some personality traits such as neuroticism or lack of openness may exacerbate these negative effects. Therefore, some traits may help low-SES students overcome the disadvantages associated with growing up in poverty and improving their performance.

2.4.1 Personality Traits Theory

Personality Theories are central to the study of human behaviour and understanding how to properly measure personality for research purposes. Developed by McCrae and Costa (1996), the Five-Factor Model of Personality (FFM) is a comprehensive theory that outlines five broad dimensions of personality: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. The FFM is based on the idea that these five dimensions are universal across cultures and can be used to comprehensively describe human personality.

Following the explanation provided by the authors, the FFM of Personality defines the dimensions as:

1. **Openness:** This trait encompasses imagination, creativity, and a willingness to try new experiences. People who score high in openness are often described as curious, innovative, and artistic.
2. **Conscientiousness:** This trait refers to being responsible and organized. Individuals high in conscientiousness are often described as hardworking, diligent, and efficient.
3. **Extraversion:** This trait encompasses sociability, talkativeness, and assertiveness. People who score high in extraversion are often described as outgoing, energetic, and confident.
4. **Agreeableness:** This trait refers to being cooperative, empathetic, and compassionate. Individuals high in agreeableness are often described as kind, forgiving, and considerate.
5. **Neuroticism:** This trait encompasses emotional instability, anxiety, and moodiness. People who score high in neuroticism are often described as sensitive, anxious, and prone to stress.

The widely accepted Five-Factor Model (FFM) will be used in this study because of its parsimonious and intuitive framework for organizing and understanding individual personality differences (McCrae & Costa Jr, 1997). Moreover, the questions included in the survey used for this study are based on the FFM, ensuring that the results can be easily compared with relevant literature in the field.

Other reasons for its general acceptance are its empirical support, comprehensive coverage of personality traits, and usefulness in predicting various behaviours, including academic achievement (Lechner et al., 2021; Serrano et al., 2022; Von Stumm & Furnham, 2012).

2.4.2 The Five-Factor Model and Academic Achievement

The literature in educational psychology has been exploring the relationship between the Big-Five factors and academic achievement, presenting findings in similar directions. Conscientiousness and Openness to Experience are generally found to be positively associated with academic success (Barakat & Othman, 2015; Novikova & Vorobyeva, 2017; Serrano et al., 2022). While Conscientiousness

appears to be more related to GPA, Openness to Experience is found to be more connected to specific verbal scores (Nofle & Robins, 2007). Serrano et al. (2022) also find Neuroticism to be negatively associated with academic performance, corroborated by Bergold and Steinmayr (2018). The latter also finds Extraversion to be a positive contributor to academic success, similar to a study with British undergraduates conducted by Von Stumm and Furnham (2012). In total, Komarraju et al. (2009) argue that Conscientiousness, Openness, Neuroticism, and Agreeableness account for 14% of the variance in GPA. Therefore, although one should not expect a big divergence in the way these factors influence academic achievement, it is relevant to understand how relevant they are in helping or damaging low-SES students from different class socioeconomic compositions.

Considering this, the importance of understanding this interplay among poor students is highlighted by Lechner et al. (2021), who argued that Conscientiousness and Openness to experience are the traits in which low- and high-SES diverge the most. Similarly, a large body of literature associates specific personality traits with socioeconomic background. Consequently, it is empirically hard to remove the endogeneity of personality when studying SES composition effects. Given its implications, personality traits' endogeneity is discussed in Section 3.

2.4.3 Adverse Psychological Effects in Class and Personality Traits of Poor Students

While poor students are often at a greater risk of experiencing adverse psychological effects in class, personality traits may play a role in determining a student's susceptibility to these adverse effects in class. Some personality traits, such as neuroticism, may increase a student's tendency to experience negative emotions, whereas others, such as extraversion, may provide a protective effect. So, personality traits may be one of the strongest weapons to help low-SES to succeed in every type of class environment, making it relevant to understand the relationship between class socioeconomic composition, personality traits, and low-SES students' academic achievement.

As previously mentioned, Lechner et al. (2021) find a significant difference in Conscientiousness between high and low-SES students. Also, a study by Jonassaint et al. (2011) found that students from low-SES families have higher levels of neuroticism and lower levels of extraversion and openness compared to students from high-SES families. Similarly, research has shown that adolescents with high levels of neuroticism are more likely to experience stress and anxiety (He et al., 2021). On the other hand, De la Fuente et al. (2021) find that Conscientiousness and Extraversion are significantly negative predictors of academic stress. Furthermore, Rizzotto and França (2022) find that school climate impacts students differently, with low-income students being the most affected in Brazil. In conclusion, as personality traits may play a role in defining who will suffer adverse peer effects, it becomes relevant to study the previous relationship among students from disadvantaged backgrounds.

To conclude, this review shows that there is a lack of evidence in the literature about the mechanisms through which class composition influences academic achievement unless psychological and non-

cognitive aspects are included. The evidence that exists typically finds positive effects of class composition, although there is still debate about the magnitude of these effects. On the other hand, psychological and sociological literature finds relatively important adverse effects of being in a minority group. Accordingly, there is evidence suggesting that mixing students from different socio-economic backgrounds can be beneficial up to a certain level. Beyond that level, the negative effects of being a minority may outweigh any positive effects of diversity (Van Houtte & Stevens, 2010).

Furthermore, both economic and psychological perspectives highlight the importance of personality traits, suggesting their mediative role in the relationship between class socioeconomic composition and poor students' academic achievement. While SES continues to have a strong impact on academic outcomes, personality traits may play a critical part in shaping how students respond to different socioeconomic environments. To address the academic achievement gap among poor students, it is essential to consider both the structural barriers associated with poverty and the individual-level factors, such as personality traits, that can impact academic success.

3 Dutch Educational System

Before delving into details, it is important to get a brief overview of the current Dutch Educational System based on Cotofan et al. (2022), the supplemental appendix of Golle et al. (2023) and the Institute of International Education. Overall, the Dutch educational path is divided into primary and secondary education.

Primary education lasts 8 years, starting with 2 years of kindergarten before 1st grade. Here, students mostly learn social skills, writing, counting, and solving problems in a didactic manner. After the 1st grade, students complete 6 years of more formal primary education, finishing in the 6th grade. In these 6 years, reading, writing, and arithmetic are the most important skills to develop, and each class has a single teacher for all the disciplines. Usually, this class teacher changes every year. In terms of age, students usually start primary education at 4, and the transition to formal primary education occurs around 6. Nevertheless, depending on the performance of the individuals, it can be accorded with teachers and parents to delay or accelerate the transition to later or earlier ages, respectively.

At the end of the sixth grade, students need to take a mandatory CITO - standardized achievement test (Eindtoets basisonderwijs). This grade, along with the teachers' recommendations, parental input, and students' aspirations, will be important to determine the track to be followed in secondary school. According to Cotofan et al. (2022), the correlation between the test and teachers' recommendations is approximately 0.82. In secondary school, students can be placed in one of three different tracks: 1) the prevocational secondary education (VMBO diploma) is a 4-year program that aims to prepare students for lower and medium vocational education (approximately 55% of students go for this track); 2) the pre-higher education (HAVO diploma) is a 5-year program designed to prepare students for higher

vocational education (approximately 25% of students end up in this track); 3) the pre-academic education (VWO diploma) is a 6-year program that aims to prepare students for academic education (approximately 20% of students pursue this track).

3.1 Implications for the Study

Understanding this information is important for this study for various reasons. Firstly, having a sample of primary education students is extremely beneficial for the research. On the one hand, while ability tracking occurs in secondary school, it does not take place in primary school. This absence of tracking in primary school naturally reduces the endogeneity in class formation that arises from ability grouping. On the other hand, the fact that usually, the class teacher changes in every year of primary education helps to reduce the concerns raised by Hattie (2002) and Boonen et al. (2014) about the influence of teachers' behaviour, the relationship between teachers and parents, and the school processes as potential biases of the relationship between class composition and the student's academic performance.

Secondly, to properly read the information gotten from the survey used to collect the data for this study, one needs to know the different layers of the Dutch education system. Specifically, as will be explained in Section 4, students were characterised into low-SES, middle-SES, and high-SES using parental education as a criterion. Therefore, knowing the type of diploma acquired by the sampled parents is important to understand the relative level of their education. Additionally, the academic achievement measure used as the dependent variable in this study is partially calculated using the before-mentioned standardised test score at the end of the sixth grade.

In the Netherlands, parents are free to choose the primary school they want their children to attend. This allows parents to select from a variety of schools based on their preferences regarding location, teaching methods, curriculum, and school culture. However, schools also have a significant degree of autonomy when it comes to forming classes, and they make efforts to randomize the composition of classes based on students' background characteristics. Recognizing that this may not fully address the complex issue of endogeneity in class formation, the topic will be explored in greater detail later on.

4 Data and Methodology

4.1 The Dataset

The data used in this research comes from the Onderwijsmonitor Limburg (OML), a cooperative project between Maastricht University, educational institutes (primary, secondary, and tertiary), and government bodies, to gain insights about the students' educational development in the region of Limburg, in the south of the Netherlands. Using ArcGIS, it was possible to construct a map with

administrative divisions of the Netherlands (Figure A in the Appendix) and Limburg (Figure B in the Appendix) so that the reader gets a locational context of the study².

The OML complements the administrative data by incorporating surveys administered to students, parents, and teachers at the end of kindergarten, 6th grade, and 9th grade (with the 6th-grade survey being the relevant one for this study). These surveys not only assign a unique ID to each student and school but also provide valuable information on various factors. These include the students' standardized test scores (CITO, IEP, and RO8³), the education level of the highest educated parent, the employment status of the mother and father, the student's gender, the level of parental support, self-efficacy, aspirations for secondary education, non-cognitive skills, personality traits, and more.

The school coverage of this survey was between 80% to 92% (Golsteyn & Schils, 2014) and, starting in 2011, it was implemented in 2012, 2013, 2014, 2015, 2017, 2019, and 2021. As each student has an identifier and is referenced once at the end of 6th grade, a repeated cross-sectional dataset was built from the survey answers. Nevertheless, some important manipulations were made and should be highlighted for a better understanding of the dataset used and more accurate results.

First of all, to ensure the integrity of the data, observations from the year 2021 were excluded from the sample. This decision was made due to the atypical academic year caused by the COVID-19 lockdown in the Netherlands. It was recognized that the students' responses to questions assessing personality traits could have been influenced by the challenging social circumstances they experienced during the pandemic (Kekäläinen et al., 2021).

Secondly, students were categorised into low-, middle-, and high-SES based on parental education and parental labour market status (the specific criteria are explained in Section 4.2). Then, after creating single class identifiers based on the year of the cohort, classes were also categorised into low-, middle-, high-, and mixed-SES, based on the percentage of students of each SES within the class (the specific criteria are explained in Section 4.2). Having students and classes divided by SES, only low-SES students were kept in order to analyse their performance across the four different class SES types.

Nevertheless, one should not ignore the fact that, although most primary schools in Limburg have only one 6th-grade class, some schools have more than one class. This raises concerns about a one-to-one conversion of a school identifier to a class identifier. Since the OML dataset does not include class identifiers required to answer the research question at a class-level, schools with more than 35 students or less than 10 students were excluded from the sample⁴. Having a sample of schools within this size

² Dutch administrative divisions data 2015 was collected and some administrative changes might have occurred since then. Nevertheless, the illustrations are still representative of the studied area.

³ The CITO, IEP, and RO8 tests are designed and evaluated by independent institutes, rather than by the teachers within the schools, ensuring that the assessment process remains unbiased and impartial.

⁴ The thresholds were defined based on the frequency distribution of the number of students/class size in each school – see Figure C in the Appendix.

range and assuming that this would correspond to the size of one class, it is possible to turn the school identifiers into class identifiers in a more accurate way.

Removing these Class IDs as an attempt to have single-class schools may result in some selection bias. Arguably, Class IDs with a larger student-teacher ratio may be associated with lower SES backgrounds. Yet, there are no reasons to believe that this sample restriction has significant effects on the results because 1) the sample is only composed of low-SES students; 2) there is no explicit tracking in Limburg; 3) schools successfully try to create heterogeneous classes; 4) the supply of schools outside bigger cities within Limburg is very limited, strongly restricting the possibility of sorting into specific schools; and 5) empirical research in Limburg not only finds distance to be the most relevant factor when choosing a school but also do not find clear evidence of sorting within bigger cities where this is more likely due to the higher number of schools, as later explained in Section 4.7.2. In addition, this sample restriction decreases the amount of Class IDs from 679 to 492, resulting in a reduction in the total number of observations from 2418 to 1803 low-SES students, which is still very relevant.

Since the standardised test score is used as the main dependent variable, all the students with missing information on this variable were also dropped. There is no reason to believe that there is a self-selection issue about dropping these missing values as the missing information is mostly about specific years (2012 and 2014) and not so much within each year in specific schools⁵. Below, in Table 1, a description of the variables included in the dataset can be found. The key variables are further elaborated upon in the following subsections.

4.2 Conceptualisation of the main Independent Variable

The main independent variable used to study the effect of class socioeconomic composition on low-SES students' academic achievement is called *ClassSES*. This is a categorical variable with four classes defined based on Belfi et al. (2016): **low-SES classes** (if it has more than 50% low-SES students); **middle-SES classes** (if it has more than 50% middle-SES students); **high-SES classes** (if it has more than 50% high-SES students); and **mixed-SES classes** (all the other classes with no majority of students from a specific socioeconomic status).

To construct the main independent variable, *ClassSES*, it is essential to identify students by socioeconomic status. Given this, a variable called *StudentSES* was created preliminarily. To generate this, three other variables collected from the parental survey were used: 1) the education level of the highest educated parent; 2) the labour market status of the mother; and 3) the labour market status of the father. According to the literature, these are strong predictors of children's socioeconomic status (Davis-Kean et al., 2019; Waters et al., 2021).

⁵ After dropping test score missing value, the number of low-SES students goes from 282 to 275, 275 to 0, 160 to 157, 124 to 0, 492 to 485, 62 to 60, 628 to 548, and 484 to 278 in 2011, 2012, 2013, 2014, 2015, 2016, 2017, and 2019, respectively.

The “*educational level of the highest educated parent*” can take four different values. “1” if the highest educated parent has elementary education (less than mbo), “2” if the highest educated parent has secondary school (mbo/havo/vwo), “3” if the highest educated parent has tertiary education with higher vocational track (hbo), and “4” if the highest educated parent has tertiary education with scientific/academic track (wo). The variables “*labour market status of the mother*” and “*labour market status of the father*” can also take four different values. “1” if she/he has a paid job, “2” if she/he is unemployed and thus has no job, “3” if she/he is disabled and thus has no job, and “4” if she/he has no job for other reason.

Following these, the study proposes an innovative classification of students’ socioeconomic status. It not only incorporates parental education, as usually addressed in the literature but also the current labour market status of each parent. This approach is believed to be more comprehensive as it includes the current economic situation of the family, which can be important for the students’ immediate well-being, their attitudes towards schools, and mostly the way students are influenced by their peers regarding SES composition. *StudentSES* can take the form of three categories: 1) low-SES student; 2) middle-SES student; and 3) high-SES student.

- A student is considered **low-SES** if one of the two following conditions holds: a) the highest educated parent does not have more than Elementary education; b) the highest educated parent does not have more than Secondary education but at least one of the parents has no job.
- A student is considered **middle-SES** if one of the three following conditions holds: a) the highest educated parent has Tertiary education with a scientific/academic track but at least one of the parents has no job; b) the highest educated parent has Tertiary education with a higher vocational track but at least one of the parents has no job; c) the highest educated parent does not have more than Secondary education but both parents have a paid job.
- Otherwise, a student is considered **high-SES**.

The incorporation of the parents’ labour market status as a criterion to determine students’ socioeconomic status is a unique aspect of this research, upgrading or downgrading the students’ socioeconomic status simply proxied by parental education. Nevertheless, one should not ignore the fact that some researchers in psychology believe that different indicators of SES should be studied independently as they reflect different resources that affect children in different ways (Duncan & Magnuson, 2003).

Another relevant categorization to analyse is the concentration of a class in terms of students from a specific socioeconomic status. This is determined by whether more than 50% of students in a class belong to a particular SES category. To account for this, a dummy variable was created, taking the value of 1 if the class is concentrated (and 0 otherwise). In other words, a class is considered non-concentrated only if it is a mixed-SES class.

Throughout the years, the *ClassSES* might change, hindering the effects of class socioeconomic composition on a specific student's academic achievement. This issue is raised by Belfi et al. (2016) and Belfi et al. (2012) in which the authors follow the same individuals with a longitudinal dataset. Therefore, it is important to understand whether the class socioeconomic status change throughout time. However, in this research, a repeated cross-sectional dataset is used, and students are individual points in time. As so, it is more relevant to analyse the result of a Pearson correlation between *ClassSES* and *SchoolID* throughout the years. This will be done in Section 4.7.2 as it is relevant to discuss the agglomeration of students from a certain socioeconomic background in specific schools/classes. Numerical information about these variables can be found in the descriptive statistics Section 4.6.

4.3 Conceptualisation of the Dependent Variable

To measure the impact of class socioeconomic composition on low-SES children's academic achievement, their Relative Exit Test Scores are used as the main dependent variable. These are artificially computed results that vary between 0 and 1. To build this variable, three different tests are used: 1) the Exit Test Score CITO, which varies between 500 and 550; 2) the Exit Test Score IEP, which varies between 50 and 100; and 3) the Exit Test Score RO8, which varies between 100 and 300. In order to get comparable values, a relative test score ranging between 0 and 1 is computed within each test type and then combined into a single variable with the information available. Although the CITO test score was the only one included until 2015, this study always uses the relative test scores between 0 and 1 so that a comparison can be made.

Even though the Relative Exit Test Scores do not represent the exact grade achieved by a student, what matters for this research is the relative variation of grades across students in different socioeconomic contexts. Although test scores rely solely on a single performance within a testing environment, which may not truly reflect students' depth of knowledge or their overall academic readiness (Godwin et al., 2015), these specific Exit Test Scores administered to students at the end of 6th grade are still a very good assessment of the students' academic ability, as they not only measure mathematics and language knowledge but also try to capture other studying and soft skills.

As they are nationally used to place students on the right educational track during secondary school, it becomes crucial that they accurately measure the potential of a student. Therefore, these Exit Test Scores provide a more robust measure of academic achievement compared to traditional test scores. Numerical information about this variable can be found in the descriptive statistics Section 4.6.

4.4 Conceptualisation of Personality Traits

To study the role of personality traits on the relationship between class socioeconomic composition and low-SES students' academic achievement, the Five-Factor Model of personality (FFM) developed by McCrae and Costa (1996) was used in the analysis. To measure openness to experience,

conscientiousness, extraversion, agreeableness, and neuroticism, the Dutch International Personality Item Pool was used to build the personality assessment through the survey constructed by the OML.

4.4.1 The Dutch International Personality Item Pool

The Big-Five personality traits in this study are assessed using the Dutch version of the IPIP-50 developed by Blanken et al. (2018), based on the original work of Goldberg (1992). It is a local adaptation of the 50-item International Personality Item Pool (IPIP) which is a public set⁶ of self-reported items used to measure personality traits through individual assessments based on the Five-Factor Model (FFM). The questionnaire used in the survey consists of questions, statements, or items related to each of the five personality traits. Participants are then required to rate the extent to which they disagree or agree on a numerical scale from 1 to 5⁷. Responses are then scored, and students get a value for each specific personality trait. Example items to measure openness to experience are “*I have a lot of ideas*” or “*I love collecting information*”. Conscientiousness is measured with statements like “*I make easy connections*” or “*I am accurate*”. Extraversion and agreeableness are measured through items like “*I do not talk much*” or “*Sometimes I am rude*”, respectively. Finally, neuroticism example statements are “*I am stressed easily*” and “*I often think something will go wrong*”⁸.

4.4.2 Index Construction - Principal Component Analysis

To get five variables with an individual index for each personality trait, a Principal Component Analysis (PCA) was conducted. This is a well-established method used in statistical analysis that was first introduced by Pearson (1901), and later developed by Hotelling (1933), in the context of educational psychology, and more recently Jolliffe (2002). This is a multidimensionality reduction technique used in large datasets that might have a specific statistical distribution. The idea is that the PCA allows uncovering low dimensional patterns, identifying which are the variables with greater explanatory power within a set of covariates. By doing this, one can reduce a large set of covariates to a smaller amount. Then, one can then create an index as a weighted sum of the covariates with greater explanatory power identified by the PCA, being the weight equal to the relative degree of explanatory power of the respective covariate.

In this research, there are nevertheless issues to consider before employing a PCA. One related to missing values and the other to the comparability of results across individuals.

Employing a PCA requires a complete dataset with no missing values. However, since the items used in the questionnaire were dropped, included, or slightly adapted throughout the years, there are missing values. Let’s take an example: if one is measuring conscientiousness, there is a total of 8 items in the

⁶ The publicly available set of items can be found here: <https://ipip.ori.org/index.htm>

⁷ The scale used to rate the Dutch International Personality Pool Items is: 1 – Strongly Disagree; 2 – Disagree; 3 – Neutral; 4 – Agree; 5 – Strongly Agree.

⁸ A complete list of all the items used to measure each of the Big-Five Personality Traits is found in List A on the Appendix.

questionnaire, distributed across more than 1800 low-SES students. However, some items were dropped, included, or slightly changed throughout the years, leading to missing information. In the case of conscientiousness, 5 items were included in 2011, one of them was dropped from 2013 to 2016, another one was dropped in 2017, and 3 new items were included in 2019. Using inference techniques to extrapolate missing values is a potential option; however, due to the substantial amount of missing information, this approach may yield highly misleading results.

Another alternative would be to drop all the missing values and simply run a mean for each individual according to the items he/she had answered. However, not only the questions are different but also the questions that were adapted from one year to another can provide incomparable results if they are framed in different ways (even if the framing is adapted to improve the accuracy of the traits' measurement). Considering these, a simple mean score would provide results that are not accurately comparable. In addition, different items may have different explanatory power within the sample.

Considering these issues, the common items throughout the years were identified for each personality trait, ensuring that there would be no missing values and the indexes would be comparable across individuals⁹. Next, a PCA was conducted on the items corresponding to each personality trait. This analysis aimed to identify the items contributing the most to measuring each personality trait. Based on the empirical Keiser criterion, only variables with an eigenvalue greater than 1 were retained, indicating their significance in capturing the underlying dimensions of the respective personality traits¹⁰. Subsequently, the index was calculated for each individual by considering the proportion of explanatory power contributed by each covariate. This was achieved by computing a weighted sum of covariates, where the weight assigned to each covariate reflected its relative explanatory power. Results were then normalised within each personality trait.

Personality Trait Index

$$\begin{aligned}
 &= \text{Principal Component 1} * \frac{\text{Proportion PC1}}{\text{Proportion PC1} + \text{Proportion PC2}} \\
 &+ \text{Principal Component 2} * \frac{\text{Proportion PC2}}{\text{Proportion PC1} + \text{Proportion PC2}}
 \end{aligned} \tag{1}$$

⁹ The increase in the comparability, truthfulness, and accuracy of results is worth the information loss given the huge sample size.

¹⁰ Provided that the Keiser criterion also mentions a threshold of 20% in the proportion of explanatory power of a specific covariate, a big difference in eigenvalues projected in a Stata scree plot was also taken into account to decide whether to keep a covariate or not.

4.5 Other Variables

In addition to students' achievement, class socioeconomic composition, and personality traits, other variables were identified as important controls. *Gender* is a dummy variable taking the value of 1 if the student is a girl, and 0 otherwise. *ClassSize*, being an important factor influencing both the relevance of peer effects and students' academic achievement (Lazear, 2001), is measured as the number of students in a specific class. *ClassGPA*, which can be considered a significant predictor of individual student achievement (Slavin, 1987; Veldman & Sanford, 1984), is calculated as the average relative test score within each class. A variable for the *Track recommendation from parents* is also considered and corresponds to the parents' track recommendation at the end of primary school. It is retrieved from the parental survey and can be important to consider the parental expectations about their children's education, given their capabilities¹¹. A variable for track recommendation based on the test is also included in the dataset¹². The results of an *IQ* test are considered as well.

From the parental survey, it is also possible to retrieve variables measuring the level of parental support received by children. This survey includes a set of items related to the intensity and type of support provided by parents. The respondents are then required to provide one out of four answers: “No”, “Somewhat”, “Pretty Much”, or “A lot”. Example questions are “*I regularly talk to my child about what he/she has done in school*”, “*I motivate and support my child with homework*”, or “*I buy external professional support for my child*”¹³.

Some of these items were also dropped, included, or slightly changed the framing throughout the decade, leading to missing information in some years. As so, to get a more complete set of variables for parental support, similar items (e.g. “*I motivate and support my child*” and “*I motivate and support my child with homework*”) were merged into one single variable, under the condition of a statistically similar distribution across individuals. Even though some appear to be similar in wording, they have a significantly different distribution. For instance, the items “*I offer homework support at home*” and “*I offer my child support with homework*” seem to be measuring the same thing but their distribution varies a lot across entities. Presented in the book “*Thinking, Fast and Slow*” by Professor Daniel Kahneman (Kahneman, 2017), a possible explanation concerns the importance of framing in activating sensorial stimulus that may statistically influence the answers provided by human beings. Since some parents preferred not to answer, some information was missing and replaced by missing values.

After all, three variables of parental support were created: *PSupport1* measures the external professional support offered to children outside school, *PSupport2* measures the homework support provided by

¹¹ The variable “Track Recommendation from parents” can take the following forms: 1 – vmbo practical; 2 – vmbo theoretical; 3 – vmbo havo; 4 – havo; 5 – havo/vwo; and 6 – vwo.

¹² The variable “Track Recommendation from test” can take the following forms: 1 – vmbo practical; 2 – vmbo theoretical; 3 – vmbo havo; 4 – havo; 5 – havo/vwo; and 6 – vwo

¹³ A complete list of all the parental support questions can be found in List B in the Appendix .

parents, and *PSupport3* measures the motivation and support provided by parents. There were additional items in the questionnaire; however, they were missing in the majority of the years, and it was not feasible to merge them with other items in the dataset.

Finally, two other variables were considered from the students' questionnaire. One measuring academic *self-efficacy* (“*Do you think you will be successful in secondary school?*”). The other one, *SecondarySc*, measures the desire of children to pursue secondary schooling. In other words, it considers a set of aspects such as how much children like school, how motivated they are, or how much they believe in school at the end of primary education. A full description of the variables can be found below.

Table 1: List of the variables included in the dataset

VARIABLE NAME	VARIABLE LABEL	VARIABLE NAME	VARIABLE LABEL
Year	Class Year	testscore	Relative exit test score
StudentID	Student Identifier	IQtest	score iq-test
StudentSES	Student Socioeconomic Status	Openness	Openness Index
SchoolID	School Identifier	Conscientiousness	Conscientiousness Index
Gender	Female = 1, Male = 0	Extraversion	Extraversion Index
ClassSize	Class Size	Agreeableness	Agreeableness Index
ClassID	Class Identifier	Neuroticism	Neuroticism Index
ClassGPA	Average Class GPA	PSupport1	External professional support provided by parents
ClassSES	Class Socioeconomic Status	PSupport2	Parental homework support
Concentrated	Concentrated Class = 1, Mixed Class = 0	PSupport3	The child is motivated and supported by parents
oplouder_g6	Education level highest educated parent	SecondarySc	How much do you like going to secondary school g6
labstatp1	Labour Market Status parent 1 (mostly mother)	SelfEfficacy	Do you think you will be successful in secondary school?
labstatp2	Labour Market Status parent 2 (mostly mother)		
advice_par	track recommendation sec school parental survey		
advice_test	track recommendation sec school based on test		

4.6 Descriptive Statistics

In this section, descriptive statistics of the main independent variable (Class Socioeconomic Composition), the main dependent variable (Relative Exit Test Score), and the other variables are presented.

Table 2 shows the number of low-SES and the number of classes per Class SES and years. In the sample used in this study, there are 28 low-SES classes, 267 middle-SES classes, 129 high-SES classes, and 68 mixed-SES classes. Accordingly, there are 424 concentrated classes. In terms of low-SES students, the majority of the sample is concentrated in middle-SES classes (974 low-SES students), followed by mixed-SES classes (293 low-SES students), high-SES classes (284 low-SES students), and low-SES classes (252 low-SES students). In total, there are 1803 low-SES students distributed across 492 classes in the sample used in this study.

In Table 2, a ratio of low-SES girls per low-SES boys within each Class SES type is also presented. In low-SES classes, high-SES classes, and mixed-SES classes, this ratio is always equal to 1.14. In middle-SES classes, this ratio decreases to approximately 0.99.

Table 2: Distribution of low-SES students across classes by SES and Gender

	LOW-SES CLASSES		MIDDLE-SES CLASSES		HIGH-SES CLASSES		MIXED-SES CLASSES	
	#Low-SES Students	#Classes	#Low-SES Students	#Classes	#Low-SES Students	#Classes	#Low-SES Students	#Classes
2011	-	-	15	9	156	61	104	25
2013	-	-	11	8	116	60	30	14
2015	93	11	338	95	2	1	52	9
2016	-	-	50	8	-	-	10	2
2017	107	11	355	82	6	3	80	15
2019	52	6	205	65	4	4	17	3
Total	252	28	974	267	284	129	293	68
Girls / Boys	134 / 118		519 / 455		141 / 143		156 / 137	

According to Table 3, the mean relative exit test score of low-SES students is approximately 0.64. Interestingly, this value seems to vary when the sample is restricted to students with different personality traits, as we can see in Figure D, Figure E, Figure F, Figure G, and Figure H in the Appendix. Table 4 represents the respective p-values associated with mean test score differences between low-SES students with low and high scores of each personality trait¹⁴ across the different Class Socioeconomic Compositions (1 - low-SES; 2 – middle-SES; 3 – high-SES; 4 – mixed-SES). Following Figures D, E, F, G, H, and Table 4, it is important to explore the significance of personality traits as mediators of the relationship here studied, particularly Neuroticism in every class SES environment, Openness to Experience in every class SES environment where there is a majority of students from a specific SES, and Agreeableness in class environments where there is a majority of students from a specific SES environment that is not low-SES. A complete descriptive statistic of the variables can be found below in Table 3.

¹⁴ After normalisation, a low-SES students is considered to have low level of a specific personality trait when the index of the respective trait is -1 SD below the mean. A low-SES students is considered to have high level of a specific personality trait when the index of the respective trait is +1 SD above the mean.

Table 3: Descriptive Statistics

	MEAN	SD	MIN	MAX	N
Class Size	19.90	6.08	10.0	35.0	1803
Education of the highest educated parent	1.48	0.74	1.0	4.0	1803
Labour Market Status parent 1 (mostly mother)	2.04	1.21	1.0	4.0	1350
Labour Market Status parent 2 (mostly mother)	1.74	1.12	1.0	4.0	1136
Track recommendation parental survey	2.77	1.75	1.0	6.0	1644
Track recommendation based on test	2.77	1.67	1.0	6.0	1316
Test Score	0.64	0.20	0.0	1.0	1803
IQ Test	-0.09	0.84	-2.9	2.2	1736
Openness	-0.11	0.83	-2.1	1.6	1740
Conscientiousness	0.01	0.74	-2.2	1.6	1729
Extraversion	-0.03	0.73	-1.4	1.7	1729
Agreeableness	-0.15	0.98	-4.0	1.3	1718
Neuroticism	0.18	1.03	-2.0	2.7	1731
PSupport1	1.28	0.71	1.0	4.0	1491
PSupport2	2.36	0.99	1.0	4.0	1482
PSupport3	3.07	0.78	1.0	4.0	956
SecondarySc	3.12	0.84	1.0	4.0	1718
Academic Self-Efficacy	3.12	0.60	1.0	4.0	1723

Table 4: *p*-Values of the mean test score differences between low-SES students with different traits' scores

	High- vs Low- Conscientiousness	High- vs Low- Openness	High- vs Low- Agreeableness	High- vs Low- Extraversion	High- vs Low- Neuroticism
Low-SES Class	0.7375	0.0087***	0.9162	0.2683	0.0007***
Middle-SES Class	0.2949	0.0001***	0.0315**	0.9458	0.001***
High-SES Class	0.5497	0.0002***	0.0031***	0.2951	0.0088***
Mixed-SES Class	0.8141	0.2114	0.9687	0.257	0.0018***

4.7 The Endogeneity Issues

In the Netherlands, parents have freedom to decide on primary school choice. As so, when studying the effects of class socioeconomic composition on low-SES students' academic achievement, the potential sorting of students to classes with higher or lower socioeconomic background poses an empirical challenge. The agglomeration of low-, middle-, or high-SES students in specific Limburg regions, and consequently specific schools and classes, may lead to an over/underestimation of the class composition effect. Two main types of sorting are discussed in this section: 1) endogenous class composition; and 2) sorting of students from specific socioeconomic backgrounds to specific schools in Limburg, which in turn endogenously influence the class formation of certain schools in precise areas of the region.

4.7.1 In Class Composition

Although class socioeconomic formation may be endogenous, there are reasons to believe that the characteristics of the Dutch educational setting make it a smaller issue.

In secondary education, students have the opportunity to “shop around” and apply to different schools until they are accepted into a higher track. Additionally, within each school, students are grouped with

others who share the same track placement. However, this level of selection and grouping does not occur in primary education. In the primary school system, students do not apply to specific tracks, nor are they grouped in classes based on their ability levels. As so, setting up this study in a primary education context instead of a secondary education one helps remove selection from tracking.

Moreover, schools in the Netherlands benefit from a high level of autonomy in decision-making. This, aligned with a view of inclusive education practices that promote equal opportunities and integration among students results in an attempt to avoid segregation in terms of abilities or background characteristics, especially in primary education where social interaction and peer learning are crucial. Therefore, even if there is some level of selection across primary schools at the school level, it is likely that classes are formed in a balanced way in terms of background characteristics. As so, setting up this study at a class level instead of a school level increases the degree of randomness of class composition because schools try to have class heterogeneity.

When conducting a series of t-tests to compare significant observable and background characteristics within the sample, such as gender and parents' labour market status, there were no statistically significant differences found between low-SES students in 14 out of 18 comparisons, at a 5% significance level¹⁵. On top of this, Cotofan et al. (2022) run a set of balance checks across various observable characteristics like “Gender”, Parental education”, “Lives with the biological parents”, “Migrant Background”, “Other Language at home”, “Dialect at home”, “Labour market status of the mother”, and “Labour market status of the father”, using a sample of 6th-grade students from the same region in the Netherlands. No significant differences were found.

In summary, four aspects minimise the importance of class formation endogeneity, favouring the validity of the empirical results of this study: 1) the inexistence of explicit tracking; 2) the schools' attempt to create heterogeneous classes; 3) the study being conducted at a class-level; and 4) empirical evidence finding no significant differences between 6th-grade students in Limburg.

4.7.2 Sorting into Schools

The freedom of school choice opens up the possibility of parents choosing whatever school they want for their children, according to their preferences. If the utility brought to parents by the schools' socioeconomic environment ensures them a higher utility compared to the cost of commuting according to the general individual preferences in Limburg, schools may end up being increasingly segregated by SES, as parents will avoid some schools that may be closer to their location.

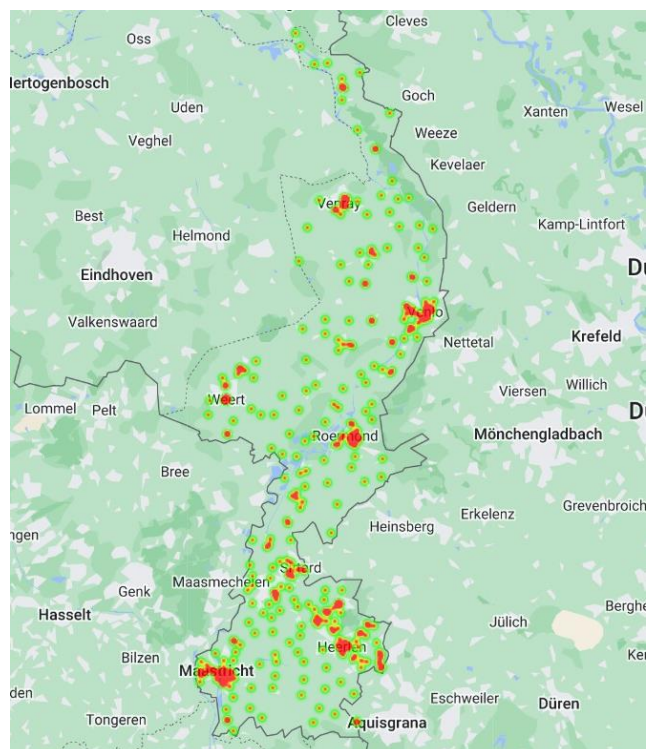
¹⁵ Statistically significant differences were found between the labour market status of the father when comparing low-SES in low vs middle-SES classes, low vs mixed-SES classes, and middle vs mixed-SES Classes. Statistically significant differences between the labour market status of the mother are also found between low-SES students in middle vs mixed-SES classes.

¹⁶ The results of the t-tests across the different variables can be found in Table A in the Appendix.

However, previous research shows that distance to school is the main determinant of secondary school choice in the Netherlands (Koning & Van der Wiel, 2013). Specifically, in the province of Limburg, both Cotofan et al. (2022) and Korthals et al. (2022) find distance to be the main determinant of parents' decisions for their children's secondary school. In the sample of the latter study, approximately 50% of secondary education students go to the nearest school. Although the study is conducted with secondary school students, it is plausible to assume that distance plays an even stronger role among the parents of primary school students. First, parents may be more prone to travel longer distances to enrol their children in highly regarded secondary schools due to the existence of track placement associated with ability tracking. Second, according to the 2014 National Travel Survey¹⁷ conducted by the British Department for Transport with data between 2003 and 2014, approximately 76% of the trips made by British primary school students are under 2 miles (approximately 3.2 km). For secondary school students, distance seems to play a smaller role as trips are more likely to be between 2 and 5 miles (approximately between 3.2 and 8.0 km). Yet, although shorter distances can be made by foot, longer trips by car raise concerns about sorting into primary schools. Nevertheless, while the car is the preferred mode of transport for primary school students for trips longer than 5 miles (73%), these trips only account for approximately 8% of the total trips to primary schools in England. Therefore, the primary education context of the study enhances the credibility of the results concerning school sorting, particularly when compared to secondary schools, because distance is the main determinant of school choice.

Not only do parents tend to choose the closest school, but they also do not have a large choice. When looking at the primary schools' distribution across Limburg (Figure 1), we see that parents, especially outside bigger cities, do not have a wide distribution of primary schools to choose from. Outside bigger cities like Maastricht, Heerlen, Sittard, Roermond, or Venlo, parents would have to commute very long distances to be able to choose other primary schools than the closest one. As so, it can be inferred that the issues related to class formation endogeneity are less prevalent in smaller cities.

Figure 1: Distribution of Primary Schools in Limburg



¹⁷ The report is available here: <https://urx1.com/uhuKF>

On the other hand, students living in larger cities have a wider range of primary schools to choose from. Without travelling long distances, they get the chance to be in schools and classes with higher or lower socioeconomic status. However, empirical research in Limburg not only concludes that students travelling more do not go much further, but they also do not find clear evidence about sorting in this context. According to Korthals et al. (2022), students in Limburg travel, on average, 3.1 km to their secondary school. Additionally, the same study finds that the subset of students going to secondary schools further away travels approximately 4.1 km, which only represents 4 minutes more on a bike trip of around 11-15 minutes (Fietzersbond, 2016). To reassure the inexistence of strong sorting within secondary schools in bigger cities, the authors find no clear evidence that these students belong to specific subgroups, based on observable covariates like parental education, labour market status, gender, and IQ.

Finally, having a school identifier that is common throughout the sampled years, and a class identifier that changes for every sampled year, it is possible to understand if classes had remained similar in terms of Class Socioeconomic Composition. With a Pearson correlation of 0.0782 between the School ID and the Class SES, it is plausible to infer that there is not a strong perpetuation of class socioeconomic composition within each school throughout the sample years, reinforcing that sorting does not significantly impact the results of the study.

In summary, the threat of sorting may still exist as parents may relocate to be closer to better schools. However, not only this issue is tackled by the study's empirical strategy but it is also less likely than commuting to primary schools with generally higher SES, which is also not a major concern because 1) most parents do not commute long distances and opt for the nearest primary school; 2) the availability of primary schools outside the major cities in Limburg is limited; 3) empirical research using the variables used to identify student socioeconomic status in this study does not indicate any evidence of socioeconomic sorting among students who commute longer distances to their chosen schools; and 4) the Pearson correlation between School ID and Class SES is very low, indicating that the socioeconomic context within each school¹⁸ varies significantly throughout the years, in opposition to what would happen in the presence of strong sorting into schools.

4.7.3 In Personality Traits

4.7.3.1 With Parental Background

Personality traits are commonly argued as endogenous variables as they can be influenced by other factors such as, among others, the socioeconomic environment (Jonassaint et al., 2011; Lechner et al., 2021), which in turn is well proxied by parental background. At the same time, Conger et al. (2021) argue that personality traits are not only influenced by the environment but also genetics. As so,

¹⁸ The sample was treated in a way that each school only has one 6th grade class. As so, conclusions at the school-level also apply to class-level.

regardless of each other's weight of importance, personality traits may be endogenous to parental background through the socioeconomic environment or simply genetics.

This reasoning should raise caution when analysing the effects of personality traits on academic performance without controlling for children's SES. However, this endogeneity with parental background is removed in this research given that the sample was restricted to students from a low-SES environment, a variable constructed through parental background (Education level of highest educated parent) and socioeconomic environment status (Labour market status of parents).

4.7.3.2 *Within Classes*

Even though only low-SES students are used for the study, the class socioeconomic composition variable is defined based on the percentage of low-, middle-, and high-SES students. Therefore, there can be some degree of endogeneity of personality traits regarding class composition.

The Latent State-Trait Theory (LST) differentiates between states and traits. States, which are emotional or behavioural reactions that can change depending on the current circumstances, depend on immediate and situational factors and so are more volatile throughout time. Traits are enduring individual characteristics with stronger consistency and stability over time. According to Steyer et al. (1999), while a score on a latent state variable corresponds to an observable variable given to a person in a specific situation, a score on a latent trait is just an expectation given to the person and not the situation. Therefore, traits are quite stable in the short run, and it is possible to assume that class SES composition does not directly affect them when interpreting the results.

This argument also suggests that running the study across primary schools benefits the personality traits' exogeneity when compared to studies conducted with higher levels of education - primary school students are subjected to the socioeconomic environment within each school for a shorter period of time compared to, for instance, secondary school students. Additionally, there is no ability tracking.

To reinforce the theoretical arguments, a series of t-tests on each trait between each combination of class SES type was run. The p-values of the mean differences can be found in Table 5 below.

Table 5: p-Values of the mean differences between low-SES students' personality traits across classes

	Low-SES vs Middle-SES Classes	Low-SES vs High-SES Classes	Low-SES vs Mixed-SES Classes	Middle-SES vs High-SES Classes	Middle-SES vs Mixed-SES Classes	High-SES vs Mixed-SES Classes
Conscientiousness	0.0221**	0.0059***	0.0077***	0.1791	0.287	0.8085
Openness	0.5774	0.009***	0.2918	0.0046***	0.4356	0.1036
Agreeableness	0.733	0.1375	0.9104	0.1278	0.6066	0.0832*
Extraversion	0.1776	0.7789	0.1377	0.0734*	0.6641	0.0664*
Neuroticism	0.7036	0.653	0.831	0.8493	0.5003	0.4945

From Table 5, one can see that there is no statistically significant difference between the mean of each personality trait in 27 out of 35 between-class comparisons, confirming the intuitions provided by the theoretical arguments. Nevertheless, the other 8 between-class comparisons¹⁹ should not be ignored when analysing the empirical results of this study, as some of these means are significantly different.

While it is important to exercise caution when interpreting the study's findings, the impact of endogeneity on class composition, school sorting, and endogenous personality traits—both with parental background and within specific classes—does not appear to be significant in this study.

4.8 The Propensity Score Matching

Regardless of the many aspects of this study's set-up favouring the randomness of class composition, one should recognise that parents may still move closer to better schools or agglomerate in some areas of Limburg for other reasons than school choice decisions, leading to a potential threat to the validity of the results. Specifically, there is not only an agglomeration of high-SES families in bigger cities and the northern part of the province, but there is also a concentration of low-SES families in the southeast. In addition to this, to the extent of my knowledge, there are no natural experiments or quasi-experiments leading to an exogenous variation in the socioeconomic composition of classes.

To guarantee an “as-good-as-random” assignment of students to each type of class socioeconomic composition, a Propensity Score Matching (PSM) was employed, allowing the results to be causally interpreted under the assumptions of this empirical strategy. Developed by (Rosenbaum & Rubin, 1983), the PSM has recently become a widely used technique to remove selection bias, particularly in class/school composition, across economics, educational research, and also psychological studies. While Belfi et al. (2016) use a PSM to remove school composition endogeneity and study the long-term differential achievement effects of school socioeconomic composition, a very recent study by Rizzotto and França (2022) attempts to study the impact of school climate on student performance by employing a PSM to control for the fact that schools with worse climates are typically related to a higher percentage of low-SES students. In the context of psychological studies, Harder et al. (2010) studies the causal relationship between early-onset cannabis problems and subsequent negative mental health outcomes, making use of a PSM to balance confounding variables influencing the individuals with and without early-onset cannabis problems.

Employing a Propensity Score Matching framework to remove the possible endogeneity inherent to class composition, the current study tries to understand the relationship between Class Socioeconomic

¹⁹ The mean difference of Conscientiousness between low-SES students in low-SES classes versus middle-SES classes, low-SES classes versus high-SES classes, and low-SES classes versus mixed-SES classes is statistically significant at a 5%, 1% and 1% level, respectively. The mean difference of Openness between low-SES students in middle-SES classes and low-SES classes versus mixed-SES classes is statistically significant at a 1% level, in both cases. The mean difference of Agreeableness between low-SES students in high-SES classes versus mixed-SES classes is statistically significant at a 10% level. The mean difference of Extraversion between low-SES students in middle-SES classes and high-SES classes, and high-SES versus mixed-SES classes is statistically significant at a 10% level, in both cases.

Composition and low-SES Children's Academic Achievement, running a series of binomial models comparing the academic performance of low-SES between the following groups: 1) low-SES vs middle-SES classes; 2) low-SES vs high-SES classes; 3) low-SES vs mixed-SES classes; 4) middle-SES vs high-SES classes; 5) middle-SES vs mixed-SES classes; 6) high-SES Classes vs mixed-SES classes; and 7) concentrated vs non-concentrated classes. A multinomial comparison could have also been taken. However, it is not only computationally complex but also Lechner (2001) finds no significant difference between the two approaches. In addition, he suggests that a series of binomial comparisons is safer since a misspecification would not compromise the whole set of results like in the multinomial approach.

The primary aim of Propensity Score Matching (PSM) in this context is to identify students in different class SES types who are as similar as possible, given a set of covariates that influence the likelihood of a student attending a low-, middle-, high-, or mixed-SES class. It then calculates the Average Treatment Effect on the Treated (ATT), rather than the Average Treatment Effect (ATE). Since it is not possible to observe a student in two different class SES types, the PSM enables the estimation of the effect of attending a specific class SES type for those students who would actually attend such a class type, rather than for every single student who may have varying probabilities of attending each class SES.

A PSM has two stages. First, based on a set of covariates, it computes the propensity score of each student based on a set of covariates. This corresponds to the conditional probability of a student attending one of the four class SES types (low-, middle-, high-, or mixed-SES classes). In this study, 9 covariates are used (Gender, Labour Market Status of Father, Labour Market Status of Mother, Track Recommendation of parents, Track Recommendation based on test, IQ Test, PSupport1, PSupport2, PSupport3) based on Belfi et al. (2016). A critical assumption is that only covariates that influence both the participation in specific class SES types and academic achievement should be included. Furthermore, these covariates should be exogenous to the participation in the treatment. Although one may argue that some covariates might have been affected by the participation in the treatment (or anticipation of it), a variable should only be excluded from the analysis whether it is clearly not related to the outcome or if it is not a proper covariate (Rubin & Thomas, 1996). In this case, all of them can be argued as either pre-determined background characteristics, pre-determined innate/genetic characteristics, or results of tests that are conducted independently from teachers, classes, and schools in which students are enrolled.

In the second stage of the PSM, students are matched based on a specific matching algorithm, and the ATT is calculated. In this case, Kernel matching²⁰²¹ with standard kernel function and bandwidth is used.

In addition to the assumptions previously mentioned, some others should be discussed: 1) Ignorability, meaning that all the confounding variables influencing being in a specific class SES type are included in the model; 2) Common support, meaning that there is overlap in the distribution of propensity scores between treatment and control groups, allowing them to be matched; 3) Balance, meaning that the covariates should be balanced between treatment and control groups; and 4) Independence, meaning matched pairs cannot be related to each other.

Tests validating Assumption 2 are presented in Figures I to O in the Appendix for each binomial comparison, providing support for their validity. In terms of Assumption 3, the indicated bias after matching should be around 3%-5% to have a satisfying balance (Caliendo & Kopeinig, 2008), which is verified. There is no compelling evidence to suggest that Assumption 4 is violated, as it is unlikely that matched students in different classes, and therefore different schools, are interrelated. Regarding Assumption 1, although it is not possible to ensure its complete fulfilment, every available data was used to address it, given the conditions for a valid covariate. Nonetheless, when interpreting the results causally, it is essential to exercise a high degree of caution.

4.8.1 Propensity Score Matching and Personality Traits

After running the PSM on the seven binomial comparisons between the different class SES types, the average treatment effect on the treated (ATT) is calculated. For instance, if low-SES classes are the treatment group and middle-SES classes the control group, the ATT will correspond to the differential impact on test scores of a low-SES student in a low-SES class compared to a low-SES student in a middle-SES class, answering the first research question of the study.

To understand the role of personality traits in the relationship between class SES and test scores, the sample is first restricted to the common support area identified by the matching algorithm used to perform the PSM. Then, a regression is run with the respective sub-sample, and the personality traits' indexes are included as variables of interest. At this stage, the analysis should be made descriptively. Finally, to understand the differential impact of personality traits between low-SES students in different class SES types, each personality trait is interacted with class socioeconomic composition (*Personality*

²⁰ According to Smith and Todd (2005), Kernel Matching is a non-parametric matching estimator that uses weighted averages of all individuals in the control group to construct the counterfactual outcome.

²¹ Nearest neighbour matching with and without replacement, as well as matching with different bandwidths were performed in order to understand which one yielded the best balance of covariates and propensity scores. The kernel matching approach with the standard bandwidth proved to yield the best results.

*Trait * ClassSES*) and included in the regression with the students lying within the common support area of each binomial comparison.

5 Results

Having homogeneous groups of low-SES students created using a Propensity Score Matching, the test scores of low-SES in the 6th grade of elementary school were compared across the different Class SES types. Test scores of low-SES students in low-SES classes were compared to test scores of low-SES students in middle-SES classes (Comparison 1), high-SES classes (Comparison 2), and mixed-SES classes (Comparison 3); Test Scores of low-SES students in middle-SES classes were compared to test scores of low-SES in high-SES classes (Comparison 4), and mixed-SES classes (Comparison 5); Test scores of low-SES students in high-SES classes were compared to test scores of low-SES students in mixed-SES classes (Comparison 6); and finally the performance of low-SES students in Concentrated classes (low, middle, or high-SES) was compared to their performance in non-concentrated classes (mixed-SES classes) (Comparison 7). In Table 6, the results of the Average Treatment Effects on the Treated (ATT) are presented, along with the respective *Cohen's d*. This is a statistical measure used to compute the standardised mean difference between two groups, thus representing the standardised regression coefficients as we are comparing a treatment and a control group.

Regarding the comparisons between low-SES students in low-SES classes and high-SES classes (Comparison 2), middle-SES classes and mixed-SES classes (Comparison 5), high-SES classes and mixed-SES classes (Comparison 6), and concentrated and non-concentrated classes (Comparison 7), no significant differences in test scores were found. However, significant differences were found in the other three comparisons. Through Comparison 1²², it was found that low-SES students tend to have lower test scores in low-SES than in middle-SES classes. On average, being in a low-SES environment is associated with a test score that is 0.0739 lower compared to being in a middle-SES class environment. The *Cohen's d* value indicates that the difference between the mean test scores of the two groups is approximately 0.36 standard deviations, suggesting a small to medium positive effect of middle-SES classes. In the same way, Comparison 3²³ indicates that low-SES students generally perform worse in low-SES classes than in mixed-SES environments. Specifically, low-SES students in mixed-SES environments have, on average, test scores that are 0.1090 higher than if they were in low-SES class environments. In addition, the *Cohen's d* calculation suggests that the mean test score in low-SES classes is -0.58 standard deviations lower than in mixed-SES classes, implying a medium to large positive effect of mixed-SES classes. Nevertheless, given the smaller number of observations in this comparison, some extra caution should be taken when making conclusions from these results.

²² Being low-SES classes the treatment assignment and middle-SES classes the control group.

²³ Being low-SES classes the treatment assignment and mixed-SES classes the control group.

Interestingly, Comparison 4²⁴ indicates that low-SES students tend to have better test scores in middle-SES classes than in high-SES classes, with low-SES students having test scores that are 0.0469 lower in the latter than in the former type of class SES, on average. With a *Cohen's d* around 0.24, it is suggested that the standardised mean difference between the two groups is medium-sized.

Notably, when Comparison 1 and Comparison 4 are put together, there are signs of a non-linear relationship between class socioeconomic composition and academic achievement. While low-SES students tend to perform better in middle-SES classes compared to low-SES classes, assigning them to high-SES classes does not necessarily have an average positive effect compared to middle-SES classes. Nevertheless, it appears from Comparison 2 that high-SES classes are still slightly beneficial compared to low-SES classes, although not statistically significant. In addition, the Comparison 3 between low-SES classes and mixed-SES classes is not only the most significant but also the largest in magnitude, possibly indicating the benefits of integration and diversity inside classrooms.

²⁴ Being middle-SES classes the treatment assignment and mixed-SES classes the control group.

Table 6: Results of the Test Scores of Low-SES Students in Low, Middle, High and Mixed-SES classes after Kernel matching

		Comparison 1	Comparison 2	Comparison 3	Comparison 4	Comparison 5	Comparison 6	Comparison 7
		Low-SES vs Middle-SES Classes	Low-SES vs High-SES Classes	Low-SES vs Mixed-SES Classes	Middle-SES vs High-SES Classes	Middle-SES vs Mixed-SES Classes	High-SES vs Mixed-SES Classes	Concentrated vs non- Concentrated
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Av. Treatment Effect on Treated (ATT)	Test Score	Test Score	Test Score	Test Score	Test Score	Test Score	Test Score	
	-0.0739** (0.0311)	-0.0183 (0.0298)	-0.1090*** (0.0409)	0.0469* (0.0261)	-0.0351 (0.0378)	-0.0495 (0.0308)	-0.0487 (0.0370)	
Constant	0.716*** (0.0134)	0.656*** (0.0206)	0.751*** (0.0320)	0.656*** (0.0231)	0.751*** (0.0353)	0.705*** (0.0232)	0.751*** (0.0350)	
Cohen's d	-0.369	-0.105	-0.582	0.238	-0.175	0.286	-0.245	
Observations	269	137	82	330	251	127	302	
R-squared	0.021	0.003	0.081	0.010	0.003	0.020	0.006	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This study hypothesises that one of the key factors influencing the way low-SES students academically benefit or struggle from a specific class socioeconomic composition is their personality. As so, each comparison was disentangled by conducting a regression on the subsample of low-SES students within the respective common support area and incorporating the Big-Five personality traits. The Class Size and Class GPA were also included in the regressions and personality traits interacted with Class SES.

5.1 Comparison 1: Low-SES vs Middle-SES classes

The results of the regression on the common support area composed of low-SES students in low- and middle-SES classes are presented in Table 7. Although the coefficient on Class SES is significantly negative in specification 1, it becomes non-significant in the rest of the specifications when Class Size and Class GPA are included. While Class Size is irrelevant across all specifications given its statistical insignificance and small magnitude, Class GPA is not only significant in specification 2 but also in specifications 3 and 4 when personality traits are considered. In addition, the R-squared significantly increases by approximately 18 percentage points when this variable is included. Nevertheless, the fact that Class GPA removes the statistical significance of this study's main explanatory variable is not problematic because they have a strong intrinsic relationship. Class GPA is a strong predictor of class ability, which in turn is also a good proxy for Class SES (Opdenakker & Damme, 2001).

Specification 3 suggests that both Openness to Experience and Neuroticism are significant predictors of test scores within the subsample of low-SES students in low- and middle-SES classes. Specifically, while, on average, a 1-unit increase in the Openness to Experience index is associated with 0.0346 points increase in test scores, a 1-unit increase in the Neuroticism index is associated with 0.0109 points decrease in test scores. Both these coefficients are in line with the literature on personality traits and academic achievement.

Nevertheless, specification 4 is the most relevant to study the influence of personality traits on the relationship between class socioeconomic composition and low-SES students' academic achievement, as it captures the comparative effect of each personality trait between students in the treatment group (being in low-SES class) and control group (being in middle-SES class). Accordingly, as the coefficients on the interaction terms between Class SES with Openness to Experience and Neuroticism are statistically significant, it means that these two traits significantly mediate the relationship between Class SES and academic achievement when comparing low-SES students in low- and middle-SES classes. Particularly, while being in a lower socioeconomic class is associated with a lower decrease in test scores for individuals who score higher on Openness to Experience, being in a lower socioeconomic class is associated with a stronger decrease in test scores for individuals who score higher on Neuroticism. These results mean that being in a low-SES class environment is, on average, more damaging to low-SES students with lower levels of openness to experience and higher levels of neuroticism.

Table 7: Regression on Common Support Area comparing Low-SES and Middle-SES Classes

VARIABLES	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
Class SES	-0.0739** (0.0311)	0.0425 (0.0324)	0.0382 (0.0330)	0.0370 (0.0330)
Class Size		0.0009 (0.0020)	0.0014 (0.0020)	0.0014 (0.0020)
Class GPA		1.0910*** (0.1430)	1.0310*** (0.1430)	1.0310*** (0.1420)
Conscientiousness			-0.0182 (0.0148)	
Openness to Experience			0.0613*** (0.0139)	
Extraversion			-0.0176 (0.0144)	
Neuroticism			-0.0186* (0.0107)	
Agreeableness			-0.0093 (0.0132)	
ClassSES*Conscientiousness				-0.0123 (0.0080)
ClassSES*Openness				0.0346*** (0.0075)
ClassSES*Extraversion				-0.0068 (0.0076)
ClassSES*Neuroticism				-0.0109* (0.0057)
ClassSES*Agreeableness				-0.0057 (0.0072)
Constant	0.716*** (0.0134)	-0.1140 (0.1070)	-0.0786 (0.1080)	-0.0781 (0.1070)
Observations	269	269	257	257
R-squared	0.021	0.205	0.267	0.272

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.2 Comparison 2: Low-SES vs High-SES classes

The results of the regression on the common support area composed of low-SES students in low- and high-SES classes are presented in Table 8. Although the coefficient on Class SES is not significant in any of the specifications, specifications 2 to 4 should not be ignored given the significance of some relevant coefficients. Based on specification 3, Openness to Experience is a significant predictor of test scores within the subsample of low-SES students in low- and high-SES classes. On average, and in line with the literature, a 1-unit increase in the Openness to Experience index is associated with 0.0511 points increase in test scores.

In the same way, specification 4 suggests that Openness to Experience significantly mediates the relationship between Class SES and academic performance when comparing low-SES students in low- and high-SES classes. Intuitively, on average, being in a lower socioeconomic class is associated with a smaller decrease in test scores for individuals who score higher on Openness to Experience. This result

suggests that low-SES with lower openness to experience are the students suffering the most from being in low-SES classes instead of high-SES classes. Interestingly, while the coefficient on *ClassSES* alone is not statistically significant, it becomes significant when interacted with Openness to Experience. This highlights the importance of considering personality traits in understanding how individuals may either benefit from positive SES peer effects or experience adverse psychological effects as a result of the same SES peer effects.

Table 8: Regression on Common Support Area comparing Low-SES and High-SES Classes

VARIABLES	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
ClassSES	-0.0254 (0.0312)	0.0117 (0.0354)	-0.0185 (0.0384)	-0.0207 (0.0385)
Class Size		-0.000603 (0.00303)	-0.00172 (0.00311)	-0.00174 (0.00312)
Class GPA		0.573** (0.254)	0.427 (0.275)	0.466* (0.274)
Conscientiousness			-0.00784 (0.0189)	
Openness to Experience			0.0511** (0.0204)	
Extraversion			-0.0266 (0.0215)	
Neuroticism			-0.0155 (0.0153)	
Agreeableness			0.0123 (0.0177)	
ClassSES*Conscientiousness				-0.00410 (0.00791)
ClassSES*Openness				0.0200** (0.00854)
ClassSES*Extraversion				-0.00524 (0.00913)
ClassSES*Neuroticism				-0.00998 (0.00611)
ClassSES*Agreeableness				0.00492 (0.00776)
Constant	0.656*** (0.0205)	0.259 (0.174)	0.400** (0.192)	0.377** (0.188)
Observations	127	127	120	120
R-squared	0.005	0.046	0.120	0.120

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.3 Comparison 3: Low-SES vs Mixed-SES classes

The results of the regression on the common support area composed of low-SES students in low- and mixed-SES classes are presented in Table 9. Similar to the previous cases, even though the coefficient on Class SES is significantly positive by itself in specification 1, Class GPA captures its significance once included. In terms of personality traits, no significant effect was found. However, having only 69 observations distributed across treatment and control groups may be weakening these results compared to the others. Therefore, no clear conclusions are taken regarding the impact of personality traits on test scores and their mediating effect on the association between class socioeconomic composition and academic performance.

Table 9: Regression on Common Support Area comparing Low-SES and Mixed-SES Classes

VARIABLES	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
ClassSES	-0.1030** (0.0429)	0.0113 (0.0544)	-0.0014 (0.0651)	-0.0126 (0.0658)
Class Size		0.0082 (0.0054)	0.0065 (0.0062)	0.0087 (0.0063)
Class GPA		0.6750** (0.3230)	0.5710 (0.3930)	0.5570 (0.3780)
Conscientiousness			0.0018 (0.0302)	
Openness to Experience			0.0192 (0.0327)	
Extraversion			0.0029 (0.0372)	
Neuroticism			-0.0238 (0.0240)	
Agreeableness			0.0128 (0.0308)	
ClassSES*Conscientiousness				-0.0057 (0.0124)
ClassSES*Openness				-0.0021 (0.0131)
ClassSES*Extraversion				0.0150 (0.0138)
ClassSES*Neuroticism				-0.0095 (0.0087)
ClassSES*Agreeableness				0.0055 (0.0170)
Constant	0.7510*** (0.0327)	0.0728 (0.2270)	0.1870 (0.2910)	0.1720 (0.2820)
Observations	76	76	69	69
R-squared	0.073	0.203	0.211	0.236

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

5.4 Comparison 4: Middle-SES vs High-SES classes

The results of the regression on the common support area composed of low-SES students in middle- and high-SES classes are presented in Table 10. First, the significance of the Class SES coefficient is captured by Class GPA, as in Comparisons 1 and 3, reinforcing the common idea that Class GPA positively influences low-SES students' test scores.

In terms of personality traits, both Openness to Experience and Neuroticism are found to be relevant predictors of test scores, according to specification 3. On average, while a 1-unit increase in the Openness to Experience index is associated with 0.0553 points increase in test scores, a 1-unit increase in the Neuroticism index is associated with 0.025 points decrease in test scores of low-SES students in middle- and high-SES classes. In line with the previous cases, specification 4 also suggests that Openness to Experience and Neuroticism are relevant mediators of the relationship between Class SES and Test Scores.

Noticeably, specification 3 of Comparison 4 is the only one finding Conscientiousness to be a significant predictor of academic achievement, with 90% of statistical confidence. However, contrary to most of the literature on the Big-Five personality traits and academic achievement, a 1-unit increase in the Conscientiousness index is associated with 0.0252 points decrease in test scores of low-SES students in middle- and high-SES classes. However, when interacting with Class SES, the coefficient becomes positive but insignificant. These show that having higher levels of conscientiousness damage low-SES students in middle- and high-SES classes but do not significantly benefit low-SES students in middle-SES classes instead of high-SES classes.

The conjunction of these two points suggests that being conscientious may have detrimental effects on low-SES students when they are a minority within a class (middle- and high-SES classes), potentially due to stronger within-group comparison effects (known as the Big-Fish-Little-Pond effect). However, if they are a minority, differences in conscientiousness do not significantly impact the academic performance of low-SES students. In fact, it may even have a positive effect when comparing low-SES students in middle- to high-SES classes, although the coefficient is not significant.

Table 10: Regression on Common Support Area comparing Middle-SES and High-SES Classes

VARIABLES	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
ClassSES	0.0435* (0.0263)	0.0145 (0.0254)	0.0102 (0.0251)	0.0046 (0.0252)
Class Size		-0.0002 (0.0018)	-0.0004 (0.0018)	-0.0005 (0.00175)
Class GPA		0.8850*** (0.1410)	0.8760*** (0.1400)	0.8680*** (0.1400)
Conscientiousness			-0.0252* (0.0139)	
Openness to Experience			0.0553*** (0.0133)	
Extraversion			-0.0066 (0.0135)	
Neuroticism			-0.0250** (0.0099)	
Agreeableness			0.0128 (0.0127)	
ClassSES*Conscientiousness				-0.0093 (0.0059)
ClassSES*Openness				0.0231*** (0.0058)
ClassSES*Extraversion				-0.0026 (0.0060)
ClassSES*Neuroticism				-0.0112*** (0.0043)
ClassSES*Agreeableness				0.0050 (0.0055)
Constant	0.6560*** (0.0230)	0.0301 (0.1020)	0.0570 (0.1010)	0.0685 (0.1020)
Observations	303	303	291	291
R-squared	0.009	0.126	0.197	0.194

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.5 Comparisons 5, 6, and 7: Middle-SES vs Mixed-SES classes, High-SES vs Mixed-SES classes, Concentrated vs non-Concentrated classes

The results of the regression on the common support area composed of low-SES students in middle- and mixed-SES, high- and mixed-SES, and Concentrated and non-Concentrated classes are presented in Table B, C, and D in the Appendix, respectively. In these three comparisons, although the coefficients of Class SES are not significant by themselves (specification 1), Class GPA is found to be significantly positive across specifications 2, 3, and 4, reinforcing the predictive power of this variable found across Comparisons 1, 2, 3, and 4.

Similar to Comparisons 1, 2, and 4, Openness to Experience is found to be a relevant positive predictor of test scores across the three comparisons here analysed. With similar magnitudes, the coefficients of

Openness to Experience are approximately 0.06, 0.04, and 0.05 in specification 3 of Comparisons 5 (middle-SES vs mixed-SES classes), 6 (high-SES vs mixed-SES classes), and 7 (concentrated vs non-concentrated classes), respectively. From specification 4 of these comparisons, it is also found that Openness to Experience is not only a predictor of test scores but also a significant mediator of the relationship between class socioeconomic composition and test scores. With the respective coefficients being approximately equal to 0.02, 0.01, and 0.02, on average, being in a mixed-SES, high-SES, or concentrated class, instead of a mixed-SES²⁵, is generally less damaging for the test scores of students with higher levels of Openness to Experience.

From specification 3, Neuroticism is found to be a significantly negative predictor of test scores across the three comparisons here analysed, with coefficients approximately equal to 0.03, 0.05, and 0.03, respectively. Furthermore, this personality trait is a significant mediator of the association between Class SES and Test Scores across the three comparisons. By observing the significantly negative coefficients of approximately 0.01 for the interaction terms between Class SES and Neuroticism, the fourth specification of these three comparisons indicates that low-SES students with higher Neuroticism scores experience greater negative effects when placed in middle-SES classes, high-SES classes, or Concentrated Classes rather than mixed-SES classes. This finding supports the results observed in Comparisons 1 and 4. Moreover, although the coefficients of Class SES are not significant, interacting them with personality traits enhances its predictive power across the three comparisons, analogous to Comparison 2.

6 Discussion

This research not only attempts to study the relationship between class socioeconomic composition and low-SES students' academic achievement, but also understand the role of the Big-Five personality traits (Conscientiousness, Openness to Experience, Agreeableness, Extraversion, and Neuroticism) as mediators of this relationship. Departing from the idea that a better class SES environment may benefit low-SES students' academic performance (Driessen, 2002; Dumay & Dupriez, 2008; Van der Slik et al., 2006), it may also be true that these students have weaker personality traits (Jonassaint et al., 2011; Lechner et al., 2021), and therefore may be more vulnerable to adverse psychological effects that may hinder the benefits of a higher-SES environment.

The first set of results showed the existence of a non-linear relationship between class socioeconomic composition and low-SES students' academic achievement. In line with the literature on this relationship, the results indicate that it is beneficial for a low-SES student to be in a middle-SES class compared to a low-SES class. Different explanations can justify this. First, teachers may have higher

²⁵ Non-Concentrated classes are the same as mixed-SES classes, which is the control group across the 3 comparisons.

expectations about students' potential in classes with higher-SES students (Rubie-Davies et al., 2012), which in turn, according to the "self-fulfilling prophecy", may lead students to put more effort to meet the expectations (Rosenthal & Jacobson, 1968). Second, schools tend to adapt the general educational level to the average level of their students (Peetsma et al., 2006). However, these reasonings do not explain why the effect is not observed between low- and high-SES classes. A third and apparently more coherent explanation is related to peer pressure. The 2001 OECD report suggests that students feel less peer pressure to succeed academically in low-SES environments. Yet, the peer pressure in high-SES classes may reach an unrealistically high level that may hinder low-SES students' academic performance. This can partly explain why the effect is not observed between low- and high-SES classes, but it is evident in middle-SES classes where peer pressure is set at a relatively high but healthy level. In line with this, the results show that the academic performance of low-SES students significantly declines when they are placed in high-SES classes instead of middle-SES classes.

Although no statistically significant comparison can be made between low-SES classes and high-SES, this set of results suggests that despite middle-SES classes being beneficial compared to low-SES classes, classes with a high-SES environment are not as beneficial as middle-SES class environments, positing a non-linear relationship between Class SES and low-SES students' academic achievement, as initially hypothesised.

Furthermore, the detrimental effect of low-SES classes is particularly pronounced when comparing low-SES students in homogeneous low-SES classes, as opposed to heterogeneous mixed-SES classes. Extending some research on the effect of class heterogeneity on students' achievement indicating that more homogeneous classes are more beneficial in terms of academic achievement (Belfi et al., 2016; Hong et al., 2012; Pinto, 2012), this study suggests a differential impact depending on the student's SES. In fact, a more heterogeneous class may actually be more advantageous for low-SES students compared to homogeneous low-SES classes. This may be attributed to the fact that the sample of this study only includes low-SES students, and high-SES students are often the ones who fall short in heterogeneous classes (Hong et al., 2012; Tomlinson et al., 2003). Therefore, this study weakens the argument that mixing students from different socioeconomic backgrounds within a class primarily serves social equity and integration purposes rather than academic performance. The findings reveal that low-SES students can be, in fact, beneficiaries of heterogeneous classes in terms of achievement.

The second set of results regards the effect of personality traits on low-SES students' academic achievement and the role of these traits in mediating the non-linear association previously identified. Although the literature in educational research finds a relationship between personality traits and students' performance, there is no research studying how the different personality traits may have different importance according to the different socioeconomic environments to which a low-SES student is being exposed, to the extent of my knowledge. This fact is reinforced by this study's results

because the effect of Class SES is always captured by Class GPA and the former's coefficient is never significant unless it is interacted with each personality trait. This highlights the importance of considering personality traits in understanding how individuals may either benefit or suffer from SES peer effects.

In educational research, a large body of literature finds Conscientiousness and Neuroticism to be the relevant predictors of students' academic achievement (Kautz et al., 2014; Poropat, 2009). Another large set of literature finds Conscientiousness and Openness to Experience to be the relevant traits (Barakat & Othman, 2015; Novikova & Vorobyeva, 2017; Serrano et al., 2022). Out of the Big-Five Traits, this study highlights Openness to Experience and Neuroticism as the significant predictors of academic achievement among low-SES students across most class SES comparisons. One possible explanation for these results is that Openness to Experience and Neuroticism are the traits that exhibit the most significant differences based on students' socioeconomic status (Jonassaint et al., 2011). Since the sample exclusively consists of low-SES students, these traits have a greater impact.

This research's main contribution to science regards the role of personality traits in the association between class SES composition and low-SES students' academic achievement. Two main findings must be highlighted here.

First, Openness to Experience and Neuroticism are not only predictors of academic success, but also significant mediators of the relationship here studied. As so, these two personality traits significantly impact the way a low-SES student may benefit or suffer from being in a specific class SES environment. On the one hand, a low-SES student with a higher Openness to Experience score may be more benefited/less damaged by being in the treatment assignment of each comparison where the respective interaction term coefficient is statistically significant (*Class SES * Openness to Experience*). On the other hand, a low-SES student with a lower Neuroticism score may be more benefited/less damaged by being in the treatment assignment of each comparison where the respective interaction term coefficient is statistically significant (*Class SES * Neuroticism*). As Openness to Experience and Neuroticism respectively contribute to academic success positively and negatively, these findings are coherent with the previous set of results. Noticeably, the effect of Class SES is not captured by Class GPA when interacting Class SES with personality traits, revealing the psychological importance of the Class socioeconomic environment for low-SES students' grades.

Second, Conscientiousness negatively impacts low-SES students' academic achievement, but only when they are in a middle- or high-SES class environment. By definition, these two class SES types are composed of a majority (>50%) of middle- or high-SES students, respectively. Therefore, this result suggests that if the majority of students in a class belong to a socioeconomic status other than low-SES, being conscientious harms the academic achievement of low-SES students, contrary to what a large body of literature indicates.

However, to the best of my knowledge, there is a lack of studies in educational psychology that specifically examine the impact of each personality trait in relation to both the socioeconomic context of the class and the individual student. Nonetheless, the negative coefficient observed in this study may be partially explained by the Big-Fish-Little-Pond effect. In educational studies, this effect refers to the fact that students' academic self-concept is shaped by the ability level of their classmates (Marsh, 1987). At the same time, the literature suggests that, on average, academic self-efficacy drops when students compare themselves with a high-ability reference group (Schwabe et al., 2019; Seaton et al., 2009). Being the ability level correlated with class SES, middle- and high-SES classes have on average a higher ability, potentially decreasing low-SES students' academic self-efficacy. On top of this, when a low-SES student is highly conscientious, the within-group comparison may be stronger, intensifying the negative impact of being surrounded by higher-SES peers. This may be due to increased academic expectations within a higher-SES context, potentially leading to a divergence between their own achievement and those of their higher-achieving peers.

Nevertheless, once a low-SES student is placed in a class where the majority of students belong to a socioeconomic status other than low-SES, conscientiousness is not a mediator of the relationship between class SES composition and low-SES students' academic achievement. This means that being more or less conscientious does not benefit or damage low-SES students who are in middle-SES classes instead of high-SES, and vice versa.

Finally, neither Extraversion nor Agreeableness are found to be predictors of academic achievement among low-SES students across the different comparisons. In the same way, they are not found to be mediators, meaning that they do not help nor damage these students when placed in a specific SES class type instead of another. Although it is not surprising that a trait like Agreeableness is not a predictor of academic success, it would be reasonable that a trait describing cooperative, empathetic, and compassionate students could have a mediative role between class SES composition and academic achievement because it could influence the way students are influenced by peer effects. Similarly, although this study does not suggest Extraversion to be a significant predictor of academic success like other descriptive psychological studies (Bergold & Steinmayr, 2018; Von Stumm & Furnham, 2012), it is somehow surprising that a trait which encompasses sociability, talkativeness, assertiveness, and confidence does not play a mediative role within the relationship here studied, working as a protector from negative effects on academic self-efficacy and within-group comparisons, specifically within classes with a majority of higher-SES peers. Further research is required to get deeper insights into the mediative role of these traits within the relationship between class SES composition and the academic success of low-SES children. Using a longitudinal measure of academic success instead of a specific observational grade could be useful to better grasp the potential longer-term role of these traits within the relationship.

6.1 Implications for Educational Policy

The findings of this study are relevant for educational policy and understanding how to enhance the academic performance of low-SES students. First, it highlights the importance of considering class socioeconomic composition in school policy design. By identifying that low-SES students perform relatively better in classrooms composed of a majority of middle-SES students instead of low- or high-SES students, it raises caution on the idea that a better class socioeconomic environment benefits low-SES students' academic success. In general, there is a trade-off between the positive peer effects of being in a higher-SES classroom and the negative effects such as the adverse psychological consequences of being a minority, identification issues, lower academic self-efficacy, etc.

Second, by highlighting the benefits of heterogeneous mixed-SES classes compared to homogeneous low-SES classes, this study suggests that low-SES schools, which typically have a higher proportion of low-SES students and classes, should have greater autonomy in determining class compositions. This would enable them to create diverse and heterogeneous classes, with a mix of students from different socioeconomic backgrounds, potentially maximising the academic outcomes of low-SES students.

Third, the study highlights the importance of Openness to Experience and Neuroticism as relevant predictors of academic outcomes for low-SES students. By doing so, the study suggests the need for targeted interventions focused on personality traits during primary school to enhance the academic achievement of low-SES students.

Last but not least, this research mainly sheds light on the subtle relationship between class socioeconomic composition, personality traits, and low-SES students' academic achievement. The finding that conscientiousness, contrary to general findings in the literature, negatively impacts the grades of low-SES students in higher-SES environments highlights the importance of moving beyond a one-size-fits-all approach and start considering the individual characteristics of these particular students when designing educational programs and interventions, specifically when deciding the best class socioeconomic composition for their academic success.

6.2 Limitations and Further Research

Apart from the meaningful contributions of this study to the field of educational research, some limitations should be pointed out. The first one regards the Conditional Independence Assumption that is necessary for an unbiased calculation of the ATT after the PSM. This assumption implies that the selection bias in class socioeconomic composition is only based on observable characteristics and all the covariates influencing both the treatment assignment and the potential outcomes are controlled by the researcher. As so, failing to control for some unobserved confounding variables bias the results. In addition, one can also question whether the included covariates are completely exogenous from the treatment in this case. Although these are very strong assumptions and a common problem across the identification strategies relying on controlling observable characteristics, the current research makes all

the efforts to get the most unbiased results given the limited data. Nevertheless, caution should always be taken analysing the results. For further research, a longitudinal dataset following the same individuals across years in several covariates and exogenous background characteristics would improve the reliability of the results. Another interesting point to explore would be applying this study to a different region with a different locational agglomeration of specific SES families, a different distribution of schools, and more schools with more than one sixth-grade class.

Longitudinal research would also be important to tackle the second limitation of the study: reversed causality between SES, cognitive and non-cognitive outcomes, academic achievement, and personality traits (Deary & Johnson, 2010; Ritchie & Tucker-Drob, 2018; Turkheimer et al., 2003). Given the nature of the data, this issue could not be accurately tackled, and further research including past achievement as a control variable is required (Hanushek et al., 2003).

The third limitation of this study concerns the way Class SES types are identified. Since this variable depends on the percentage of students from a specific socioeconomic status within each class, being 50% the threshold used in this study, small variations of class socioeconomic compositions around the threshold are not studied and might significantly affect the results. The same issue applies to the construction of the variables Student SES. Moreover, since it is also measured categorically using parental education and parental labour market status to define the type of student SES, small variations around the defined criteria are not considered but may slightly influence the results. This is a problem of measuring variables categorically to employ a Propensity Score Matching. However, it is important to consider that the benefits of addressing selection bias through the use of Propensity Score Matching may outweigh the potential drawbacks associated with this issue. For further research, different thresholds/criteria to define Class and Student SES types should be tested.

As previously mentioned, SES is defined based on parental education and labour market status. Other variables such as parental occupation, family income, wealth, neighbourhood characteristics, eligibility for free- or reduced-lunch program, or the availability of books at home are used in the literature as proxies for SES and could enrich the strength of this study's proxy. Due to data limitations, including these variables was not possible and could be explored in further research. Yet, parental education is still considered a strong predictor of students' SES, and therefore, significant deviations in the direction of the results are not expected.

The fourth limitation of this study regards the use of relative test scores to make conclusions about academic success. Even though the measure used in this study is relatively more robust compared to other test score measures, it is still limited to make conclusions about what is more beneficial for low-SES students' lifetime outcomes. Although GPA and test scores are significant predictors of lifetime success, the conclusions of this study require some caution when discussing what classroom composition is better for disadvantaged children's future. Since other factors can be used to measure

lifetime success, possible future research could explore the robustness of this study's results when varying the main dependent variable.

Lastly, the external validity of this study can be questioned due to the particular specificities of the Dutch educational system such as the school choice freedom, the decision over three different tiers, and the general degree of segregation across schools in the Netherlands. These are self-fulfilling factors, and these idiosyncratic characteristics can undermine the results of the study. Having this in mind, further research can explore the sensitivity of this study's results to the school choice mechanism, educational system structure, and the general level of segregation across schools in different countries.

7 Conclusion

As an attempt to study the association between class socioeconomic composition and low-SES students' academic achievement, this study highlights the complex relationship between these two factors, indicating a non-linear relationship between them. In order to make effective class composition decisions, schools should not rely on the simplistic idea that a better SES environment is necessarily better for low-SES students. Having peers with generally higher expectations and abilities may negatively influence other non-cognitive outcomes among students from a lower socioeconomic background, which in turn contributes to worse academic performance. In addition, within low-SES environments, the study suggests the creation of heterogeneous classes instead of homogeneous classes as a way to benefit low-SES students. In this context, integration and diversity are not only justified by ethical and social reasons but also by academic achievement.

On top of this, the study highlights the importance of going beyond a one-size-fits-all approach when making compositional decisions as individual personality traits of low-SES students play a significant role in the way low-SES students benefit from specific socioeconomic classes. Particularly, while students with higher levels of Openness to Experience tend to be less affected by lower-SES classes, those with higher levels of Neuroticism are generally more impacted by such class compositions. Additionally, low-SES students with higher levels of conscientiousness may end up being damaged by being in a higher-SES class, potentially explained by stronger within-group comparison, known as the Big-Fish-Little-Pond effect.

8 References

- Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of educational psychology*, 84(3), 261.
- Barakat, A., & Othman, A. (2015). The Five-Factor Model of personality and its relationship to cognitive style (rush and prudence) and academic achievement among a sample of students. *Journal of Education and Practice*, 6(35), 156-165.
- Becker, H. (1963). *Outsiders: Studies in the Sociology of Deviance* (New York) 1982. *Art Worlds* (Berkeley).
- Belfi, B., Goos, M., De Fraine, B., & Van Damme, J. (2012). The effect of class composition by gender and ability on secondary school students' school well-being and academic self-concept: A literature review. *Educational research review*, 7(1), 62-74.
- Belfi, B., Haerlemans, C., & De Fraine, B. (2016). The long-term differential achievement effects of school socioeconomic composition in primary education: A propensity score matching approach. *British Journal of Educational Psychology*, 86(4), 501-525.
- Bergold, S., & Steinmayr, R. (2018). Personality and intelligence interact in the prediction of academic achievement. *Journal of Intelligence*, 6(2), 27.
- Blanken, T., Dekker, K., & van Someren, E. (2018). How personality profile similarity can improve comparability between assessment formats: An example of the Mini-IPIP and IPIP-NEO-120 in a Dutch community sample.
- Boonen, T., Speybroeck, S., de Bilde, J., Lamote, C., Van Damme, J., & Onghena, P. (2014). Does it matter who your schoolmates are? An investigation of the association between school composition, school processes and mathematics achievement in the early years of primary education. *British Educational Research Journal*, 40(3), 441-466.
- Bouchard Jr, T. J. (1997). IQ similarity in twins reared apart: Findings and responses to critics. *Intelligence, heredity, and environment*, 126-160.
- Brutsaert, H., & Van Houtte, M. (2004). Gender context of schooling and levels of stress among early adolescent pupils. *Education and urban society*, 37(1), 58-73.
- Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of economic surveys*, 22(1), 31-72.
- Conger, K. J., Neppl, T. K., & Scaramella, L. (2021). Special section on personality development: Testing environmental and genetic associations across generations. *Developmental psychology*, 57(2), 139.
- Cotofan, M., Diris, R., & Schils, T. (2022). Who benefits from attending the higher track? The effect of track assignment on skill development and the role of relative age. *Journal of Human Capital*, 16(2), 273-302.
- Crosnoe, R. (2009). Low-income students and the socioeconomic composition of public high schools. *American sociological review*, 74(5), 709-730.
- Dar, Y., & Resh, N. (1986). Classroom intellectual composition and academic achievement. *American Educational Research Journal*, 23(3), 357-374.
- Davis-Kean, P. E., Tang, S., & Waters, N. E. (2019). Parent education attainment and parenting. In *Handbook of parenting* (pp. 400-420). Routledge.
- De Fraine, B., Belfi, B., Van Damme, J., & Seel, N. M. (2011). Composition of learning groups.

- De la Fuente, J., González-Torres, M. C., Artuch-Garde, R., Vera-Martínez, M. M., Martínez-Vicente, J. M., & Peralta-Sánchez, F. J. (2021). Resilience as a buffering variable between the big five components and factors and symptoms of academic stress at university. *Frontiers in Psychiatry*, 12, 600240.
- Deary, I. J., & Johnson, W. (2010). Intelligence and education: causal perceptions drive analytic processes and therefore conclusions. *International journal of epidemiology*, 39(5), 1362-1369.
- Driessen, G. (2002). School composition and achievement in primary education: A large-scale multilevel approach. *Studies in educational evaluation*, 28(4), 347-368.
- Dumay, X., & Dupriez, V. (2008). Does the school composition effect matter? Evidence from Belgian data. *British Journal of Educational Studies*, 56(4), 440-477.
- Duncan, G. J., & Magnuson, K. A. (2003). Off with Hollingshead: Socioeconomic resources, parenting, and child development. *Socioeconomic status, parenting, and child development*, 287, 83-106.
- Eder, D. (1985). The cycle of popularity: Interpersonal relations among female adolescents. *Sociology of Education*, 154-165.
- Gang, G., Han, C., & Bansa, L. (2019). Contribution of psychological factors on academic achievement of rural students in the Interior School of Sabah Division. *International Journal of Education, Psychology and Counseling*, 2(27), 76-90.
- Godwin, A., Scott, T. D., Potvin, G., Sonnert, G., & Sadler, P. M. (2015). The academic performance index: Creating a more robust and less biased measure of student academic performance. 2015 IEEE Frontiers in Education Conference (FIE),
- Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological assessment*, 4(1), 26.
- Golle, J., Schils, T., Borghans, L., & Rose, N. (2023). Who Is Considered Gifted From a Teacher's Perspective? A Representative Large-Scale Study. *Gifted Child Quarterly*, 67(1), 64-79.
- Golsteyn, B. H., & Schils, T. (2014). Gender gaps in primary school achievement: a decomposition into endowments and returns to IQ and non-cognitive factors. *Economics of Education Review*, 41, 176-187.
- Hallinan, M. T., & Sørensen, A. B. (1985). Ability grouping and student friendships. *American Educational Research Journal*, 22(4), 485-499.
- Hanushek, E. A., Kain, J. F., Markman, J. M., & Rivkin, S. G. (2003). Does peer ability affect student achievement? *Journal of applied econometrics*, 18(5), 527-544.
- Harder, V. S., Stuart, E. A., & Anthony, J. C. (2010). Propensity score techniques and the assessment of measured covariate balance to test causal associations in psychological research. *Psychological methods*, 15(3), 234.
- Hargreaves, D. H., & Hargreaves, D. (2006). *Social relations in a secondary school*. Routledge.
- Hattie, J. A. (2002). Classroom composition and peer effects. *International Journal of Educational Research*, 37(5), 449-481.
- He, Y., Li, A., Li, K., & Xiao, J. (2021). Neuroticism vulnerability factors of anxiety symptoms in adolescents and early adults: an analysis using the bi-factor model and multi-wave longitudinal model. *PeerJ*, 9, e11379.
- Hoffer, T. B. (1992). Middle school ability grouping and student achievement in science and mathematics. *Educational evaluation and policy analysis*, 14(3), 205-227.

- Hong, G., Corter, C., Hong, Y., & Pelletier, J. (2012). Differential effects of literacy instruction time and homogeneous ability grouping in kindergarten classrooms: Who will benefit? Who will suffer? *Educational evaluation and policy analysis*, 34(1), 69-88.
- Hotelling, H. (1933). Analysis of a complex of statistical variables into principal components. *Journal of educational psychology*, 24(6), 417.
- Jolliffe, I. T. (2002). *Principal component analysis for special types of data*. Springer.
- Jonassaint, C. R., Siegler, I. C., Barefoot, J. C., Edwards, C. L., & Williams, R. B. (2011). Low life course socioeconomic status (SES) is associated with negative NEO PI-R personality patterns. *International journal of behavioural medicine*, 18, 13-21.
- Kahneman, D. (2017). *Thinking, fast and slow*.
- Kautz, T., Heckman, J. J., Diris, R., Ter Weel, B., & Borghans, L. (2014). Fostering and measuring skills: Improving cognitive and non-cognitive skills to promote lifetime success.
- Kekäläinen, T., Hietavala, E.-M., Hakamäki, M., Sipilä, S., Laakkonen, E. K., & Kokko, K. (2021). Personality traits and changes in health behaviours and depressive symptoms during the COVID-19 pandemic: a longitudinal analysis from Pre-pandemic to onset and end of the initial emergency conditions in Finland. *International journal of environmental research and public health*, 18(15), 7732.
- Komarraju, M., Karau, S. J., & Schmeck, R. R. (2009). Role of the Big Five personality traits in predicting college students' academic motivation and achievement. *Learning and Individual Differences*, 19(1), 47-52.
- Koning, P., & Van der Wiel, K. (2013). Ranking the schools: How school-quality information affects school choice in the Netherlands. *Journal of the European Economic Association*, 11(2), 466-493.
- Korthals, R., Schils, T., & Borghans, L. (2022). Track placement and the development of cognitive and non-cognitive skills. *Education Economics*, 30(5), 540-559.
- Lane, J., & Lane, A. (2001). Self-efficacy and academic performance. *Social Behavior and Personality: an international journal*, 29(7), 687-693.
- Lazear, E. P. (2001). Educational production. *The Quarterly Journal of Economics*, 116(3), 777-803.
- Lechner, C. M., Bender, J., Brandt, N. D., & Rammstedt, B. (2021). Two Forms of Social Inequality in Students' Socio-Emotional Skills: Do the Levels of Big Five Personality Traits and Their Associations With Academic Achievement Depend on Parental Socioeconomic Status? *Frontiers in Psychology*, 12, 679438.
- Lechner, M. (2001). *Identification and estimation of causal effects of multiple treatments under the conditional independence assumption*. Springer.
- Marsh, H. W. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of educational psychology*, 79(3), 280.
- Marsh, H. W., & Hau, K.-T. (2003). Big-Fish--Little-Pond effect on academic self-concept: A cross-cultural (26-country) test of the negative effects of academically selective schools. *American psychologist*, 58(5), 364.
- Marsh, H. W., & Parker, J. W. (1984). Determinants of student self-concept: Is it better to be a relatively large fish in a small pond even if you don't learn to swim as well? *Journal of personality and social psychology*, 47(1), 213.
- McCrae, R., & Costa, J. (1996). of personality theories: Theoretical contexts for the five-factor model. *The five-factor model of personality: Theoretical perspectives*, 51.

- McCrae, R. R., & Costa Jr, P. T. (1997). Personality trait structure as a human universal. *American psychologist*, 52(5), 509.
- Noftle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: big five correlates of GPA and SAT scores. *Journal of personality and social psychology*, 93(1), 116.
- Novikova, I. A., & Vorobyeva, A. A. (2017). Big Five Factors and academic achievement in Russian students. *Psychology in Russia*, 10(4), 95.
- Opdenakker, M.-C., & Damme, J. (2001). Relationship between school composition and characteristics of school process and their effect on mathematics achievement. *British Educational Research Journal*, 27(4), 407-432.
- Pearson, K. (1901). LIII. On lines and planes of closest fit to systems of points in space. *The London, Edinburgh, and Dublin philosophical magazine and journal of science*, 2(11), 559-572.
- Peetsma, T., van der Veen, I., Koopman, P., & van Schooten, E. (2006). Class composition influences on pupils' cognitive development. *School effectiveness and school improvement*, 17(3), 275-302.
- Pinto, Y. (2012). The efficacy of homogeneous groups in enhancing individual learning.
- Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of educational psychology*, 82(1), 33.
- Pokay, P., & Blumenfeld, P. C. (1990). Predicting achievement early and late in the semester: The role of motivation and use of learning strategies. *Journal of educational psychology*, 82(1), 41.
- Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological bulletin*, 135(2), 322.
- Richer, S. (1976). Reference-group theory and ability grouping: A convergence of sociological theory and educational research. *Sociology of Education*, 65-71.
- Ritchie, S. J., & Tucker-Drob, E. M. (2018). How much does education improve intelligence? A meta-analysis. *Psychological science*, 29(8), 1358-1369.
- Rizzotto, J. S., & França, M. T. A. (2022). Indiscipline: The school climate of Brazilian schools and the impact on student performance. *International Journal of Educational Development*, 94, 102657.
- Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41-55.
- Rosenthal, R., & Jacobson, L. (1968). Pygmalion in the classroom. *The urban review*, 3(1), 16-20.
- Rubie-Davies, C. M., Flint, A., & McDonald, L. G. (2012). Teacher beliefs, teacher characteristics, and school contextual factors: What are the relationships? *British Journal of Educational Psychology*, 82(2), 270-288.
- Rubin, D. B., & Thomas, N. (1996). Matching using estimated propensity scores: relating theory to practice. *Biometrics*, 249-264.
- Scharenberg, K. (2012). Do secondary students learn more in homogeneous or heterogeneous classes? The importance of classroom composition for the development of Reading achievement in secondary school. *Online Educational Research Journal*, 3(12), 1-11.
- Schunk, D. H. (1984). Self-efficacy perspective on achievement behavior. *Educational psychologist*, 19(1), 48-58.
- Schwabe, F., Korthals, R., & Schils, T. (2019). Positive social relationships with peers and teachers as moderators of the Big-Fish-Little-Pond Effect. *Learning and Individual Differences*, 70, 21-29.

- Seaton, M., Marsh, H. W., & Craven, R. G. (2009). Earning its place as a pan-human theory: Universality of the big-fish-little-pond effect across 41 culturally and economically diverse countries. *Journal of educational psychology*, 101(2), 403.
- Serrano, C., Murgui, S., & Andreu, Y. (2022). Improving the prediction and understanding of academic success: The role of personality facets and academic engagement. *Revista de Psicodidáctica (English ed.)*, 27(1), 21-28.
- Shonkoff, J. P. (2003). From neurons to neighborhoods: old and new challenges for developmental and behavioral pediatrics. *Journal of Developmental & Behavioral Pediatrics*, 24(1), 70-76.
- Slavin, R. E. (1987). Ability grouping and student achievement in elementary schools: A best-evidence synthesis. *Review of educational research*, 57(3), 293-336.
- Sørensen, A. B., & Hallinan, M. T. (1986). Effects of ability grouping on growth in academic achievement. *American Educational Research Journal*, 23(4), 519-542.
- Steyer, R., Schmitt, M., & Eid, M. (1999). Latent state-trait theory and research in personality and individual differences. *European Journal of Personality*, 13(5), 389-408.
- Tabbodi, M., Rahgozar, H., & Makki Abadi, M. M. (2015). The relationship between happiness and academic achievements. *European Online Journal of Natural and Social Sciences: Proceedings*, 4(1 (s)), pp. 241-246.
- Tomlinson, C. A., Brighton, C., Hertberg, H., Callahan, C. M., Moon, T. R., Brimijoin, K., Conover, L. A., & Reynolds, T. (2003). Differentiating instruction in response to student readiness, interest, and learning profile in academically diverse classrooms: A review of literature. *Journal for the Education of the Gifted*, 27(2-3), 119-145.
- Turashvili, T., & Japaridze, M. (2012). Psychological well-being and its relation to academic performance of students in Georgian context. *Problems of Education in the 21st Century*, 49, 73.
- Turkheimer, E., Haley, A., Waldron, M., d'Onofrio, B., & Gottesman, I. I. (2003). Socioeconomic status modifies heritability of IQ in young children. *Psychological science*, 14(6), 623-628.
- Van der Slik, F. W., Driessen, G. W., & De Bot, K. L. (2006). Ethnic and socioeconomic class composition and language proficiency: a longitudinal multilevel examination in Dutch elementary schools. *European sociological review*, 22(3), 293-308.
- Van Houtte, M. (2006). School type and academic culture: Evidence for the differentiation-polarization theory. *Journal of curriculum studies*, 38(3), 273-292.
- Van Houtte, M., & Stevens, P. A. (2010). School ethnic composition and aspirations of immigrant students in Belgium. *British Educational Research Journal*, 36(2), 209-237.
- Veldman, D. J., & Sanford, J. P. (1984). The influence of class ability level on student achievement and classroom behavior. *American Educational Research Journal*, 21(3), 629-644.
- Von Stumm, S., & Furnham, A. F. (2012). Learning approaches: Associations with typical intellectual engagement, intelligence and the big five. *Personality and Individual Differences*, 53(5), 720-723.
- Warrington, M., & Younger, M. (2003). 'We decided to give it a twirl': Single-sex teaching in English comprehensive schools. *Gender and education*, 15(4), 339-350.
- Waters, N. E., Ahmed, S. F., Tang, S., Morrison, F. J., & Davis-Kean, P. E. (2021). Pathways from socioeconomic status to early academic achievement: The role of specific executive functions. *Early Childhood Research Quarterly*, 54, 321-331.

9 Appendix

Figure A GIS illustration of the Netherlands



Figure B GIS illustration of Limburg, the Netherlands



Figure C: Frequency distribution of the number of students/class size

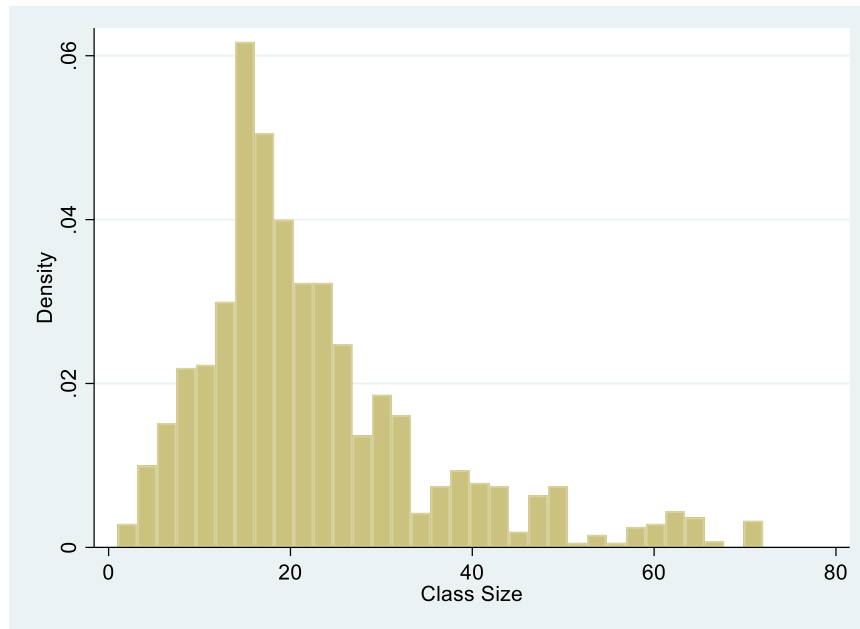


Figure D: Mean Test Scores of low-SES students by Class SES and degree Openness to Experience

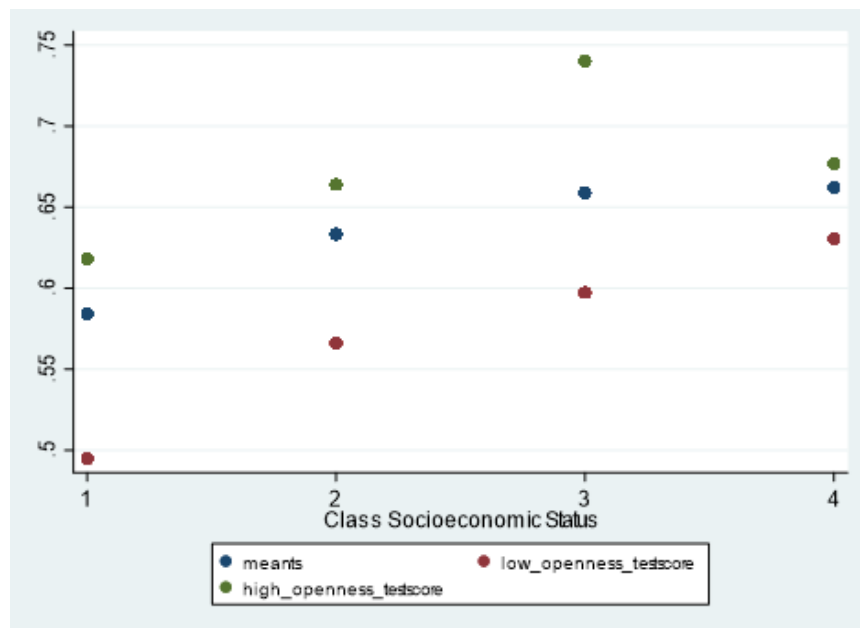


Figure E: Mean Test Scores of low-SES students by Class SES and degree of Conscientiousness

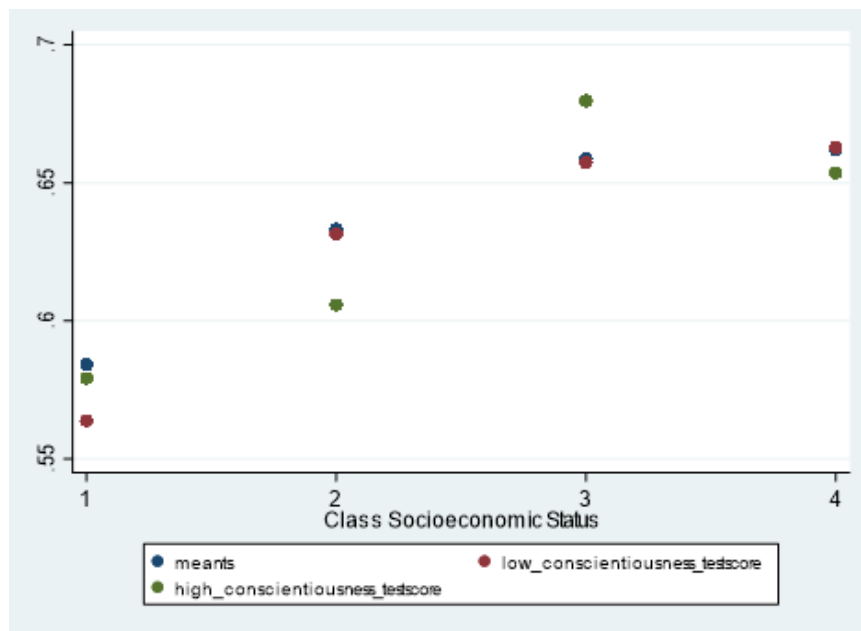


Figure F: Mean Test Scores of low-SES students by Class SES and degree of Agreeableness

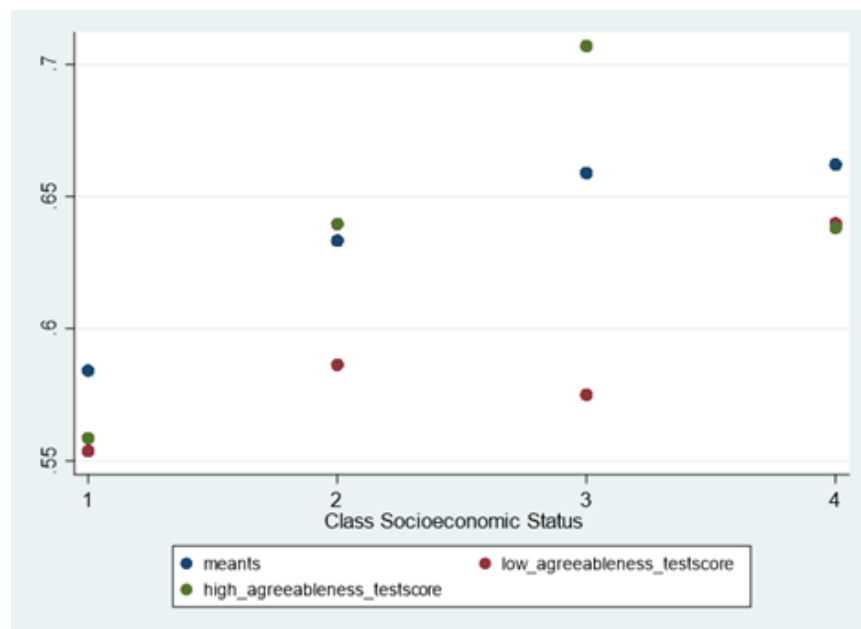


Figure G: Mean Test Scores of low-SES students by Class SES and degree of Extraversion

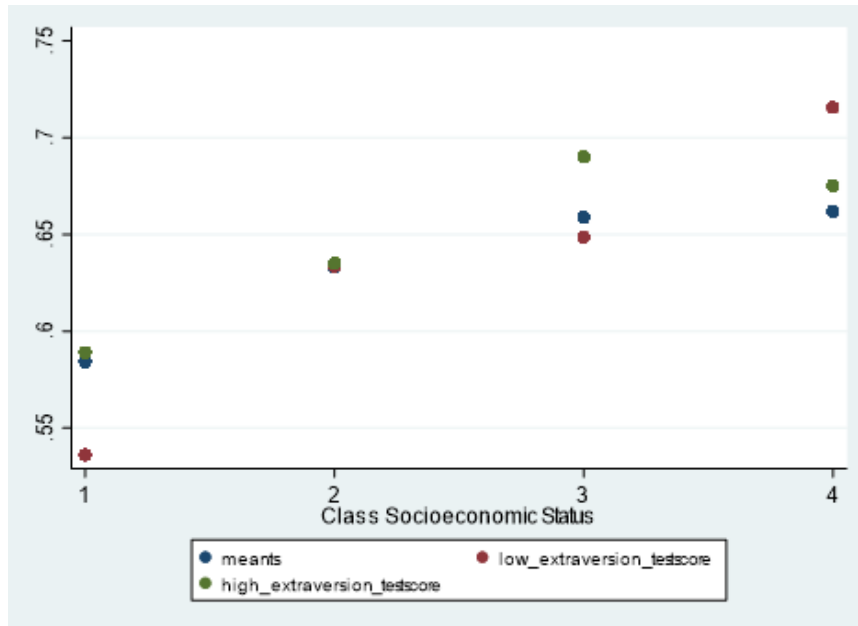


Figure H: Mean Test Scores of low-SES students by Class SES and degree of Neuroticism

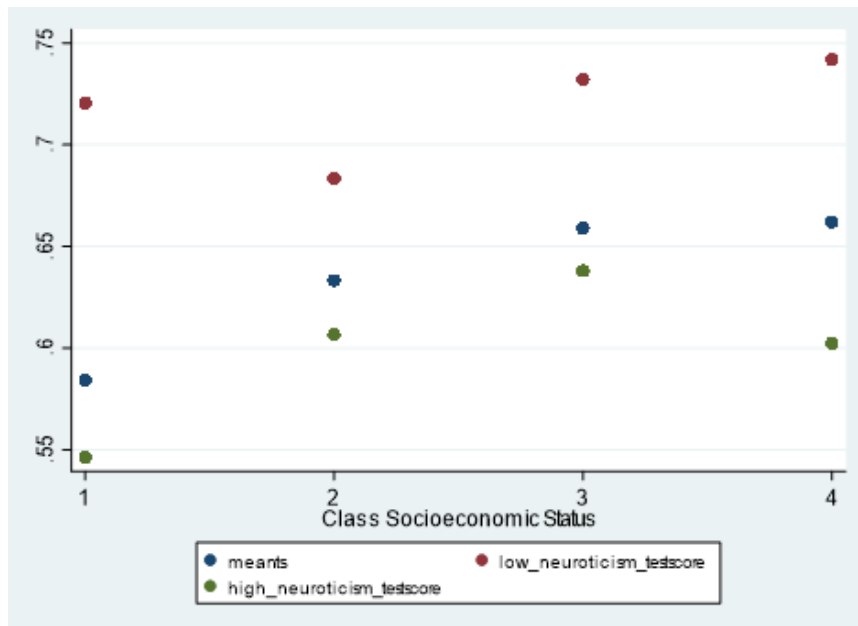


Figure I: Common Support Region between low-SES students in low-SES and middle-SES classes

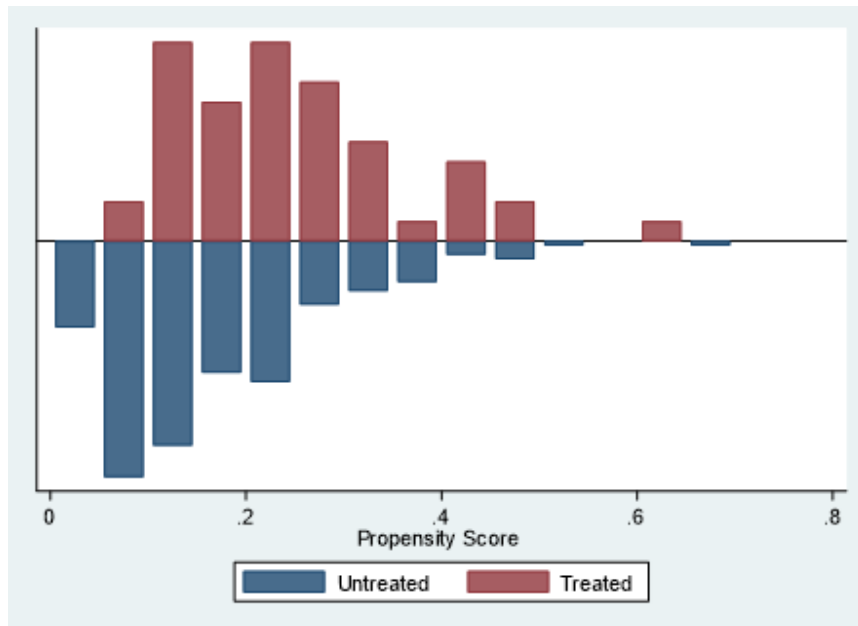


Figure J: Common Support Region between low-SES students in low-SES and high-SES classes

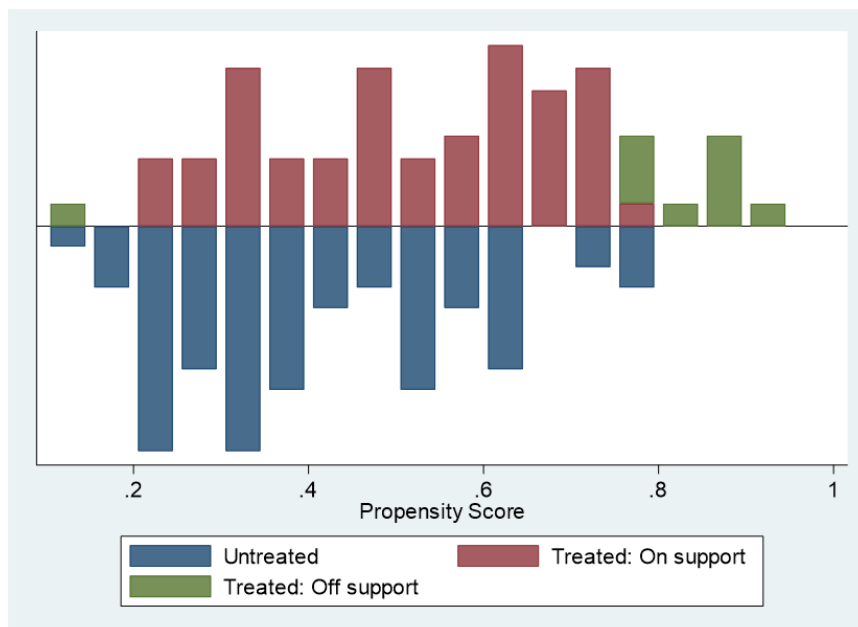


Figure K: Common Support Region between low-SES students in low-SES and mixed-SES classes

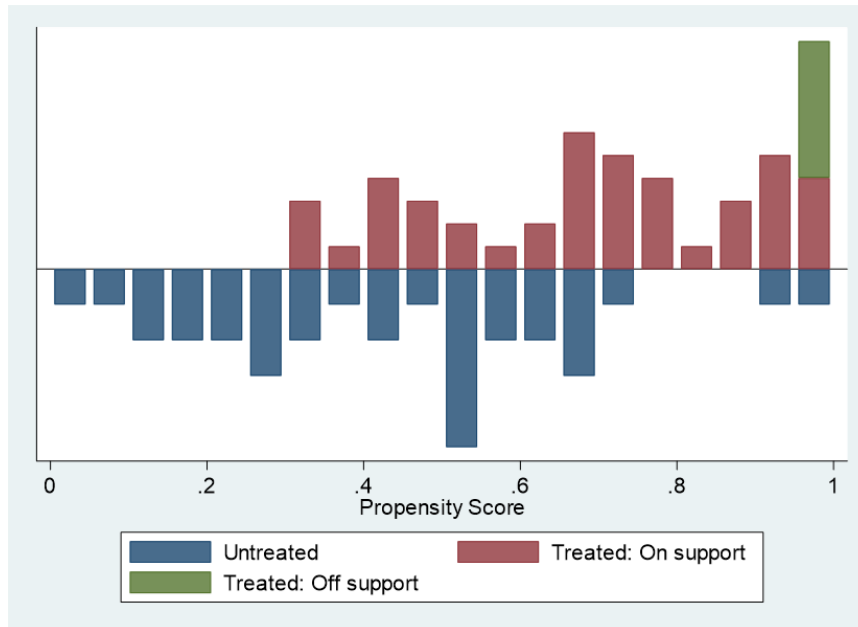


Figure L: Common Support Region between low-SES students in middle-SES and high-SES classes

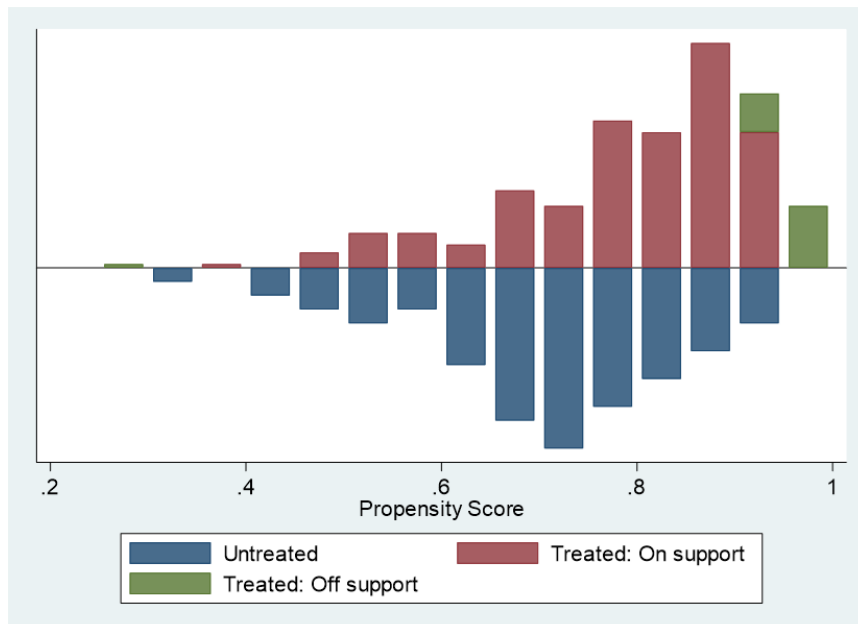


Figure M: Common Support Region between low-SES students in middle-SES and mixed-SES classes

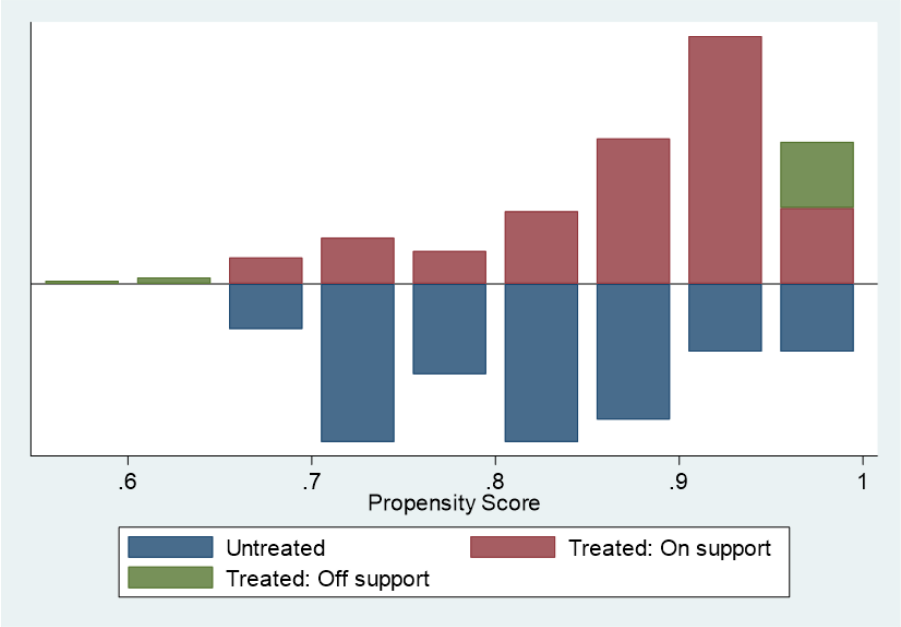


Figure N: Common Support Region between low-SES students in high-SES and mixed-SES classes

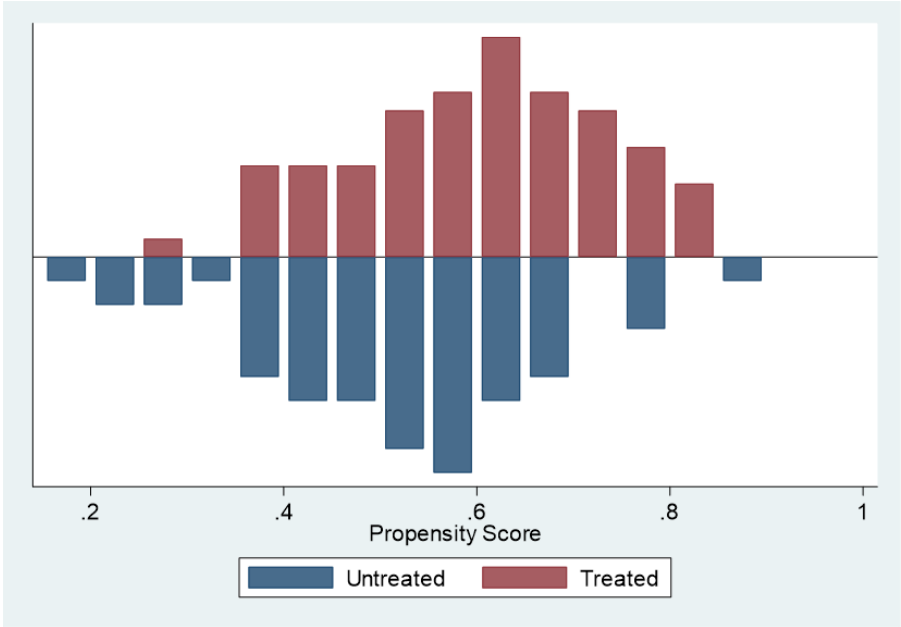
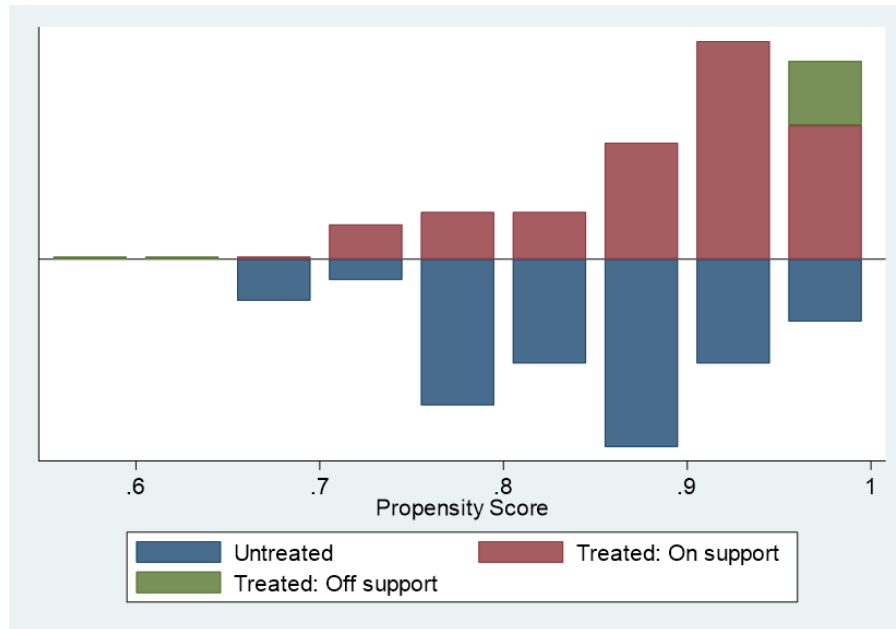


Figure O: Common Support Region between low-SES students in Concentrated and non-Concentrated classes



List A: Complete list of items used to measure personality traits

Openness to Experience	"I have a lot of ideas" "I use difficult words" "I love collecting information" "I have little fantasy" "I often think a lot about things" "I easily pick up on things" "I know many words" "I am interested in difficult ideas" "I have very good ideas"
Conscientiousness	"I make easy connections" "I am accurate" "If I do something, I am organised and precise" "I am always well-prepared" "I always make a mess" "I always keep my appointments" "I often leave my things around" "Sometimes I forget that I need to do something"
Agreeableness	"I have little interest in others" "Sometimes I am rude" "I am friendly" "I empathise with people" "I try to help others out" "I show interest in others" "I understand how the others feel" "I make other kids feel at ease"
Extraversion	"I do not talk much" "I am quiet in a group of strangers" "I like being with many people" "I like to receive attention" "I am the one who keeps the party going" "I start conversations with others" "I talk to many different people in parties"
Neuroticism	"I am stressed easily" "I often think something will go wrong" "I easily get upset" "I often feel depressed" "I am often in a sad mood" "My mood changes frequently" "I get easily angry"

List B: Complete list of items used to measure Parental Support

“I regularly talk to my child about what he/she has done in school”
 “I motivate and support my child with homework”
 “I buy external professional support for my child”
 “I offer homework support at home”
 “I check whether my child understand his/her homework”
 “I help my child with homework and assignments”
 “I regularly talk to my child about what he/she had done in school”
 “I teach my child at home”
 “I offer my child support with homework”

Table A: t-tests across background characteristics of the low-SES students in different SES classes

	Low-SES vs Middle-SES Classes	Low-SES vs High-SES Classes	Low-SES vs Mixed-SES Classes	Middle-SES vs High-SES Classes	Middle-SES vs Mixed-SES Classes	High-SES vs Mixed-SES Classes
Gender	0.975	0.4158	0.9874	0.2805	0.9897	0.3886
Labour Market Status of Father	0.0035***	0.0553*	0.000***	0.2115	0.0124**	0.5538
Labour Market Status of Mother	0.8634	0.0923*	0.0676*	0.0973*	0.0409**	0.2882

Table B: Regression on Common Support Area comparing Middle-SES and Mixed-SES Classes

VARIABLES	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
ClassSES	-0.0278 (0.0383)	0.0018 (0.0348)	0.0103 (0.0360)	0.0117 (0.0366)
Class Size		0.0006 (0.0021)	0.0012 (0.0021)	0.0010 (0.0021)
Class GPA		1.1480*** (0.1560)	1.0450*** (0.1580)	1.0530*** (0.1590)
Conscientiousness			-0.0205 (0.0167)	
Openness to Experience			0.0567*** (0.0161)	
Extraversion			-0.0031 (0.0159)	
Neuroticism			-0.0266** (0.0118)	
Agreeableness			-0.0052 (0.0156)	
ClassSES*Conscientiousness				-0.0079 (0.0072)
ClassSES*Openness				0.0211*** (0.0070)
ClassSES*Extraversion				0.0002 (0.0070)
ClassSES*Neuroticism				-0.0119** (0.0051)
ClassSES*Agreeableness				-0.0012 -0.0073
Constant	0.7510*** (0.0355)	-0.1500 (0.1240)	-0.0875 (0.1260)	-0.0908 (0.1270)
Observations	228	228	216	216
R-squared	0.002	0.204	0.252	0.245

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table C: Regression on Common Support Area comparing High-SES and Mixed-SES Classes

VARIABLES	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
ClassSES	-0.0495 (0.0308)	-0.0109 (0.0337)	-0.0098 (0.0342)	-0.0139 (0.0341)
Class Size		-0.0004 (0.0025)	-0.0016 (0.0024)	-0.0016 (0.0024)
Class GPA		0.6900** (0.2640)	0.5350* (0.2790)	0.5210* (0.2790)
Conscientiousness			-0.0187 (0.0189)	
Openness to Experience			0.0416** (0.0199)	
Extraversion			0.0147 (0.0219)	
Neuroticism			-0.0464*** (0.0137)	
Agreeableness			0.0131 (0.0197)	
ClassSES*Conscientiousness				-0.0059 (0.0056)
ClassSES*Openness				0.0116** (0.0059)
ClassSES*Extraversion				0.0045 (0.0065)
ClassSES*Neuroticism				-0.0139*** (0.0040)
ClassSES*Agreeableness				0.0046 (0.0060)
Constant	0.7050*** (0.0232)	0.1820 (0.2020)	0.3330 (0.2110)	0.3440 (0.2110)
Observations	127	127	118	118
R-squared	0.020	0.072	0.192	0.195

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table D: Regression on Common Support Area comparing Concentrated and non-Concentrated

VARIABLES	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
ClassSES	-0.0423 (0.0373)	0.0023 (0.0340)	0.0112 (0.0355)	0.0136 (0.0361)
Class Size		0.0005 (0.0019)	0.0001 (0.0020)	0.0008 (0.0020)
Class GPA		1.0170*** (0.1320)	0.9480*** (0.1320)	0.9550*** (0.1320)
Conscientiousness			-0.0139 (0.0150)	
Openness to Experience			0.0526*** (0.0148)	
Extraversion			-0.0137 (0.0147)	
Neuroticism			-0.0261** (0.0108)	
Agreeableness			-0.0089 (0.0136)	
ClassSES*Conscientiousness				-0.0067 (0.0069)
ClassSES*Openness				0.0214*** (0.0068)
ClassSES*Extraversion				-0.0024 (0.0068)
ClassSES*Neuroticism				-0.0127*** (0.0049)
ClassSES*Agreeableness				-0.0030 (0.0069)
Constant	0.7510*** (0.0350)	-0.0465 (0.1020)	-0.0086 (0.1040)	-0.0120 (0.1040)
Observations	274	274	258	258
R-squared	0.005	0.203	0.248	0.243

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1