THE WELL-BEING OF ACADEMICALLY RESILIENT STUDENTS IN GERMANY

Reanalysis of PISA 2015 data using Structural Equation Modeling

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Abstract

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Aim: This study aims at investigating the well-being of academically resilient students, as well as examining a possible effect of well-being on achievement. In doing so, this study attempts at contributing to a smaller research gap concerning the well-being of academically resilient students.

Theory: The combination of Bronfenbrenner's theory of child development and the definition of health as stated by the World Health Organisation is building the theoretical framework of this study, and thus, provides the base for the multi-dimensional measurement tool of well-being, as well as for other methodological and analytical choices.

Method: With the use of SPSS for data management and bivariate analysis, and Mplus Software for Structural Equation Modeling (SEM), the German PISA 2015 dataset was reanalyzed to, in a first step, investigate the overall level of well-being and, in a second step, test possible effects of student well-being on achievement. A complex comparison of academically resilient students with not only the average student but also with students from different socio-economic backgrounds and achievement levels (nine sub-groups in total) allowed for an in-depth analysis.

Results: The results of this study suggest, inter alia, that academically resilient students report higher motivation and lower test anxiety than their disadvantaged peers as well as being less exposed to (perceived) unfair treatment by the teacher. Results from the structural equation modeling indicate that, contrary to other subgroups, the group of academically resilient students shows neither direct nor indirect effects of well-being on achievement.

Foreword

Writing this thesis has been a journey that influenced my outlook on life. While reading and writing about student well-being, about the importance of parental support and guidance by the teacher and the positive relationship with peers, this study constantly reminded me of my personal privilege; the privilege and advantage of having all of the above, and about feeling satisfied with life.

Therefore, I am grateful for the remarkable support of my supervisor Kajsa Yang Hansen. I am thankful for her patience, her constant motivation, and positive attitude as well as her constructive and crucial feedback.

Furthermore, I am thankful for the constant support of my family and friends, that has accompanied and guided me throughout my personal and academic life.

I am curious about what the future holds.

Deborah Elin Siebecke

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Table of contents

List of Tables and Figures

List of Abbreviations

α   Cronbach's alpha

ESCS   PISA Index of Economic, Social, and Cultural Status

N   Sample Size

OECD   Organisation for Economic Co-operation and Development

PISA   Programme for International Student Assessment

SEM   Structural Equation Modeling

WHO   World Health Organisation

1 Introduction

Student achievement and well-being are two of the main priorities in many school systems around the world. Nevertheless, research from previous years not only showed a significant correlation between students' socio-economic background and achievement but also highlighted that socio-economically disadvantaged students often report lower well-being and life satisfaction (Müller & Ehmke, 2016; Organisation for Economic Co-operation and Development (OECD), 2017a); an issue that appears to be global.

Academically resilient students are the exceptions, as they beat the odds and achieve high academically despite their socio-economically challenging background. But where do they fit in when it comes to student well-being? And does their well-being even affect their achievement?

As equity, high achievement and high levels of well-being are utterly desirable in our school system, it is rather surprising that an intensive literature review prior to this study did not reveal any previous research focusing on the well-being of academically resilient students. Even though the group of academically resilient students may be rather small and represent a minority in Germany, the analysis of their self-reported levels of well-being could provide crucial information about important educational issues. Studies dedicated to academic resilience may promote understanding of why some students are more successful than others despite similar preconditions and family backgrounds (Özberk, Findik, & Özberk, 2018). Thus, this study is carrying out a first attempt at filling the gap and providing crucial information about this very special group of students. The main questions leading this research are focused on the overall well-being of academically resilient students as well as how they compare to their peers. Additionally, the possible effect of different aspects of well-being on academic achievement is tested, and again, compared to other subgroups.

Germany, the country in focus of this study, is interesting to analyze as the number of academically resilient students has recently increased (OECD & Vodafone Stiftung, 2018) and, thus, produces hope for a better, more equitable educational system. However, as in today, Germany's equity is below OECD-average as there still is a large performance difference between socio-economically disadvantaged and advantaged students (OECD, 2018).

In the theoretical framework, the definition of health by the World Health Organisation (WHO) is combined with Bronfenbrenner's developmental theory, thus, building the base for the multi-dimensional measurement tool of well-being, as well as for other methodological and analytical choices. The German 2015 dataset of the OECD's Programme for International Student Assessment (PISA) is used to address the research questions. In order to provide the possibility of an in-depth comparison with other peer-groups, the data set is divided into nine subgroups with different levels of achievement and socio-economic backgrounds, one of which is the group of academically resilient students. This setting then allows comparing academically resilient students, which are socio-economically disadvantaged high-achievers, with other socio-disadvantaged students and other groups of high-achievers. With the use of SPSS for data management and bivariate analysis, and Mplus Software for path analysis within the Structural Equation Modeling (SEM) framework, the PISA 2015 dataset is reanalyzed to, in a first step, investigate the overall level of well-being and, in a second step, test possible effects of student well-being on achievement.

At the start, a short literature study is presented to not only define the terms *academic resilience* and *well-being* but to also provide insight into the research that has previously been done. The following chapter addresses the theoretical framework, together with different dimensions and sources of well-being, as well as offering some theoretical background for the structural model used in this study. After shortly addressing the main research questions, this dissertation then, in the method chapter, describes the data sources, instruments, and analysis, as well as focusing on possible reliability, validity, and ethical considerations and concerns. The result chapter consists of the results of bivariate analysis and a path analysis and is followed by an in-depth discussion of results and limitations.

2 Literature study

To provide detailed background knowledge crucial for this study, the terms *academic resilience* and *well-being* will be defined, and previous research done in these fields will be reviewed; first separately, then the well-being of academic resilient students. Due to the issue that both terms do not have a universal definition, this chapter concludes in the specific definitions used in this

very study and may, therefore, differ from other definitions or interpretations that can be found in academic literature.

2.1 Academic Resilience

2.1.1 Definition

When reading about resilience in German literature, you often stumble across the image of a tumbler-toy which is commonly used to metaphorically describe the phenomena. No matter how often you try to tip a tumbler-toy over, it seems to defeat both gravity and expectations and raises itself again. Resilient individuals tend to behave in a similar matter – they keep on standing up or bouncing back no matter the difficulties thrown in their way. Therefore, in broad terms, resilience is commonly defined as this ability to "bounce back" when facing difficulty (Coronade-Hijón 2016, Fredrickson & Tugade 2004) and is used to describe "relative resistance to psychosocial risk experiences" (Rutter, 1999, p. 119).

The term *academic resilience* describes such phenomena in an academic setting, often focusing on students that accomplish high academic achievement despite facing psychosocial risk or other high difficulties. As the socio-economic status and achievement at school often show high correlations, suggesting that students from lower socio-economic backgrounds tend to achieve lower (Müller & Ehmke, 2016), students who beat the odds academically and achieve high at school despite their challenging socio-economic background can be considered as academically resilient. To put it into Rutter's words mentioned above: These students show "relative resistance to psychosocial risk experiences" (Rutter, 1999, p. 119) and can, therefore, be categorized as academically resilient.

Nevertheless, an extensive literature review prior to this study revealed that defining academic resilience and academically resilient students is not as simple and caution must be taken as there is no universal definition and finding consensus on the definition is challenging. According to Brackenreed (2010), an individual can be defined as resilient when positive results are achieved despite being in a high-risk situation. Therefore, when it comes to academic resilience, it is often argued - whilst not commonly agreed upon - that high academic achievement despite risk factors defines academically resilient students (Yavuz & Kutlu 2016). The researchers Neal (2017), Hass and Graydon (2009), Gonzalez and Padilla (1997), Perez et al. (2009) and Strolin-

Goltzman et al. (2016) somewhat agree in their definition and measurements of academic resilience as their studies all focus on students with challenging backgrounds, such as former foster youth or students with an immigrant background or low socio-economic status, that beat the odds and perform high despite their challenges. Both psychosocial challenges and high academic achievement can, therefore, be seen as a criterion when it comes to defining an academically resilient student.

Nevertheless, there seem to be other positive outcomes besides high achievement that can be used for the definition of resilience. Rojas (2015), for example, claims to have identified a resilient student with low academic achievement; a claim that is impossible to achieve with the former understanding of academic resilience. It becomes apparent that caution needs to be taken when defining academic resilience and that the terms resilience and academic resilience cannot be used interchangeably. Rojas (2015) argues in her case study that a student can be categorized as resilient if environmental protective factors, such as a supportive family and individual characteristics, such as optimism and empathy are met, even if the student is not successful academically.

As there does not seem to be a universal definition of academic resilience, and, as the previous literature review clearly exhibits, different researchers can have very different, even contradicting views on the definition and classification of academically resilient students. To prevent confusion or misinterpretations of this study, it is important to underline at this point that the terms *academically resilient students* and *socio-economically disadvantaged high-achievers* can be used interchangeably to describe the students focused on in this very study. Hence, the definition of academic resilience, in the understanding of this study, does not include individual characteristics such as optimism and empathy, nor do environmental protective factors suffice to characterize a student as academically resilient (as it was done in Rojas 2015 study mentioned above). These personal characteristics may rather be included in the definition and understanding of resilience in general or emotional resilience but do not play any role in defining academic resilience in this study.

Thus, the possible overlap of aspects of well-being with the overall or emotional resilience of a person, such as a person's optimism or motivation, will not cause a problem for this study, as academic resilience can clearly be distinguished from emotional resilience and student well-being. This being said, individual and environmental protective factors may very well have a

positive or negative impact on academic resilience but are not included in the definition of academic resilience used for this study.

2.1.2 Academic Resilience in Germany

The results of the very first PISA study, published in 2001, lead to harsh criticism towards the German school system. An overall achievement well below OECD-average[1], as well as the issue of a strong correlation between a student's socio-economic background and achievement in PISA, made phrases such as the "PISA-Shock" and "deutsche Bildungsmisere" (English: the German education misery) popular throughout Germany (Son, 2003). Ever since then, this strong relation of students' background and achievement, as well as the German school system itself, have been the focal point of many discussions in the educational and political sector in Germany (Klemm, 2016).

Since then, a lot of reform measures have been introduced. In 2002, the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (Kultusministerkonferenz), declared seven areas in need of improvement, including, inter alia, language and reading literacy, teaching quality and the support of disadvantaged students. One year later, in April 2003, four billion euros were used to promote the expansion of all-day schools, and numerous federal states transferred the tripartite school system (consisting of Gymnasium, Realschule, Hauptschule) to a bipartite one (consisting of Gesamtschule/ Sekundarschule and Gymnasium), and thus, aiming at achieving an increase in social diversity at schools (OECD & Vodafone Stiftung, 2018).

Although social background still is a strong factor behind academic achievement, the correlation is much weaker today than it was back in 2000. Equity in achievement improved in all three core subjects (Science, Reading and Mathematics) and Germany, together with the United States, achieved the largest improvements in equity in reading performance, "where the relationship between socio-economic status and reading performance weakened by 10 percentage points or more" (OECD, 2018, p. 62).

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[1] In PISA 2000, Germany achieved the following average scores: reading: 484, mathematics: 490, science 487; while the OECD average was at 500 (OECD, 2004)

Back then as well as today, there have been academically resilient students beating the odds and achieving high despite their challenging socio-economic background. Analyses show, that the percentage of resilient students rose significantly. While in the German dataset of 2006, 25% of students were considered as resilient, this percentage rose to 32.3% in 2015 - which is, together with Portugal, the largest recorded increase among OECD countries (OECD & Vodafone Stiftung, 2018). At this point, it is important to mention that the measurement and definition of academic resilience can be different from study to study. The study mentioned above defines academically resilient students as students whose socio-economic status is in the lower fourth of the German distribution and whose achievement is reaching proficiency level 3 and above, which is considered as a rather moderate achievement.

Even though the increasing number of resilient students sound promising, it is important to note that Germany is still below OECD-average when it comes to equity and equal opportunities and there still is a large performance difference between socio-economically advantaged and disadvantaged students. To be exact, there is an achievement gap of 103 points, where students from socio-economically disadvantaged backgrounds achieve a mean science score of 466 points and advantaged students 569; an achievement difference that is not only higher than the OECD average of 88 points but equivalates to almost three and a half school years (OECD, 2018).

Even though recent PISA studies show that disadvantaged students who attend schools where other students tend to be advantaged score 122 points higher than their disadvantaged peers attending disadvantaged schools, still 46% of disadvantaged students attend disadvantaged schools (OECD & Vodafone Stiftung, 2018).

2.2 Student Well-Being

2.2.1 Definition

A simple search for literature with the use of the digital library catalog of the University of Gothenburg (SuperSearch) reveals 469 results when searching for publications with the keywords "student well-being" within the last decade in comparison to only 129 results from

the decade before; an enormous increase of publications indicating that student well-being has become a more popular and trending topic2.

Along with all these publications come a lot of different definitions and theories about well-being and finding consensus or a universal definition seems rather impossible. Hence, only some of those many definitions will shortly be presented in this chapter.

Student well-being has commonly been connected to the concepts of happiness and health, as well as being defined as the ability to lead a thorough and productive life (Graham, Powell, Truscott, 2016). Additionally, it has, at times, been defined as or used synonymously with the absence of depression, or a student's standard of living (Pollard & Lee, 2003). As a rather young field of research, student well-being was often measured as one single item in the beginning (see Fend, Knörzer, Nagl, Specht & Väth-Szusziara, 1976, as referred to by Hascher & Hagenauer, 2011). Later on, the concept has been specified and developed. As a result of this development, Columbo (1986) later described well-being as "a multidimensional construct incorporating mental/ psychological, physical, and social dimensions" (as cited in Yarcheski, Scoloveno, & Mahon, 1994, p. 288).

As research revealed that individuals often show diverse values on those different dimensions, influenced by individual circumstances (Hascher & Hagenauer, 2011), it can be argued that measurement tools, too, have to be multi-dimensional in order to capture well-being accurately. Nonetheless, a systematic literature review by Pollard and Lee (2003) revealed that 80 percent of the reviewed studies claiming to measure child's well-being actually solely measured one single domain of well-being.

According to Weisner (1998), the health and well-being of a child are directly linked to "their families' ability to provide their essential physical, emotional, and social needs" (p.413). Other studies support the view that it is not only the relationship with and support by the family but also relationships and connectedness in the educational setting, with teachers and peers, that influence a child's well-being (Patton et al. 2000; Rowe, Stewart & Patterson 2007). Further,

2 Both searches used the exact same keywords ("student well-being") but then limited the results to publications from either 2000-2009 or 2010-2019. The large increase in publications may indicate that student well-being has become a lot more popular over time. Nevertheless, this simple search result comparison only focuses on the quantity, not the quality of studies, nor does it pay attention to other key terms or the mere possibility that more literature, in general, has been published in recent years.

well-being is said to be closely linked to the quality of education and its ability to support the development of self- and social competences, as well as contributing to healthy behavior and emotional security (Hascher & Hagenauer, 2010).

Hodgson (2007) goes as far as to argue that experiences and relationships at school may shape future pathways and explains that these crucial experiences occur within different kind of relationships "which students have with each other, with educators, and with the total logic of education [and] include the capacity (or not) to feel included, responded to, to have one's particular learning and educational needs understood and respectfully responded to, and to have a say in their educational experiences" (p.59). Thus, schools can be seen as relational places that may have a direct positive or negative impact on a student's well-being, be it through friendship or bullying, support or unfair treatment (Graham, Powell & Truscott, 2016).

In summary, the well-being of a student or child is a construct that has been and can be defined and shaped in different ways, including socio-emotional aspects such as happiness, parental and educational support and relationships or rather economic aspects such as one's standard of living. It becomes apparent that definitions differ and variably focus on one or multiple dimensions. By following the claim that well-being is a multidimensional construct (Columbo, 1986) that needs to be measured multi-dimensionally (Pollard & Lee, 2003), this present study as well incorporates psychological, physical and social aspects of well-being. More detailed information about these dimensions and the measurements used in this study can be found in the theoretical framework (chapter 4).

2.2.2 Student Well-Being in Germany

As there is a variety of definitions of well-being, studies as well focus on different aspects and therefore report different, partially contradicting results. In the following, a few German studies concerning student or child well-being will be introduced. Due to different definitions and measurements of student well-being, caution must be taken when considering and comparing research results. Thus, this chapter is merely aimed at providing a first short overview of previous research on student well-being in Germany.

The DJI-Kinderpanel is a large scale study that was created on behalf of the Federal Ministry for Family, Senior Citizens, Women and Youth (BMFSFJ) by the German Youth Institute (DJI) and focuses on the well-being of 8 - 9-year-old students. It is claimed that the study results indicate an overall positive level of well-being as 98% of students report that they are feeling "okay" about themselves and 94% of students generally are in a good mood. However, the study also indicates that 71% of students sometimes feel anxious and 51% report feeling lonely (BMFSFJ, 2009).

The LifE-Studie is a German longitudinal study that aims at monitoring cultural and educational changes over a period of 30 years. Adolescents that grew up in the late 1970s and early 1980s are now being compared to today's generation of students. The study suggests that students from today's generation report higher levels of emotional well-being at school than their parental generation. When today's parents were in eighth grade, 52% reported positive emotions towards school while today, 86% of students report positive emotional well-being at school (Fend & Berger, 2016). These results not only mark an increase in well-being but also, similar to the results of the DJI-Kinderpanel mentioned above, that most of today's students report a positive level of emotional well-being.

Hascher and Hagenauer (2010) support the latter statement with similar study results as they state that students, in general, report high levels of well-being in Germany. Nevertheless, positive attitudes at school, as well as the joy of life at school, is decreasing between fifth and seventh grade. In eighth grade, this downward trend is continuing for boys while the level of well-being for girls is starting to increase again at that time. Additionally, the study reveals that the class climate, as well as boredom at school and the fear of learning, have a significant effect on student well-being (Hascher & Hagenauer, 2010).

Central to this study is PISA 2015, which is measuring student well-being through four dimensions, namely the physical, social, psychological and cognitive dimension (for more information, see Chapter 3). At this point, only a few research results will be presented as it will be focused on more detailed throughout this paper. Both the students' achievement motivation and schoolwork-related anxiety are measured as aspects of a student's psychological well-being. German students report lower levels of motivation and anxiety than OECD average, whereas they do report slightly higher levels of overall life satisfaction (73% of students in Germany are satisfied or very satisfied with life, OECD average 71%, see OECD, 2017b).

Considering the social well-being, German students report a higher sense of belonging to school as well as higher perceived emotional parental support than OECD average, whilst the level of teacher support is below OECD average and only 59% of students reported that their science teacher shows interest and support in most or every lesson (OECD average 77%, see OECD, 2017b).

In summary, research from previous year indicates that students in Germany report overall fair levels of well-being. However, there is room for improvement as students report feeling anxious, lonely and not adequately supported by the teacher.

2.3 Academic Resilience and Well-Being

Previous research supports the idea, that there is not only an achievement gap when it comes to comparing socio-economically advantaged and disadvantaged students, but there are also socio-economic disparities in student well-being (von Rueden, Gosch, Rajmil, Bisegger, & Ravens-Sieberer, 2006; Müller & Ehmke, 2016). Additionally, studies found a significant correlation between high-achievement and well-being (Bücker, Nuraydin, Simonsmeier, Schneider, & Luhman, 2018). As academically resilient students are those from disadvantaged backgrounds that are beating the odds academically and achieve high, this study is centering the question:

Where do academically resilient students fit in?

2.3.1 Well-Being and Achievement

An extensive literature review prior to this study revealed that there is a large gap in research and the well-being of academically resilient students has not been fully focused on yet. In the following, some studies will be introduced that, in some way or another, focus on the link of well-being and achievement.

According to Sznitman, Reisel, & Romer (2010), who conducted a large scale analysis across 23 developed countries and 39 US states, poverty is recognized as a crucial determinant for low academical achievement. Their study additionally focused on the role of students' mental health and well-being. The results not only showed that a country's or state's emotional well-being

can predict its educational achievement but also that emotional well-being is a mediator in the relationship between poverty and achievement. Therefore, these results highlight the importance of well-being. As academic resilience has not been focused on in the study, it can only be speculated that well-being is playing a key role for academically resilient students as well.

Hanson, Austin & Lee-Bayha (2003) took a different approach and analyze schools with various levels of health-risk factors, such as poor physical health of students, drug use and lack of safety at school as well as individual and environmental factors promoting health and well-being. Additionally, the secondary school Academic Performance Index (API) was used to measure academic performance. The researchers suggest that students' general psychological well-being is strongly related to academic performance. Again, these results can only lead to hypotheses and do not directly relate to the field of academic resilience but suggest a relationship between achievement and well-being.

Even though Esteve (2008) took a methodologically different approach to the topic and conducted an intervention study, the researcher also underlines the importance of supporting students' psychological health and well-being in order to improve their performance. Multiple additional studies suggested that aspects of well-being, such as a sense of belonging to school, as well as a positive peer- and teacher relationships in educational settings are positively related to academic achievement (Murdock, Anderman, & Hodge 2000; Ryan & Patrick 2001).

Hence, various studies indicate a link between well-being and academic achievement. Nevertheless, the well-being of academically resilient students has not been focused on.

2.3.2 Protective Factors of Academic Resilience

As no study directly focusing on the well-being of academically resilient students was detected, other studies exploring protective factors for academic resilience may be used to gain insight and possibly link different aspects of well-being to academic resilience.

Whilst at times, academic resilience is seen as a personal trait, more recent research focuses on resilience as an outcome of the interactions between an individual and his/her environment,

family and community (Turliuc, Mairean, & Danila, 2013). Therefore, environmental and individual protective factors play an important role in the study of academic resilience as academic resilience is often considered to be a "dynamic developmental process" (Jowkar, Kohoulat & Zakeri, 2011, p. 88) that involves the interaction of both the internal (individual) protective factors and external (environmental) protective factors in order to contribute to student's success. To mention a few examples, Neal's (2017) study on academically resilient foster youth, for instance, revealed that socio-emotional and academic environments play an important role in achieving academic resilience and persistence. Students reported positive feelings about their school environment and felt overall supported by adults and the school in general. Interviews with adult supporters revealed that they perceive students' intrinsic characteristics, such as intelligence, discipline, and goal-orientation, as the main reason for academic resilience. Additionally, the role of extracurricular activities as an addition to the students' support system was discussed (Neal, 2017).

Similar results were achieved by Hass & Graydon (2009) and their study of foster youth as they also stress the importance of extracurricular and community service activities. Additionally, a variety of other protective factors, such as goal-orientation and social support were acknowledged by the foster youth in focus. According to Hersi (2011), family support and the inclusion and connection of families to the school community are two of the most important aspects affecting students' academic resilience.

When focusing on the results of studies on academic resilience and protective factors, slight disagreements become apparent, as Gonzalez and Padilla (1997) for example analyze a range of possible protective factors, including the role of peers and adults, students' sense of belonging, the academic environment and cultural factors. A regression analysis revealed that there was only one significant predictor of academic resilience: students' sense of belonging to school. Martin and Marsh (2006) on the other hand, examined psychological and educational correlates of academic resilience and resulted in a list of five factors predicting academic resilience: self- efficacy, low anxiety, persistence, planning, and control. It is further argued that enjoyment of school, class participation, and students' self-esteem can be predicted by academic resilience.

Even though it is fairly interesting to discover and discuss disagreements within the corpus of literature analyzed for this study, it cannot be forgotten that the studies are executed in different

countries and cultures and focus on a variety of different subjects. Therefore, even though comparisons can be made to achieve a broader insight into the topic, they do not necessarily lead to concrete results and no judgments about what is right and wrong can be made.

Therefore, the following list provides an overview of environmental and personal factors that have been analyzed in previous research and are said to promote or protect academic resilience. Nevertheless, caution must be taken as some studies suggest contradicting results and the population in focus were neither students from Germany nor were the definition of academic resilience identical.

Environmental Factors/ Resources

- peer-support
- support by adults
- positive school environment
- participation in school activities
- family involvement at school

Personal Factors/ Resources

- self-esteem
- motivation
- persistence
- self-efficacy
- control
- sense of belonging at school
- intelligence
- goal-orientation
- discipline

These environmental and personal factors that are said to influence or protect academic resilience, partially conform to indicators used to measure well-being. As mentioned above, well-being can be defined as "a multidimensional construct incorporating mental/

psychological, physical, and social dimensions" (Columbo 1986, as cited in Yarcheski et al. 1994, p. 288). Protective factors, such as a student's sense of belonging to school, peer- and parental support, for instance, are used in PISA 2015 to indicate the social dimension of student well-being (see OECD, 2017a or Chapter 3). Whilst motivation is commonly used as an indicator of the psychological dimension of well-being (see OECD, 2017a), intelligence could be used to measure the cognitive dimension.

Therefore, whilst no study was found that directly focuses on the well-being of academically resilient students, other studies provided crucial information about that matter and a link between well-being and academic resilience can be hypothesized.

3 Theoretical Framework

As the previous chapter focused on the overall definition of academic resilience and student well-being as well as previous research results, this chapter is meant to provide an overview over the theories and perspectives used by the OECD as well as for this study. The framework of this study combines Bronfenbrenner's (1979) theory of child development and the definition of health as stated by the World Health Organisation (WHO, 2006), that are building the base for the different dimensions of well-being that have been used in several studies (see Pollard and Lee 2003, Columbo 1986).

According to the World Health Organisation (WHO, 2006) "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition" (p.1). This quote not only underlines the importance of well-being as an aspect of human health and suggests the different dimensions of physical, mental and social well-being that will be addressed later on in this thesis, but it also stresses that well-being is a fundamental right for everyone that should not be linked to socio-economic, racial or religious background. Therefore, this definition is ever more important for this very study focusing on the well-being of disadvantaged students as it puts the spotlight on the very issue whether students with socio-economically challenging backgrounds and high achievement show high levels of well-being.

The OECD (2015) expresses their interest in student well-being by underlining that "giving children a good start in life is important for well-being here and now, but it also improves a child's life chances later" (p.7). With this statement, the grounding for the conceptualization and measurement of well-being in PISA 2015, as well as for this very study, becomes apparent as it is based on two approaches. First of all, the children's rights approach is used as it focuses on children's "here and now" instead of only considering the children/youth as "human becomings" and solely focusing on their future (Ben-Arieh et al., 2005).

Secondly, Bronfenbrenner's (1989) developmental approach is underlining the importance of attaining human capital and social skills today as it may influence their well-being in the future. To give a short overview, this developmental approach is centering the individual child into a microsystem that "is a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (Bronfenbrenner, 1979, p. 22). This could be the student's close interaction with its immediate environments such as peers in the classroom, the family or the neighborhood. Level 2, the mesosystem, describes "the interrelations among two or more settings in which the developing person actively participates" (Bronfenbrenner, 1979, p. 25) and is, thus, referring to the relationship between different microsystems. Experiences at home can, for instance, influence the experiences made at school. The third level is then referred to as the exosystem, in which "one or more settings that do not involve the developing person as an active participant, but in which events occur that affect or are affected by, what happens in the setting containing the developing person" (Bronfenbrenner, 1979, p. 25). Thus, the exosystem may include the societal context in which the child lives with his/her family. The macrosystem as the highest level, involves "the subculture or culture as a whole, along with any belief system or ideology" (Bronfenbrenner, 1979, p. 26). These levels can influence the child as it interacts with his/her environment and, in this, learns and develops different skills, such as making use of resources and finding appropriate responses to stress, as well as encountering barriers and facilitators that can shape a child's well-being (Ben-Arieh, 2010).

3.1 Dimensions and Sources of Student Well-Being

Figure 1 by the OECD (2017a) combines the definition of health by the World Health Organisation (2006) that was mentioned above, with Bronfenbrenner's developmental approach. It displays the different dimensions of well-being, including the physical, social and mental aspect of well-being. In this case, the domain of mental well-being was divided into the two separate domains psychological and cognitive well-being as it is often done in other studies as well (see Pollard and Lee, 2003; Columbo, 1986).
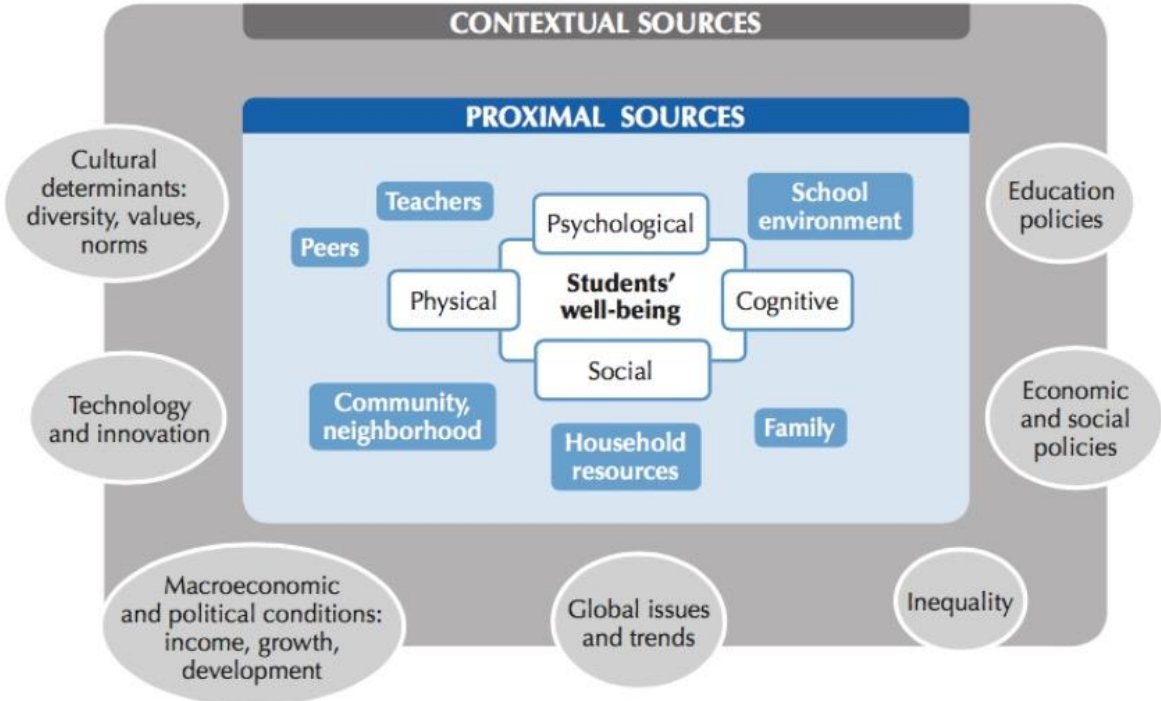
Figure 1 Dimensions and sources of student well-being (OECD 2017a, p. 62)

While the psychological dimension of well-being describes the student's view about life, as well as future goals and ambitions (Borgonovi & Pál, 2016) and is measured in PISA as well as in this present study by students' motivation for achievement and schoolwork related anxiety; the social dimension focuses more on students' social life and their relationship to their immediate environment (Rath et al., 2010) and is measured by the concepts of the sense of

belonging at school, exposure to bullying, and perception of parental and teacher support and teacher's fairness as well as the overall disciplinary climate at school. The physical dimension of well-being usually refers to the student's general health and the absence of disease (Minkkinen, 2013) and is measured by the students' physical activity and regular eating habits[3]. Lastly, the cognitive dimension of well-being includes skills that students require to be lifelong learners as well as effectively participate in society (Borgonovi & Pál, 2016) and is measured as the performance across the PISA domains.

The OECD (2017a) describes well-being as a result of students' "interaction with their environment, the material resources they have access to, and students' responses to external opportunities and stress factors" (p. 64). This primary interaction in the immediate environment of the child mirrors Bronfenbrenner's approach of a Microsystem that was described above. These interactions are not only interrelated and influenced by each other (Bronfenbrenner's Mesosystem) but also by the socio-cultural environment and community as well as by cultural values, economic, social and educational policies (Bronfenbrenner's Exo- and Macrosystem).

3.2 Linking Theoretical Model to Statistical Model

This present study is mainly focusing on the student's Micro- and Mesosystem as experiences with parents, teachers, and peers as well as their interrelationship will be addressed. The use of a complex structural equation model in general, and path model in particular corresponds well with this framework as it allows for the in-depth analysis of systems of relationships as well as direct and indirect effects (for more information about Structural Equation Modeling see chapter 5.3).

The path model used for this study is based on previous research that is linking student well-being to achievement. Bücker et al. (2018), for example, conducted a meta-analysis across 47 studies that revealed a significant correlation between subjective well-being and academic achievement. Additionally, different aspect of student well-being seem to affect each other, as for instance, relationships at school, with peers or teachers, are often associated with 'school

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[3] Due to a very small variance as well as a high amount of missing data, the aspect of regular eating habits had to be excluded out of the present study.

connectedness' (Graham et al. 2016), or the student's *sense of belonging* as it is called in this study. Negative experiences and relationships, in turn, may lead to a lack of school connectedness (Patton et al, 2000 as referred to by Graham et al. 2016). Furthermore, the meta-study conducted by Bücker et al. (2018) found that negative emotions may have a negative impact on school achievement (Gumora & Arsenio, 2002), while positive emotions, in turn, are linked to higher motivation as well as higher academic achievement (Mega, Ronconi, & De Beni, 2014). Additionally, positive relationships seem to affect the psychological well-being of a student, as previous research reveals that peer support is a significant predictor against anxiety (Lester & Cross, 2015).

Thus, this study hypothesizes that a student's sense of belonging (school connectedness), as well as his/her psychological well-being (measured by motivation and level of test anxiety), have a special significance and may serve as mediators between other aspects of well-being (physical activity, bullying, teacher fairness and support, parental emotional support and the overall disciplinary climate) and achievement. Additionally, direct effects of all aspects of well-being on achievement will be tested (see Figure 4 in chapter 5.3).

Along these lines, the theoretical framework, as well as the analytical model, enable crucial questions concerning the interrelationship of students' microsystems (see Bronfenbrenner, 1979) and provide the base for questions concerning, for example, the effect of the perceived parental emotional support on the student's sense of belonging to school. Even further, the indirect effect of parental emotional support through the sense of belonging on his/her achievement can be tested.

At this point, it is important to mention that this study, as it uses secondary data, is closely dependent on the definition and measurement used by the OECD in PISA 2015, and also is constrained by the data availability. Well-being is a highly complex subject and therefore, cannot fully be measured by PISA testing. Nevertheless, the definition and measurements used in PISA create an extensive and diverse portrait of student well-being which is regarded as "one of the most comprehensive ones around the world to date" (Borgonovi & Pál, 2016, p. 7).

4 Research Questions

Even though the relationship between student well-being and academic achievement is well established, there are, however, fewer studies focus on the subgroup of academically resilient students. No studies were found that compared academically resilient students with other non-resilient groups to examine the effect of different aspects of well-being on academic achievement. Therefore, this study aims at shedding light on the well-being of academically resilient students as well as providing an in-depth comparison with other disadvantaged students as well as high-achieving students from different backgrounds. The following research questions are steering the study:

Q1. How do academically resilient students compare to other student groups concerning their level of well-being?

Q2. What is the relationship between academic resilience and student's well-being?

Q3. Do an academically resilient student's sense of belonging to school and psychological well-being (anxiety & motivation) have a mediating effect between other aspects of well-being and academic achievement?

Q4: How do academically resilient students compare to their peers concerning the effect of different aspects of well-being on achievement?

5 Methods

Aiming at providing an overview of this study's method**s,** this chapter introduces the data source, sampling procedure, and final sample, as well as variables used within this study and an overview of the statistical method called structural equation modeling. Considerations about reliability, validity as well as ethics complete this chapter.

5.1 Data Source and Sample

The present study is based on the 2015 data set of the *Programme for International Student Assessment* (PISA), initiated by the *Organisation for Economic Co-operation and Development* (OECD). Starting with 32 participating countries/states in 2000, PISA has now grown to include 72 countries/states worldwide. In order to closely mirroring the population of students, a two-stage stratified sample design was used for PISA 2015. In the first stage, individual schools that were prior defined as PISA-eligible schools and assigned to different groups based on school characteristics were then sampled systematically. The second stage sample consisted of the random selection of 15-year old students within those schools (OECD, 2017a). Due to this cluster sampling design, students within one school tend to be more similar than students from different schools. This sampling procedure is leading to an underestimation of standard errors. One way to cope with this would be the use of a two-level analysis but as this study solely focuses at the student level, the COMPLEX option in Mplus is used to correct the Standard Error Estimation (see Appendix).

PISA's complex survey and test program are being distributed every three years, alternately focusing on the three competencies reading, mathematics, and natural science as well as including teacher, parent and student surveys about the school itself, the design of lessons, the student's socio-economic background amongst other things too. While the OECD specifically focused on student's science achievement in 2015, the PISA questionnaires went beyond the mere assessment of academic proficiency and additionally focused on student well-being. Both the measures of student's science achievement, as well as overall well-being, will be used in the present study (for more information, see chapter 5.2).

5.1.1 German dataset

In Germany, PISA has become an important component in the German overall strategy for educational monitoring (Gesamtstrategie zum Bildungsmonitoring), which aims at examining the country's current educational state with its strengths, weaknesses and overall developments (Kultusministerkonferenz, 2016). International large scale comparative studies such as PISA are of particular interest as such studies not only inform about students' current competencies

but also provide comparative information about other educational systems around the globe which can be helpful to identify problematic developments at an early stage and to incite government to rethink current policies (Sälzer & Reiss, 2016).

Nevertheless, the present study only focuses on the German dataset as the concept of well-being may be prone to bias and cultural factors may influence the interpretation of questions, the overall definition of well-being as well as the response to survey questions (heaping vs. modesty). To minimize this possible bias, it was decided to only focus on one country and the German data set was chosen.

5.1.2 Group definition and demographics

In order to allow for a complex within-country comparison, the German dataset, consisting of N=6504 students (3197 female, 3307 male) in the age of approximately 15 years, will be further split into nine additional groups. Following the statistical definition of the OECD, academically resilient students will be those students "who fall in both the bottom third of their country's socio-economic background distribution and the top third of their country's performance distribution on the PISA science assessment scale" (OECD, 2011, p. 25). Making use of this definition, the other groups are created in a similar matter (see Table 1).

While the main focus of this study is on academically resilient students, the other groups may also provide crucial information and open up for the possibility of not only comparing resilient to non-resilient students but also students with a similar socio-economic background but different levels of achievement as well as similarly achieving students with diverse socio-economic preconditions.

Table 1 Group Definition[4]

Group	ESCS distribution	Science performance Distribution
Group 1: all students	All students	All students
Group 2: disadvantaged high-achievers/ academically resilient students	In the bottom third	In the top third
Group 3: disadvantaged medium achievers	In the bottom third	In the middle third

[4] For more information about the variables ESCS and PV1SCIE, used to define the different groups, see chapter 5.2.

Group		
Group 4: disadvantaged low achievers	In the bottom third	In the bottom third
Group 5: average ESCS high achievers	In the middle third	In the top third
Group 6: average ESCS medium achievers	In the middle third	In the middle third
Group 7: average ESCS low achievers	In the middle third	In the bottom third
Group 8: advantaged high-achievers	In the top third	In the top third
Group 9: advantaged medium achievers	In the top third	In the middle third
Group 10: advantaged low achievers	In the top third	In the bottom third

Table 2 Group Demographics (% = valid percent)

Group	N	Gender	Language spoken at home	Immigration Status[5]
Group 1 all students	6504	Female: 3197 Male: 3307	German: 5130 (88.1%) Turkish: 161 (2.8%) Russian: 119 (2.1%) Other languages: 384 Missing: 710	Native: 4724 (83%) Second-Generation: 752 (13.2%) First-Generation: 215 (3.8%)
Group 2 academically resilient students	360	Female: 162 Male: 198	German: 331 (92.5%) Russian: 6 (1.7%) Polish: 5 (1.4%) Other languages: 16 Missing: 2	Native: 295 (82.6%) Second-Generation: 54 (15.1%) First-Generation: 8 (2.2%) Missing: 3
Group 3 disadvantaged medium-achievers	653	Female: 345 Male: 308	German: 559 (86%) Turkish: 17 (2.6%) Russian: 14 (2.2%) Other languages: 60 Missing: 3	Native: 496 (76.5%) Second-Generation: 127 (19.6%) First-Generation: 25 (3.9%) Missing: 5
Group 4 disadvantaged low-achievers	864	Female: 469 Male: 395	German: 651 (75.7%) Turkish: 74 (8.6%) Russian: 32 (3.7%) Other languages: 103 Missing: 4	Native: 576 (67.9%) Second-Generation: 211 (24.9%) First-Generation: 61 (7.2%) Missing: 16
Group 5 average ESCS high-achievers	644	Female: 307 Male: 337	German: 613 (95.2%) Russian: 11 (1.7%) Turkish: 4 (.6%) Other languages: 16 (2.5%)	Native: 591 (92.1%) Second-Generation: 43 (6.7%) First-Generation: 8 (1.2%) Missing: 2
Group 6 average ESCS medium-achievers	656	Female: 342 Male: 314	German: 606 (92.8%) Russian: 9 (1.4%) Turkish: 7 (1.1%) Other languages: 31 Missing: 3	Native: 575 (88.5%) Second-Generation: 65 (10%) First-Generation: 10 (1.5%) Missing: 6
Group 7 average ESCS low-achievers	577	Female: 306 Male: 271	German: 459 (79.5%) Turkish: 33 (5.7%) Russian: 15 (2.6%) Other languages: 68 Missing: 2	Native: 419 (73.4%) Second-Generation: 110 (19.3%) First-Generation: 42 (7.4%) Missing: 6
Group 8	1014	Female: 471	German: 994 (98.2%)	Native: 973 (96.2%)

[5] Native students are those who have at least one parent born in Germany, second-generation students are those students born in Germany with parent(s) born in another country and first-generation students were born outside of Germany with parents also born in another country

advantaged high-achievers		Male: 543	Russian: 4 (.4%) Turkish: 3 (.3%) Other languages: 11 Missing: 2	Second-Generation: 30 (3%) First-Generation: 8 (.8%) Missing: 3
Group 9 advantaged medium-achievers	561	Female: 293 Male: 268	German: 521 (93%) Russian: 8 (1.4%) Polish: 6 (1.1%) Other languages: 25 Missing: 1	Native: 506 (90.5%) Second-Generation: 40 (7.2%) First-Generation: 13 (2.3%) Missing: 2
Group 10 advantaged low-achievers	301	Female: 151 Male: 150	German: 234 (78.3%) Russian: 13 (4.3%) Turkish: 12 (4%) Other languages: 40 Missing: 2	Native: 226 (76.4%) Second-Generation: 42 (14.2%) First-Generation: 28 (9.5%) Missing: 5

5.2 Instruments

In the following, all variables and indexes used in the present study will be presented and categorized by the different dimensions of student well-being.
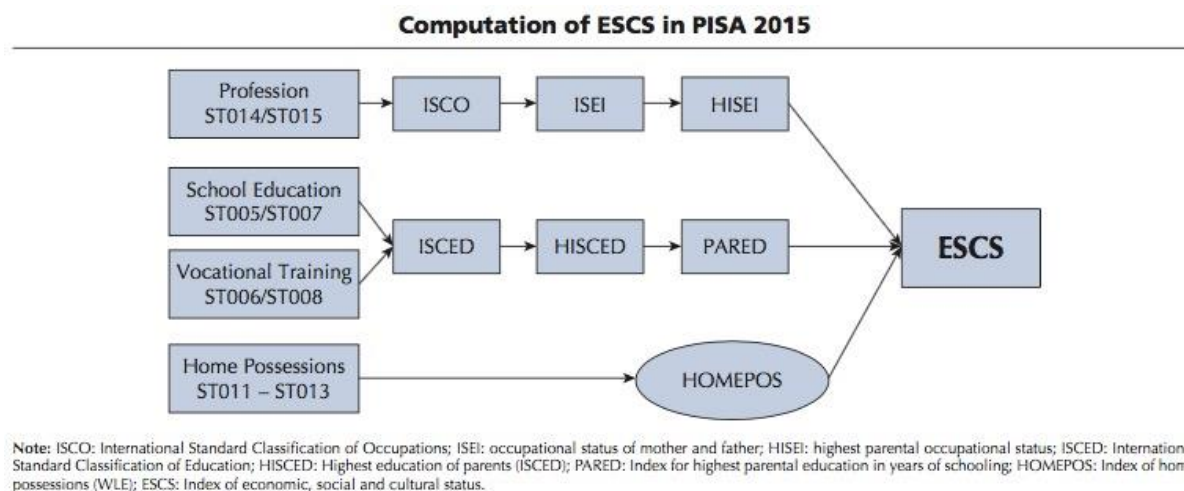
Defining Academic Resilience

This study uses the ESCS Index together with the Plausible Value 1 in Science, both presented below, in order to classify students into different groups (see chapter 5.1.2 for more detailed information).

ESCS

As stated in figure 2 below, the PISA Index of Economic, Social, and Cultural Status (ESCS) comprises of various indicators to measure the socio-economic status of the student's family of origin. According to the encyclopedia of the Sciences of Learning, the socio-economic status "combines three concepts to measure overall socioeconomic background: (a) educational attainment of the parent(s), (b) family income, and (c) social prestige of the job held by the parent(s)" (Seel, 2012, para.1).

The ESCS Index used in PISA mirrors this definition by combining measures of parental occupational and educational status with the family wealth. Due to the fact that no direct income has been measured by PISA, the index of home possessions (HOMEPOS) was used to define family wealth (OECD, 2017a).

Computation of ESCS in PISA 2015

Note: ISCO: International Standard Classification of Occupations; ISEI: occupational status of mother and father; HISEI: highest parental occupational status; ISCED: International Standard Classification of Education; HISCED: Highest education of parents (ISCED); PARED: Index for highest parental education in years of schooling; HOMEPOS: Index of home possessions (WLE); ESCS: Index of economic, social and cultural status.

Figure 2 Computation of ESCS in PISA 2015 (OECD 2017a, p. 340)

PV1SCIE

For each student and each domain (Science, Reading, Mathematics), five plausible values are included in the PISA 2015 dataset. PISA estimated multiple plausible values for its tested domains to develop a more accurate measurement of student's achievement. These values are "drawn from a posteriori distribution by combining the IRT scaling of the test items with a latent regression model using information from the student context questionnaire in a population model." (OECD 2017a, p. 128). The variable PV1SCIE, the first of five plausible values in the subject science, is used to measure students' science achievement in the present study, as science was the focal subject in PISA 2015.

Defining Well-Being

In the following, different scales to measure student well-being will be introduced. All of the scales, except for BULLY, UNFAIRT and PHYAC, were created in PISA 2015 to measure latent variables. These variables are IRT scaled and weighted likelihood estimates were used as individual scores, meaning that the scores do not reveal the actual item responses. Rather,

24

students with a value zero represent the OECD average while students with higher values are above average across OECD countries (OECD, 2017a).

Cronbach's alpha was used by the OECD as well as for this study only including the German dataset to test the internal consistency of each scale where higher numbers indicate a higher internal consistency.

Psychological Dimension of Well-Being

The psychological dimension of well-being is measured by students' achievement motivation and test anxiety, both explained below.

MOTIVAT

The index MOTIVAT is used to measure students' achievement motivation. Students were asked to rate statements about themselves (see table 3) on a four-point Likert scale ("strongly agree", "agree", "disagree", "strongly disagree"). Cronbach's alpha is 0.796, indicating a good internal consistency of the scale.

Table 3 Motivation

Item	Question	Response categories
ST119Q01NA	I want top grades in most or all of my courses.	Strongly agree, agree, disagree, strongly disagree
ST119Q02NA	I want to be able to select from among the best opportunities available when I graduate.	
ST119Q03NA	I want to be best, whatever I do.	
ST119Q04NA	I see myself as an ambitious person.	
ST119Q05NA	I want to be one of the best students in my class.	

ANXTEST

The index ANXTEST was created to describe students' test anxiety as measured by five statements (see table 4 below). Again, a four-point Likert scale with the answering categories "strongly agree", "agree", "disagree" and "strongly disagree" were used. Cronbach's alpha of 0.804 is, again, indicating a good internal consistency of the scale.

Table 4 Test Anxiety

Item	Question	Response categories
ST118Q01NA	I often worry that it will be difficult for me taking a test.	Strongly agree, agree, disagree, strongly disagree
ST118Q02NA	I worry that I will get poor grades at school.	
ST118Q03NA	Even if I am well prepared for a test I feel very anxious.	
ST118Q04NA	I get very tense when I study for a test.	
ST118Q05NA	I get nervous when I don't know how to solve a task at school.	

Social Dimension of Well-Being

The social dimension of well-being includes students' sense of belonging to school, the perceived parental emotional support, the perceived teacher support, perceived unfair treatment by the teacher, students exposure to bullying as well as the overall disciplinary climate.

BELONG

The index BELONG is used to measure students' sense of belonging to school by asking students to rate six statements on a four-point Likert scale ("strongly agree", "agree", "disagree", "strongly disagree"). All items were (re-)coded so that high values correspond with a higher sense of belonging to school. Cronbach's alpha of 0.854 indicates good internal reliability.

Table 5 Sense of Belonging

Item	Question	Response categories
ST034Q01TA	I feel like an outsider (or left out of things) at school.	Strongly agree, agree, disagree, strongly disagree
ST034Q02TA	I make friends easily at school.	
ST034Q03TA	I feel like I belong to school.	
ST034Q04TA	I feel awkward and out of place in my school.	
ST034Q05TA	Other students seem to like me.	
ST034Q06TA	I feel lonely at school.	

EMOSUPS

EMOSUPS is used to describe the level of a student's perceived emotional support from his/her parents. Students were asked to rate four statements on a four-point Likert scale with the

answering categories "strongly agree", "agree", "disagree", "strongly disagree". Cronbach's alpha is 0.819, indicating a good internal consistency of the scale.

Table 6 Parental Emotional Support

Item	Question	Response categories
ST123Q01NA	My parents are interested in my school activities.	Strongly agree, agree, disagree, strongly disagree
ST123Q02NA	My parents support my educational efforts and achievements.	
ST123Q03NA	My parents support me when I am facing difficulties at school.	
ST123Q04NA	My parents encourage me to be confident.	

TEACHSUP

TEACHSUP is used to measure the level of teacher support perceived by the student. The four-point Likert scale consists of the categories "every lesson", "most lessons", "some lessons" and "never or hardly ever". Cronbach's alpha of 0.885 is indicating a good internal consistency.

Table 7 Teacher Support

Item	Question	Response categories
ST100Q01TA	The teacher shows an interest in every student's learning.	Every lesson, most lessons, some lessons, never or hardly ever
ST100Q02TA	The teacher gives extra help when students need it.	
ST100Q03TA	The teacher helps students with their learning.	
ST100Q04TA	The teacher continues teaching until the students understand.	
ST100Q05TA	The teacher gives students an opportunity to express opinions.	

DISCLISCI

The index DISCLISCI measures the perceived disciplinary climate in science classes and students were asked to select their response on a four-point Likert scale with the categories "every lesson", "most lessons", "some lessons" and "never or hardly ever". High values in the DISCLISCI scale refer to higher levels of discipline in the science classroom. Cronbach's alpha of 0.878 indicates good internal reliability.

Table 8 Disciplinary Climate in Science Class

Item	Question	Response categories
ST097Q01TA	Students don't listen to what the teacher says.	Every lesson, most lessons, some

ST097Q02TA	There is noise and disorder.	lessons, never or hardly ever
ST097Q03TA	The teacher has to wait a long time for students to quiet down.	
ST097Q04TA	Students cannot work well.	
ST097Q05TA	Students don't start working for a long time after the lesson begins.	

BULLY

PISA 2015 initially intended measuring students' exposure to bullying with eight items (see below). Students were asked how frequently they experienced different scenarios/types of bullying or unfair treatment in the past year and were asked to respond on a scale from "never or almost never", "a few times a year", "a few times a month" to "once a week or more".

However, the first two items were not strongly correlated with the other six items and the averages vary substantially across countries so that these two items were suppressed from the PISA 2015 database (OECD, 2017a).

For the purpose of the present study, items ST038Q03NA through ST038Q08NA were summed up in one bullying score, where a high number indicates high exposure to bullying. Cronbach's alpha of 0.776 indicates good internal reliability.

Table 9 Bullying

Item	Question	Response categories
ST038Q01NA *excluded	I got called names by other students.	never or almost never, a few times a year, a few times a month, once a week or more
ST038Q02NA *excluded	I got picked on by other students.	
ST038Q03NA	Other students left me out of things on purpose.	
ST038Q04NA	Other students made fun of me.	
ST038Q05NA	I was threatened by other students.	
ST038Q06NA	Other students took away or destroyed things that belonged to me.	
ST038Q07NA	I got hit or pushed around by other students.	
ST038Q08NA	Other students spread nasty rumors about me.	

UNFAIRT

To measure the perceived unfair treatment by teachers, the items, ST039Q01NA through ST039Q06NA were used, measured with a four-point Likert scale with the categories "Never

or almost never", "a few times a year", "a few times a month", "Once a week or more". An overall scale was computed as the sum of all items where higher numbers indicate a higher level of perceived unfairness. Cronbach's alpha of 0.770 indicates good internal reliability.

Table 10 Unfair Treatment by the Teacher

Item	Question	Response categories
ST039Q01NA	Teachers called on me less often than they called on other students.	never or almost never, a few times a year, a few times a month, once a week or more
ST039Q02NA	Teachers graded me harder than they graded other students.	
ST039Q03NA	Teachers gave me the impression that they think I am less smart than I really am.	
ST039Q04NA	Teachers disciplined me more harshly than other students.	
ST039Q05NA	Teachers ridiculed me in front of others.	
ST039Q06NA	Teachers said something insulting to me in front of others.	

Physical Dimension of Well-Being

Originally, the physical dimension of well-being was measured by students' physical activity as well as regular eating habits. The latter (regular eating habits measured by ST076Q01NA, ST078Q01NA) had to be excluded of the study as there was close to no variance (ST078Q01NA Variance of .045) as well as about half of the values were missing (ST076Q01NA, 51.12 % missing values).

PHYAC

To measure a student's physical activity, the items ST031Q01NA, ST032Q01NA and ST032Q02NA were computed to an overall physical activity sum score in terms of time spent on physical activities. As the measure of students' physical activity is the sum of the three variables rather than a latent variable, no internal reliability is necessary.

Table 11 Physical Activity

Item	Question	Response categories
ST031Q01NA	This school year, on average, how many days do you attend physical education classes each week?	1-5
ST032Q01NA	Outside of school, during the past 7 days, how many days did you engage in the following? Moderate physical activities for a total of at least 60 minutes per day (e.g. walking, climbing stairs, riding a bike to school)	1-7

| ST032Q02NA | Outside of school, during the past 7 days, how many days did you engage in the following? Vigorous physical activities for at least 20 minutes per day that made you sweat and breath hard (e.g. running, cycling, aerobics, soccer, skating) | 1-7 |

5.3 Analysis

5.3.1 Structural Equation Modeling

Structural Equation Modeling, short SEM, can be viewed as an umbrella term covering different statistical approaches to data analysis, such as the analysis of variance and covariance, factor analysis, multiple regression and path analysis (Bowen & Guo, 2011). As its name suggests, Structural Equation Modeling is a statistical modeling technique which is used when "investigating the plausibility of theoretical models that might explain the interrelations among a set of variables" (Hu & Bentler 1999). Based on a theory, a hypothetical model implying relations among different factors is created and in a second step, this model is tested by using data. If the theory is valid, the pattern of relations should be reproduced with the statistical data (Kelloway, 2015).

In order to do so, factor analysis models are used to test how well latent constructs - which are rather abstract constructs that cannot be measured directly, such as attitudes or behavior - are measured by a set of observed variables - that can be measured directly. If the latent constructs are measured well, they can be used in regression analysis which test hypotheses about the relationship between these constructs (Kelloway, 2015). At this point, it is important to mention that this study focused on the relationship among the constructs to study the mechanism, therefore the measurement model of each of these constructs is not tested by confirmatory factor analysis (CFA). The variables used in the path analysis in the current study were derived with the generalized partial credit model (see OECD, 2017a).

As a structural equation model represents multiple hypotheses about how the variables are generated and related, it is crucial to assess the goodness of fit and the estimation of parameters.

Common cutoff levels indicating a good model fit are: RMSEA (root mean squared error of approximation) < .06, CFI (Comparative Fit Index) > .95, and SRMR (standardized root mean squared residual) < .08 (Hu & Bentler, 1999). Since the path model used in this study is a saturated model, the model fit indicates a perfect model and does not need to be presented further.

The perks of using path model instead of conventional multiple regression analysis are that path models within the SEM framework provide the possibility to analyze models in which variables can simultaneously be *predicted* and *predictor* variables in one single analysis procedure (Bowen & Guo, 2011). At this point, it might help to give a little input on different types of variables. Predicted variables, also known as endogenous variables or outcome variables, are those the researcher wants to explain with his/her model (see PV1SCIE in Figure 3). Exogenous variables, that very often are being called independent variables, on the other hand, are used to predict endogenous variables and are considered the starting point of the structural model (see Bully in Figure 3), meaning that the researcher is not interested in explaining how those variables came about (Kelloway, 2015). As stated before, endogenous variables can in some cases be *predicted* and *predictor* simultaneously as they can be used to predict another endogenous variable and be predicted by exogenous variables (see Belong in Figure 3). Thus, a path model makes use of various exogenous and endogenous variables to explain the relationships that are being expected or not expected to emerge (Kelloway, 2015).

In other words, the path model enables us to examine direct effects from a predictor on an outcome variable, as well as indirect effects from the predictor on the outcome variable via a third variable, which is an endogenous variable to the predictor and an exogenous variable to the outcome variable.
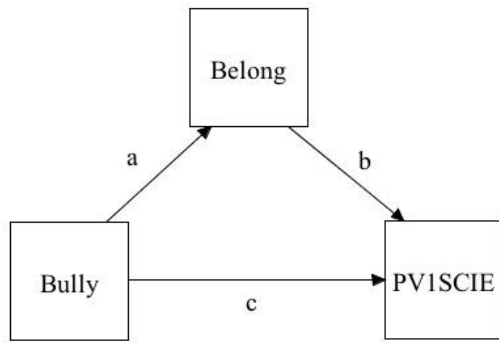
Figure 3 Mediation Model

Figure 3 above illustrates a simplified hypothesized mediation model that is part of this study, where Bully (student's exposure to bullying) is the exogenous or independent variable and PV1SCIE (science achievement) is the endogenous or outcome variable that is being predicted in this study. The student's sense of belonging (Belong) is hypothesized to have a mediating effect between student's exposure to bullying and achievement and is, therefore, both dependent and independent. This model shows three paths: *path a* displays the direct effect of the independent variable on the mediator, *path b* the direct effect of the mediator on the outcome variable and *path c* shows the direct effect of the independent variable with the outcome variable. Thus, both the independent variable (Bully) and the mediator variable (Belong) have a direct impact on the outcome variable (PV1SCIE).

Besides direct effects, path analysis can also show significant indirect effects, which occurs when an exogenous variable (Bully) affects the dependent variable (PV1SCIE) through another variable (Belong).

In order for the variable Belong to function as a mediator, the following conditions have to be met (see Baron & Kenny, 1986):

1. Variations of the independent variable (Bully) affect the mediator variable (Belong) → path a
2. Variations of the mediator (Belong) affect the outcome variable (PV1SCIE) → path b
3. When path a and b are controlled for, the effect of path c is no longer significant

5.3.2 Analytical Process

The study makes use of path model within the Structural Equation Modeling framework in order to analyze and describe the relationship between different aspects of student well-being and achievement and, in doing so, testing the theoretical model. For this, the statistical program Mplus was used to detect direct, indirect and total effects between variables.

Figure 4 below shows the hypothetical model that was applied to all ten different subgroups (for more information about the sub-groups, see Chapter 5.1.2**,** for more information about the theoretical background of the model, see Chapter 3). Unidirectional arrows are used to represent causal relationships while the bidirectional curved arrows symbolize simple correlations between exogenous variables. This is a saturated model with zero degrees of freedom. However, for each subgroup, not all the relationships are significant. In the result section, only the significant paths are included in the path diagram, albeit the basic model structure being the same.
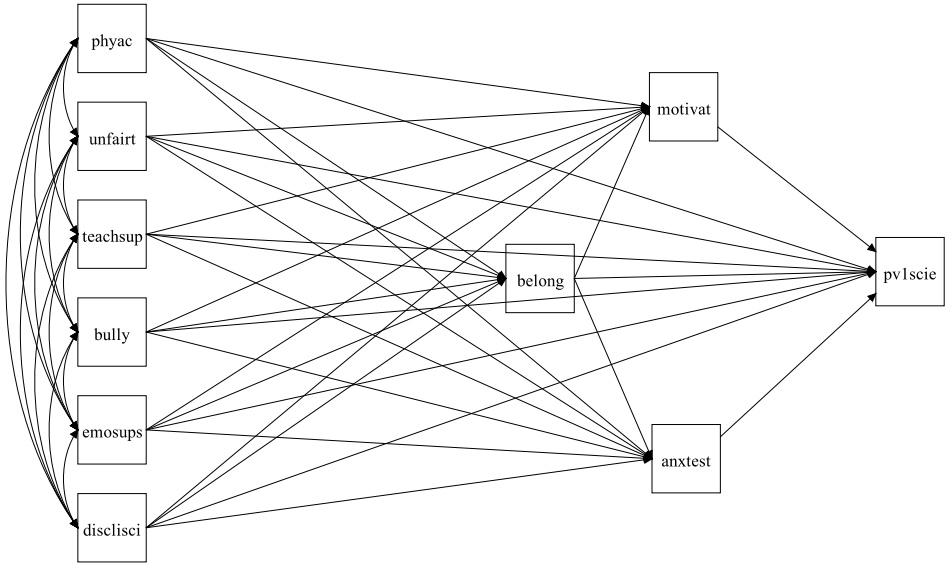
Figure 4 Hypothesized Model

5.4 Reliability and validity

To assure validity and reliability, PISA measurements are constantly being tested, changed and improved over time. Especially because PISA originally aims at comparing different countries, achieving cross-country construct validity is of major importance. Therefore, different approaches were used to assure construct validity. As the present study focuses merely on the German dataset, Cronbach's coefficient alpha was calculated and focused on as an indicator for internal consistency of scales. Cronbach's alpha values range from 0 to 1, where higher values indicate greater reliability. This study, in accordance to the OECD, uses the cut-off value 0.7 to indicate internal consistence, meaning that all alpha values 0.7 or above are considered as acceptable for assuming reliability (OECD, 2017a; Taber, 2017).

As shown in the previous chapter 5.2, the Cronbach's alpha coefficient of internal consistency reliability for the items associated with test anxiety was $\alpha = 0.796$, motivation $\alpha = 0.804$, sense of belonging $\alpha = 0.804$, parental emotional support $\alpha = 0.819$, teacher support $\alpha = 0.885$, disciplinary climate $\alpha = 0.878$, bullying $\alpha = 0.776$ and teachers unfairness $\alpha = 0.77$. As previously mentioned, all alpha values 0.7 or above are considered as reliable. Therefore, this study fulfills the requirements to be considered internally reliable.

Nevertheless, this study does have slight validity restraints as there is missing data that, in conclusion, lead to the exclusion of the variable measuring regular eating habits as too many missing values would change the nature of the sample and affect the population inference.

Additionally, the sample size of the nine different subgroups may be a validity threat as well as the group sizes differ considerably as they range from N = 301 (advantaged low-achievers) to N = 1014 (advantaged high-achievers). Smaller sample size may have less power to detect a significant relationship in the population, thus leading to type II error (the non-rejection of a false null hypothesis). Larger groups, on the other hand, may lead to type I error (the rejection of a true null hypothesis). As a consequence, both very large and very small groups may affect the statistical inference and caution must be taken.

Furthermore, it is generally admitted that causal inference requires longitudinal studies and cross-sectional data cannot draw a causal inference. Even though this view is occasionally challenged and it can be argued that the establishment of causal relations also depends on the modeling strategy (Wunsch et al. 2010), it is important to mention again, that the results of this study should be interpreted with caution.

Despite the validity restraints, it is believed that this study provides a fair first attempt at addressing the research gap and providing a first overview of the well-being of academically resilient students and their non-resilient peers.

5.5 Ethical Considerations

When using large scale comparative data such as the PISA 2015 dataset used in this study, the main ethical consideration is the handling of confidential information. Due to the use of specific school and student ID codes, the data set does not contain any identifying information and therefore, it allows for extensive analyses while maintaining anonymity.

The statistical analysis was done with care, following strict mathematical and statistical rules to the researchers best knowledge and should therefore not raise any ethical considerations.

Nevertheless, the reader's reaction to and interpretation of study results could raise severe ethical issues that are partly related to this study's method. Even though this study is mostly focusing on students' individual qualities and characteristics, this paper does not claim in any way that students themselves are solely responsible for their academic success, nor that they are responsible for overcoming disadvantages themselves. It is, therefore, important to acknowledge that other factors may play an important role and that the reader of this paper has to be warned not to jump to conclusions. These concerns are repeatedly voiced, both at this part of the paper as a methodological ethical consideration, as well as further on in the discussion chapter of this paper.

6 Results

6.1 Descriptive Statistics

Do academically resilient students (= disadvantaged high-achievers) report higher levels of well-being in its several dimensions? Do they show higher motivation and lower test anxiety than disadvantaged students that achieve low? How do academically resilient students compare to high-achievers from higher socio-economic backgrounds? In order to provide answers to these and more questions as well as providing a general overview of academically resilient students and their level of well-being on different aspects, as well as a comparison with other students groups, this chapter provides the results of a bivariate analysis of mean scores and -differences across subgroups.

The following plots are provided to visually show mean differences between groups for all variables used in the model to describe student well-being. The results of a one way ANOVA with the additional use of the Brown-Forsythe test, which is more robust against non-normally distributed data and unequal sample size (for more information see Brown & Forsythe, 1974), show that there are, in fact, significant differences between groups in all variables. Nevertheless, only statistically significant differences with the group of academically resilient students will be focused on in the following.[6]

At this point, it is important to underline that positive values do not necessarily imply that students responded overall positively and furthermore negative responses do not imply negative responses by the student. The values do not reveal any information about the individual item responses but rather the possible variation from the OECD average. A student with score 0, therefore, represents the average OECD student, while negative values refer to responses that were less positive than the OECD average (OECD, 2017a). This is not the case for the values on the bullying score, unfair treatment by the teacher score, and physical activity score, as these scores were created in a different matter (for more information, see chapter 5.2).

Motivation

[6] Additional results are available upon request.
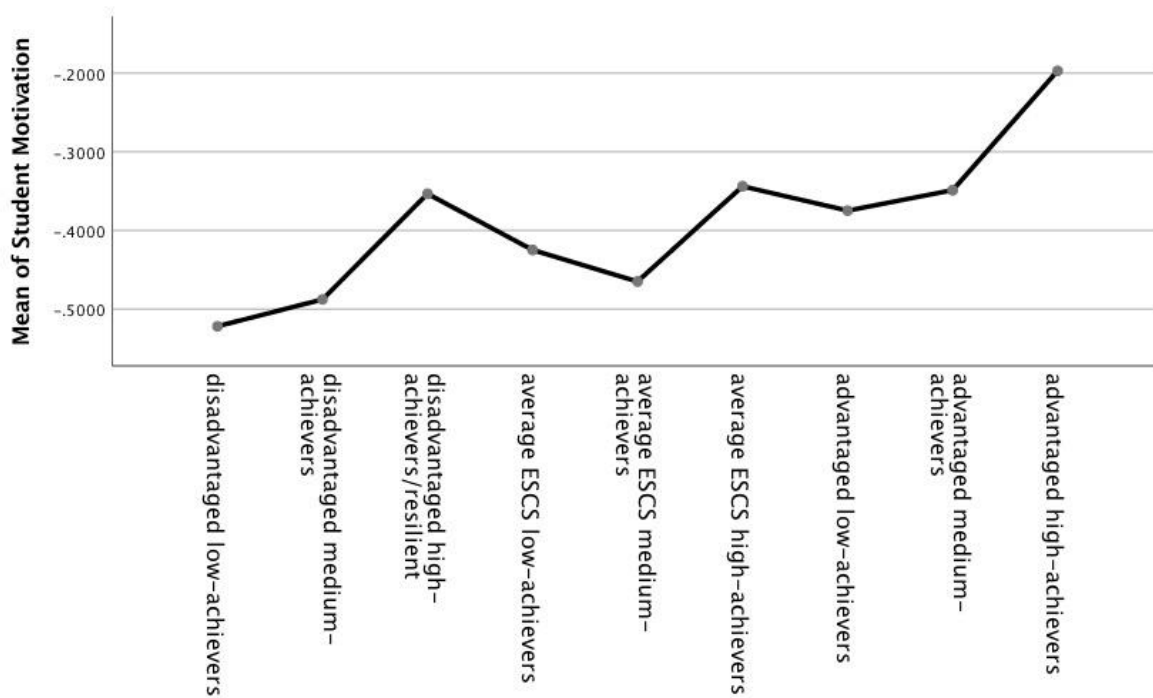
Figure 5 Results of Group Comparison: Motivation

A Post-Hoc test reveals that the following groups show statistically significant mean differences when they are being compared to the group of academically resilient students:

Disadvantaged low-achievers ($p = 0.003$) and disadvantaged medium achievers ($p = 0.024$) show significantly lower motivation while advantaged high-achievers ($p = 0.005$) show significantly higher motivation. Non-significant mean differences can be found when comparing academically resilient students with average ESCS low-achievers ($p = 0.246 > 0.05$), average ESCS medium-achievers ($p = 0.06 > 0.05$), average ESCS high-achievers ($p = 0.873 > 0.05$), advantaged low-achievers ($p = 0.765 > 0.05$) and advantaged medium-achievers ($p = 0.941 > 0.05$).

Test Anxiety
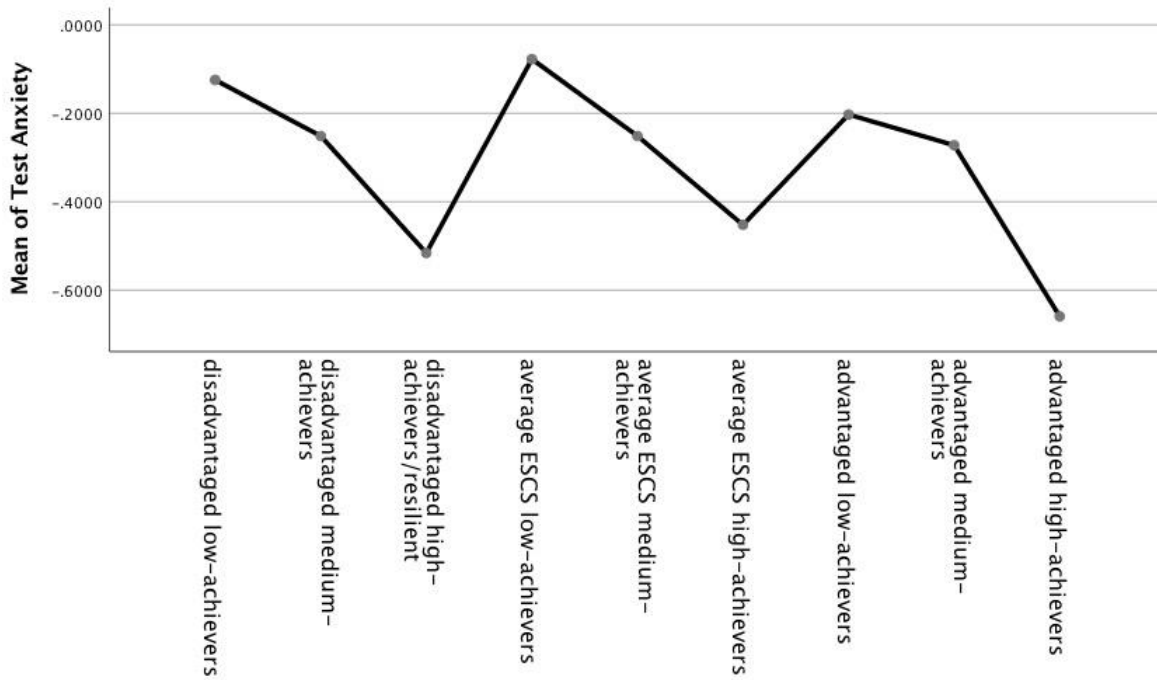
Figure 6 Results of Group Comparison: Anxiety

When comparing the mean scores for test anxiety from academically resilient students with other groups, all mean differences except for the group of average ESCS high-achievers (p = 0.296) are significant. All but the group of advantaged high-achievers report higher levels of test anxiety than academically resilient students.

Sense of Belonging to School
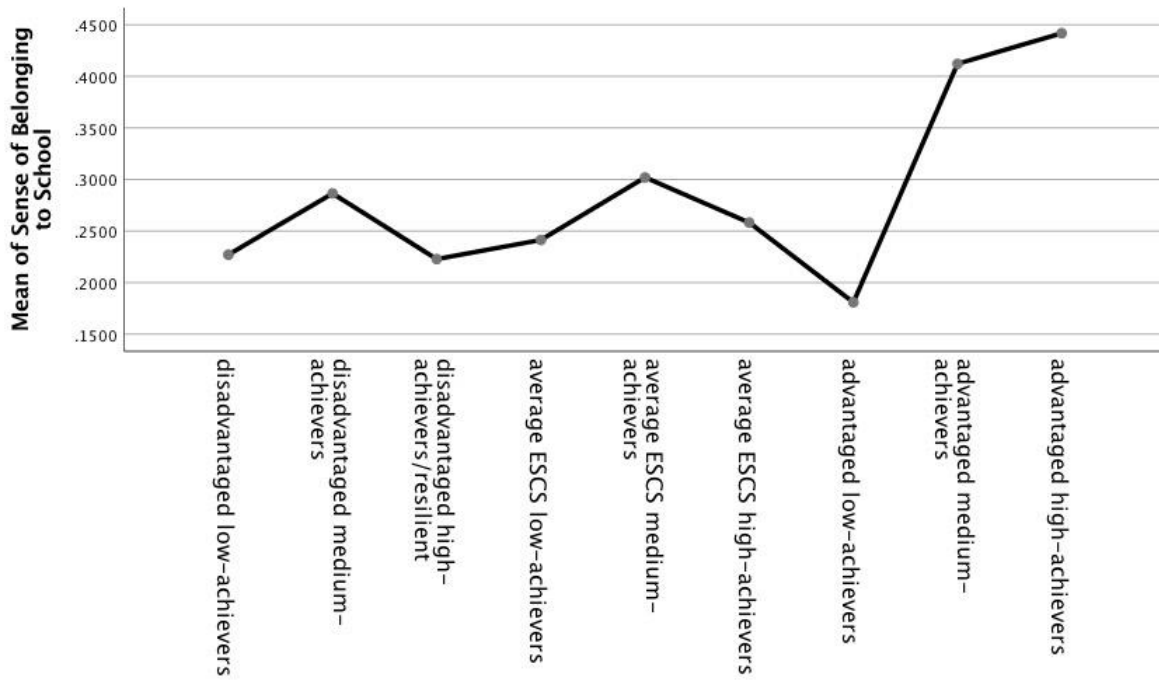
Figure 7 Results of Group Comparison: Sense of Belonging to School

As for the sense of belonging to school, only the groups of advantaged medium- and high-achievers show significant mean differences when compared with the group of academically resilient students (p = 0.009 & p = 0.001). Thus, there are no significant differences in students' sense of belonging to school when comparing all groups of disadvantaged students.

Parental Emotional Support
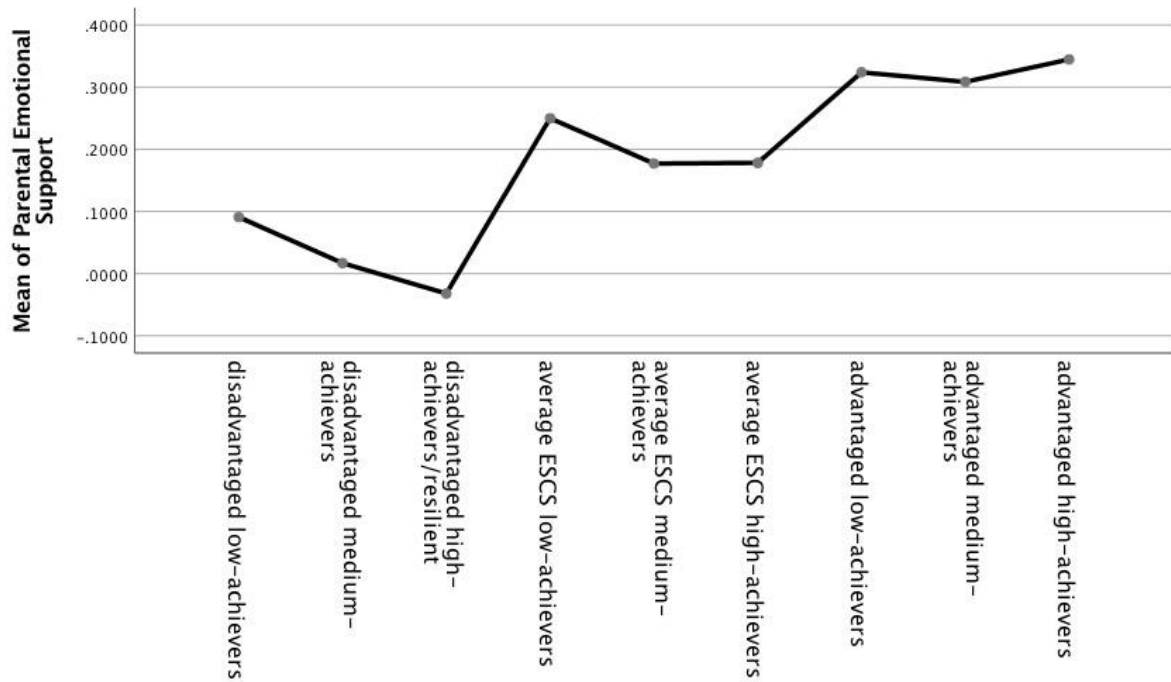
Figure 8 Results of Group Comparison: Parental Emotional Support

All mean differences concerning the parental emotional support are statistically significant except for the group of disadvantaged medium-achievers ($p = 0.437$) when compared with academically resilient students. Surprisingly, academically resilient students report the lowest level of parental emotional support of all groups, that is, in fact, also lower than OECD-average.

Teacher Support
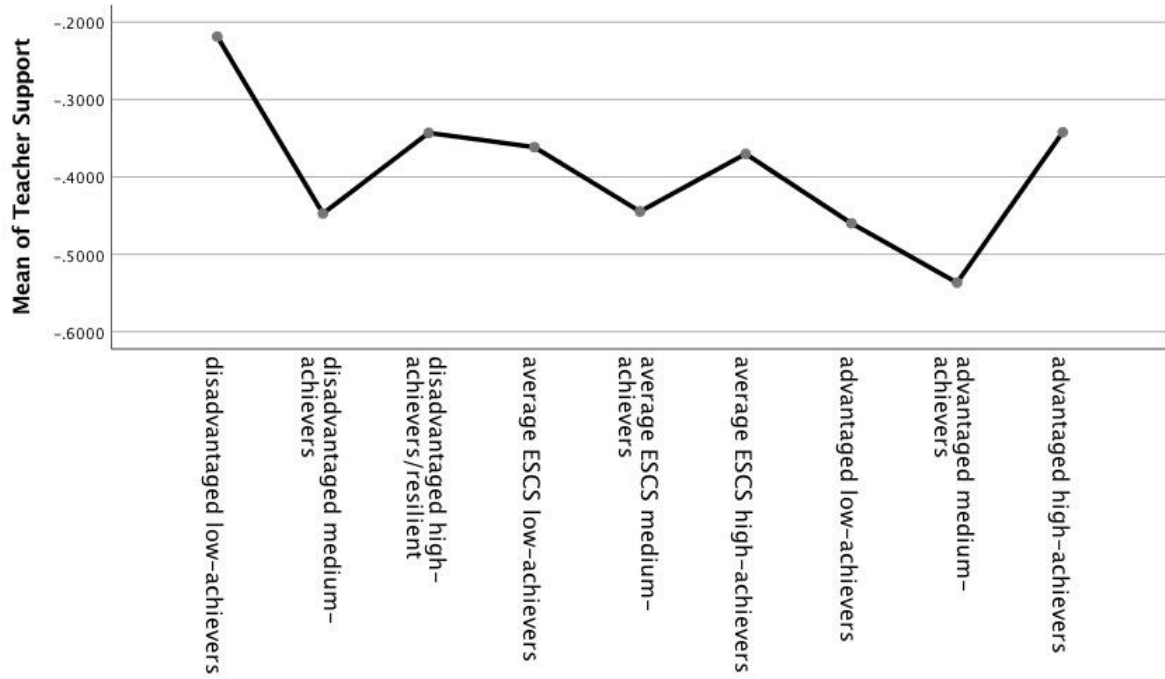
Figure 9 Results of Group Comparison: Teacher Support

Looking at the mean differences of teacher support, the only significant difference of academically resilient students is with their advantaged medium-achieving peers (p = 0.008). All other differences are non-significant when comparing with academically resilient students.

Disciplinary Climate
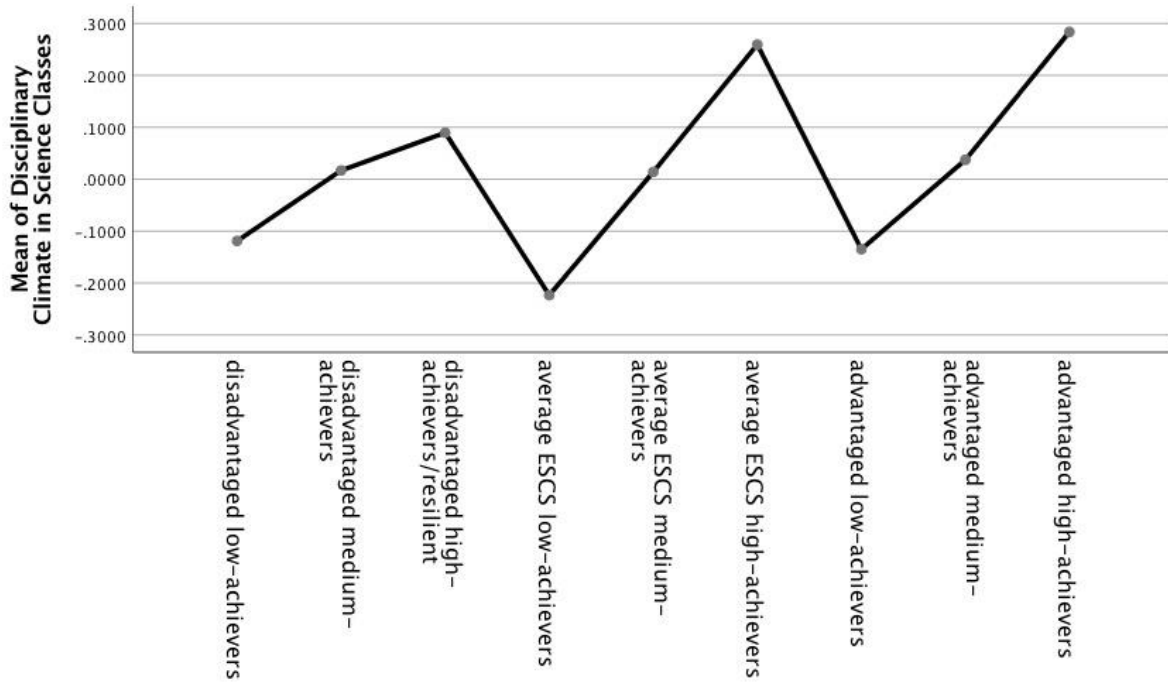
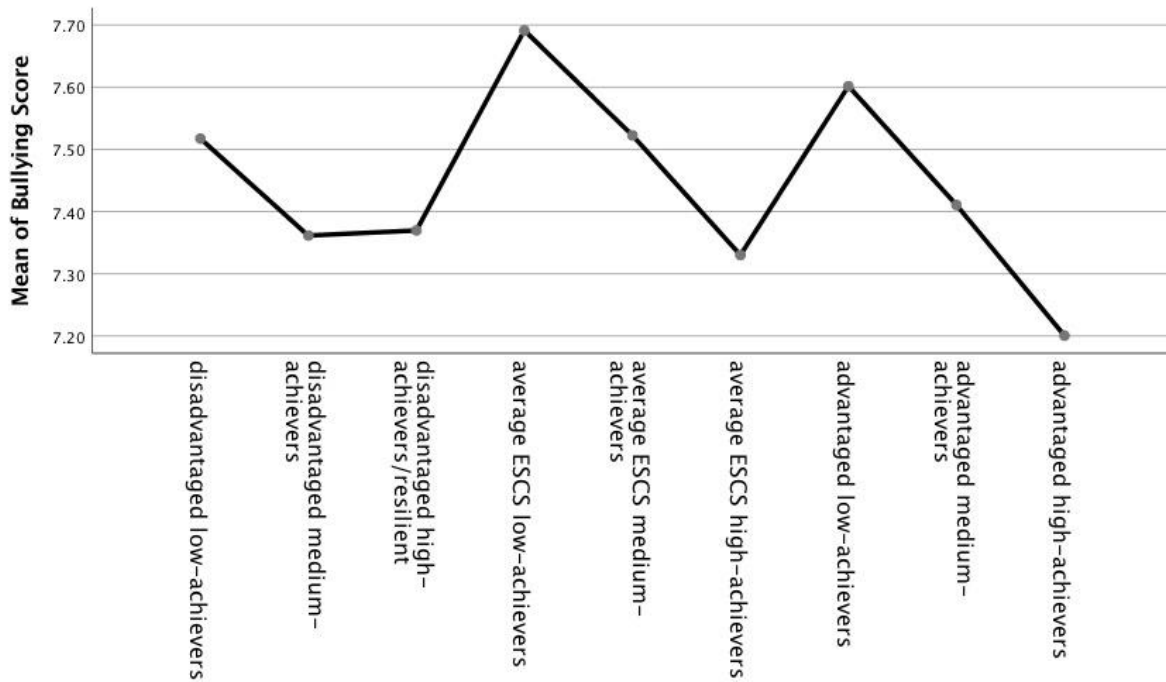*Figure 10 Results of Group Comparison: Disciplinary Climate in Science Classes*

The Post-Hoc test for mean differences of the disciplinary climate in science classes shows multiple significant between group-differences: All groups with low-achievers report a significantly lower disciplinary climate in science classes (disadvantaged low achievers $p = 0.001$, average ESCS low-achievers $p = 0.000$, advantaged low-achievers $p = 0.005$) while the other two groups of high-achieving students report a significantly higher disciplinary climate (average ESCS high-achievers $p = 0.009$, advantaged high-achievers $p = 0.001$).

Bullying

Figure 11 Results of Group Comparison: Bullying

Unlike the previous variables, the scores of the following three variables/scores (Bully, UnfairT and PHYAC) do not display an overall OECD-comparison. Higher values in the Bullying-Score refer to higher exposure to bullying. A Post-Hoc test reveals that there are no statistically significant group-differences when comparing academically resilient students with others.

Unfair Treatment by Teacher
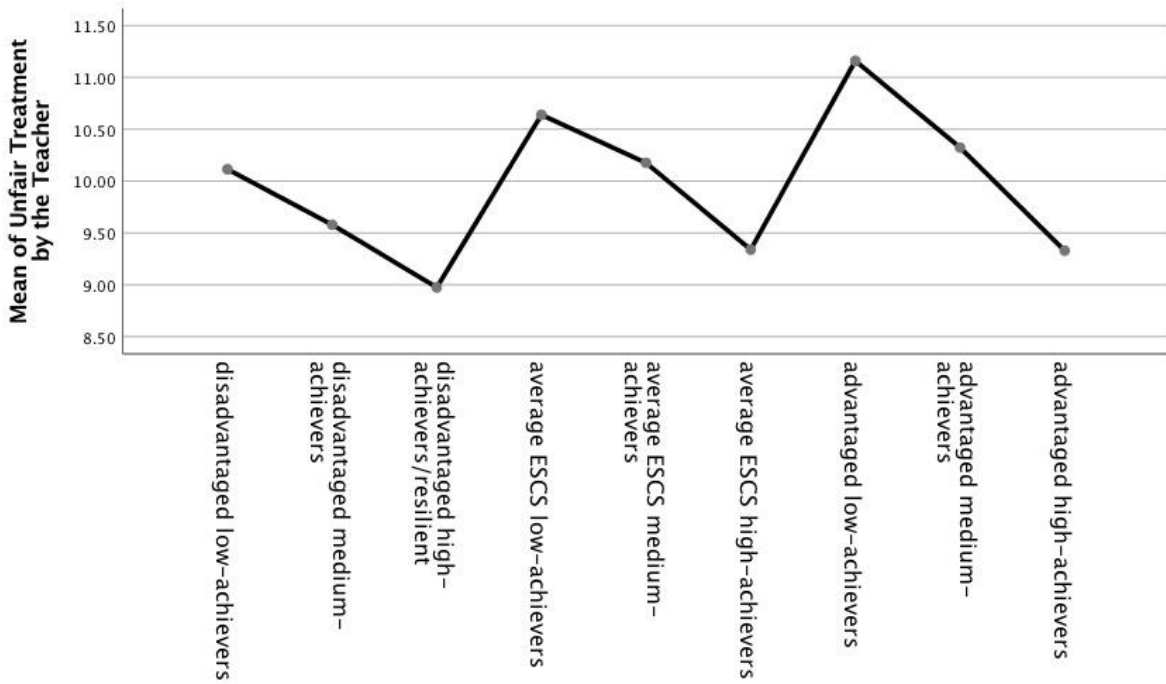
Figure 12 Results of Group Comparison: Unfair Treatment by the Teacher

For the score of perceived unfair treatment by the teacher, high values indicate higher levels of perceived unfair treatment. When comparing academically resilient students with their peers, all other groups except for average ESCS high-achievers ($p = 0.119$) and advantaged high-achievers ($p = 0.104$) show significant differences in means. These results suggest that high-achieving students are less exposed to (perceived) unfair treatment by teachers than their peers. Low-achievers report, overall, the highest perception of unfair treatment.

Physical Activity
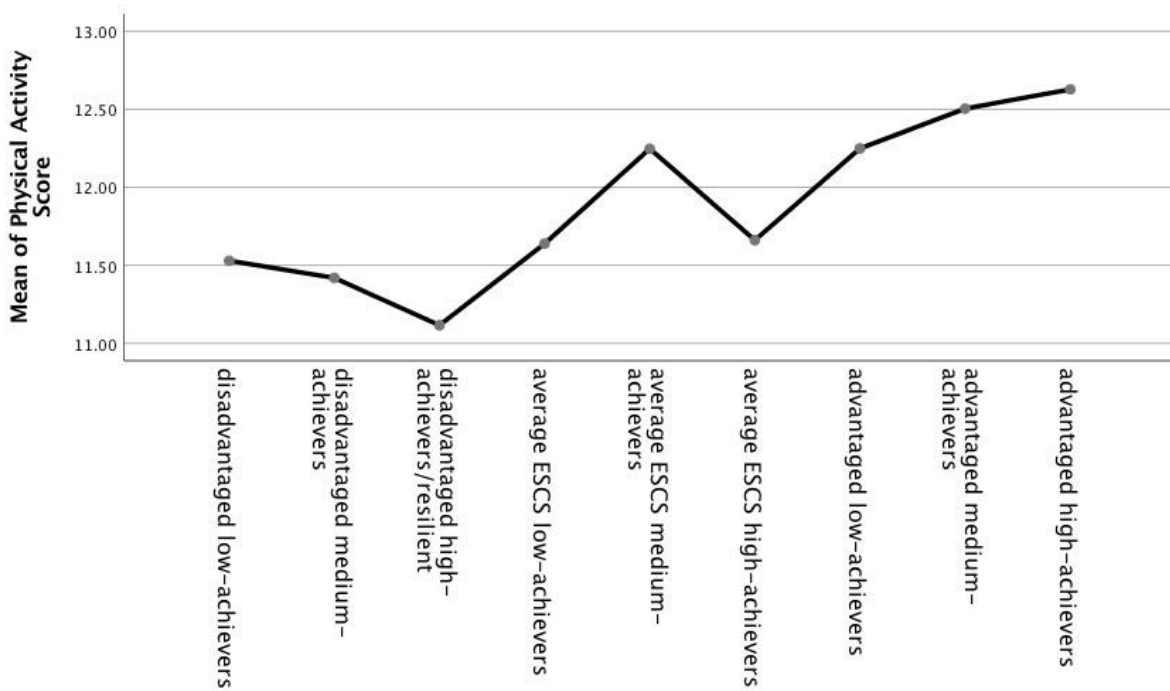
Figure 13 Results of Group Comparison: Physical Activity

As for the two previous scores, this score as well uses high values to indicate high physical activity. Group differences between academically resilient students and disadvantaged low-achievers ($p = 0.108$), disadvantaged medium-achievers ($p = 0.248$) and average ESCS low-achievers ($p = 0.058$) are non-significant while all other group differences are indeed significant.

To sum up, this bivariate analysis of the mean difference in aspects of well-being across subgroups revealed, that there are indeed significant differences. Academically resilient students do not only tend to report higher motivation than their disadvantaged peers but also report the second-lowest levels of test anxiety (after the group of advantaged high-achievers). Nevertheless, their sense of belonging to school, while being similar to other disadvantaged and average ESCS students, is significantly lower than the sense of belonging of advantaged medium- and high-achievers. Additionally, academically resilient student report the lowest levels of parental emotional support whereas the perceived teacher support is comparable to their peers. According to the research results, academically resilient students are also less

45

exposed to unfair treatment by the teacher and, overall, high-achievers from all three background categories report a higher disciplinary climate at school.

These study results leave room for various hypotheses such as to the hypothesis that motivation, low anxiety, and the disciplinary climate have a (mediating) effect on achievement, as high-achievers report higher levels across those aspects. Since bivariate analysis is not conditioned nor able to study effects, the estimation of a path model seems necessary.

6.2 Model Results

In the following, model results of all ten groups are displayed, whereas only significant relationships are shown. The values displayed on the arrows are Complete Standardized Estimates (STDYX), meaning that the estimates are standardized both with the standard deviation of x and standard deviation of y (Muthén & Muthén, 2017). As this study focuses mainly on academically resilient students, a comparison in writing of all student groups would exceed the frame of this study. Nevertheless, all direct and indirect effects on student achievement will be displayed, providing the reader with the possibility to deepen the comparison independently[7]. A short description of results and an additional comparison of high-achievers (Groups 5 & 8) and disadvantaged students (Groups 3 & 4) with their academically resilient classmates (Group 2) will be provided in the description below every graphic.

[7] Direct and indirect effects that do not include the variable PV1SCIE and are from groups that are not in the main focus of this study (Group 1, 6, 7, 9, 10) are not focused on in this report as they exceed the overall frame of this study. Additional model results are available upon request.
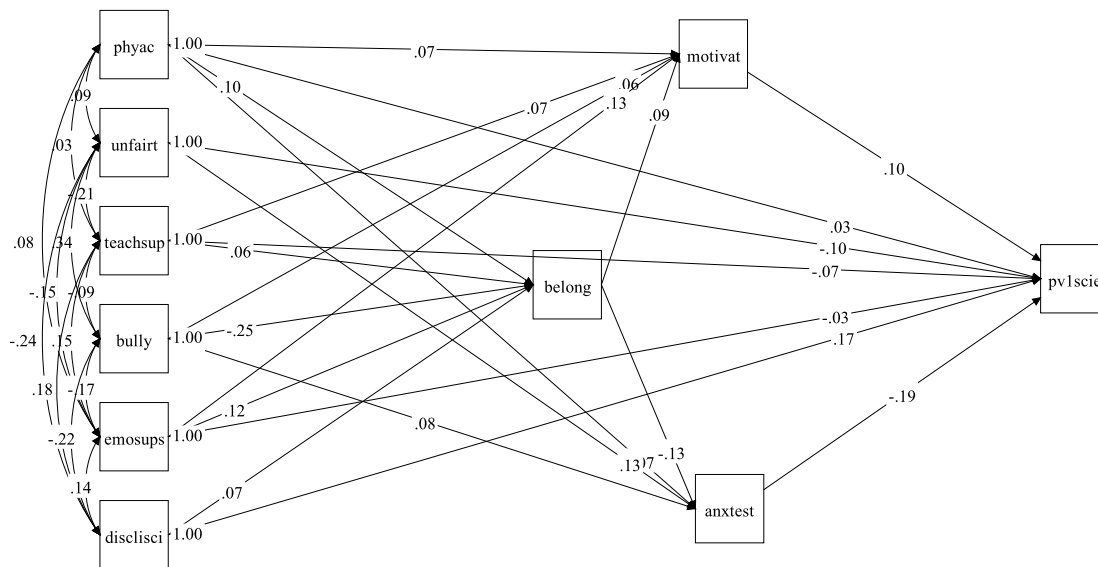
Group 1: All Students

Figure 14 Model Results: Group 1

The model results of the model including all students of the German dataset illustrated above show that almost all relations between the tested variables are, in fact, significant. All significant direct and indirect effects on achievement are displayed below. The cutoff value used for significance is 0.05 whereas all p-values above this point are declared non-significant. The model shows the direct effect one variable has on the other. Significant indirect effects can only be assumed when looking at the graphic and are, therefore, also described below.

Significant Direct Effects on Achievement

ANXTEST on PV1SCIE -.19, p = 0.000

DISCLSCI on PV1SCIE .17, p = 0.000

EMOSUPS on PV1SCIE -.03, p = 0.029

MOTIVAT on PV1SCIE .10, p = 0.000

PHYAC on PV1SCIE .03, p = 0.039

TEACHSUP on PV1SCIE -.07, p = 0.000

UNFAIRT on PV1SCIE -.10, p = 0.000

Significant Indirect Effects on Achievement

BULLY through ANXTEST on PV1SCIE -.016, p = 0.000

BULLY through MOTIVAT on PV1SCIE .006, p = 0.003

BULLY through BELONG through MOTIVAT on PV1SCIE -.002, p = 0.000

BULLY through BELONG through ANXTEST on PV1SCIE -.006, p = 0.000

DISCLISCI through BELONG through MOTIVAT on PV1SCIE .001, p = 0.002

DISCLISCI through BELONG through ANXTEST on PV1SCIE .002, p = 0.000

EMOSUPS though MOTIVAT on PV1SCIE .013, p = 0.000

EMOSUPS through BELONG through MOTIVAT on PV1SCIE .001, p = 0.000

EMOSUPS through BELONG through ANXTEST on PV1SCIE .003, p = 0.000

PHYAC through MOTIVAT on PV1SCIE .007, p = 0.000

PHYAC through ANXTEST on PV1SCIE .014, p = 0.000

PHYAC through BELONG through MOTIVAT on PV1SCIE .001, p = 0.000

PHYAC through BELONG through ANXTEST on PV1SCIE .002, p = 0.000

TEACHSUPS through MOTIVAT on PV1SCIE .007, p = 0.000

TEACHSUPS through BELONG through MOTIVAT on PV1SCIE .001, p = 0.004

TEACHSUPS through BELONG through ANXTEST on PV1SCIE .001, p = 0.001

UNFAIRT through ANXTEST on PV1SCIE -.024, p = 0.000

The indirect effects found for this model are rather small. However, the presented indirect effects are all statistically significant and substantively meaningful. Unlike the theoretical model, there is no significant direct nor mediating effect of a student's sense of belonging to school on achievement as well as no effect of the perceived teachers' unfairness on the students' sense of belonging. Additional, both the support by teachers as well as the parental emotional support show a significant negative effect on achievement. This could be explained by the view that high-achieving students may require less support by teachers and parents in general.

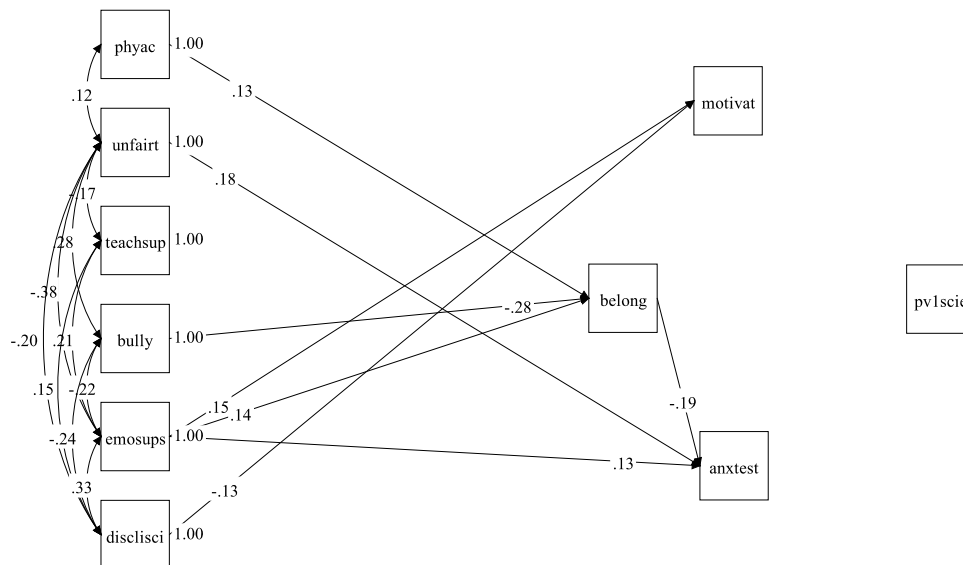**Group 2: Academically Resilient Students/ Disadvantaged High-Achievers**

Figure 15 Model Results: Group 2

When only looking at the model of academically resilient students, it becomes apparent that there are, overall, fewer significant relationships between variables and there is no significant relationship of any variable with achievement. Thus, no aspects of well-being shows any significant effect on academically resilient students in this study and the high achievement of academically resilient students cannot be predicted by the model. Consequently, no mediating effect of a student's sense of belonging or psychological aspects of well-being (motivation and test anxiety) can be found.

Nevertheless, the physical activity of a student (PHYAC) and the perceived parental emotional support (EMOSUPS) show a positive effect on the sense of belonging (BELONG) to school (.13, p = 0.015 & .14, p = 0.006), while bullying (BULLY) shows a negative effect on the students sense of belonging to school (-.28, p = 0.000). Additionally, both the parental emotional support and the disciplinary climate (DISLISCI) show an effect on student motivation (MOTIVAT), where parental emotional support shows a positive effect on students' motivation (.15, p = 0.013) and the disciplinary climate, contrary to expectation, a negative effect on motivation (-.13, p = 0.022). Perceived unfair treatment by teachers (UNFAIRT) as

well as parental emotional support has, according to the model, an impact on test anxiety (ANXTEST; .18, p = 0.011 & .13, p = 0.029) whereas the "positive" effect of parental emotional support is contradicting the theoretical model as it indicated that parental emotional support has a strengthening effect on anxiety. The opposite was hypothesized. The students' sense of belonging to school, on the other hand, has a "negative effect" on anxiety, meaning that it can contribute to lower anxiety (-.19, p = 0.001).

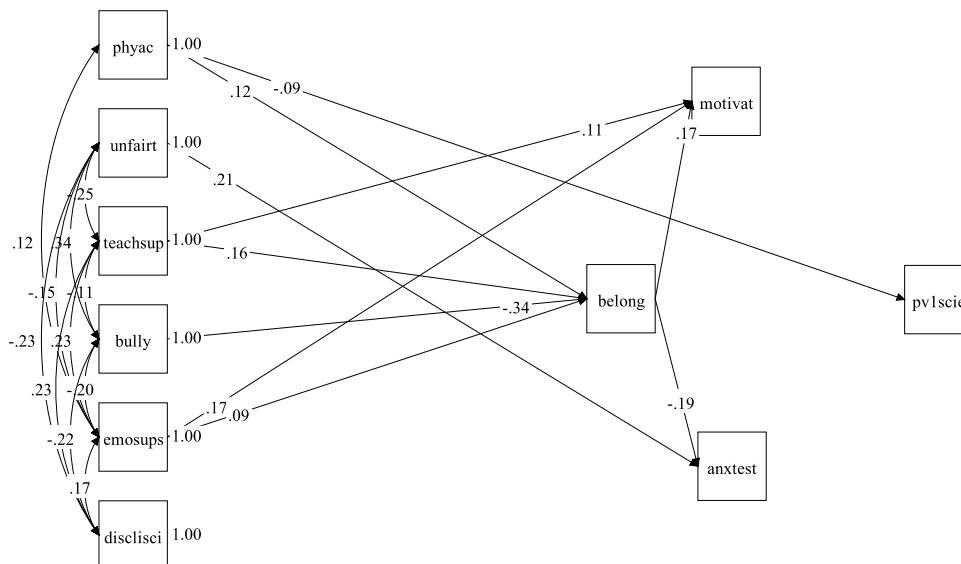## Group 3: Disadvantaged Medium-Achievers

Figure 16 Model Results: Group 3

As it can be seen in the model above, in the group of disadvantaged average-achievers only one variable displays a significant, negative effect on achievement and there are no significant indirect effects on achievement.

Direct Effects on Achievement

PHYAC: -.09, p = 0.042

Similar to the model of academically resilient students, BULLY shows a significant negative effect on BELONG (-.34, p = 0.000), while EMOSUPS and PHYAC both display a positive effect on BELONG (.09, p = 0.02 & .12, p = 0.004). Additionally, as in the previous model, this model also shows a significant positive effect of UNFAIRT on ANXTEST (.21, p = 0.000), as well as a negative effect of BELONG on ANXTEST (-.19, p = 0.000).

Two effects have previously not been significant in the model of academically resilient students but are significant for this model. TEACHSUP shows a positive effect on BELONG (.16, p = 0.001) and there is a positive effect of BELONG on MOTIVAT (.17, p = 0.000).
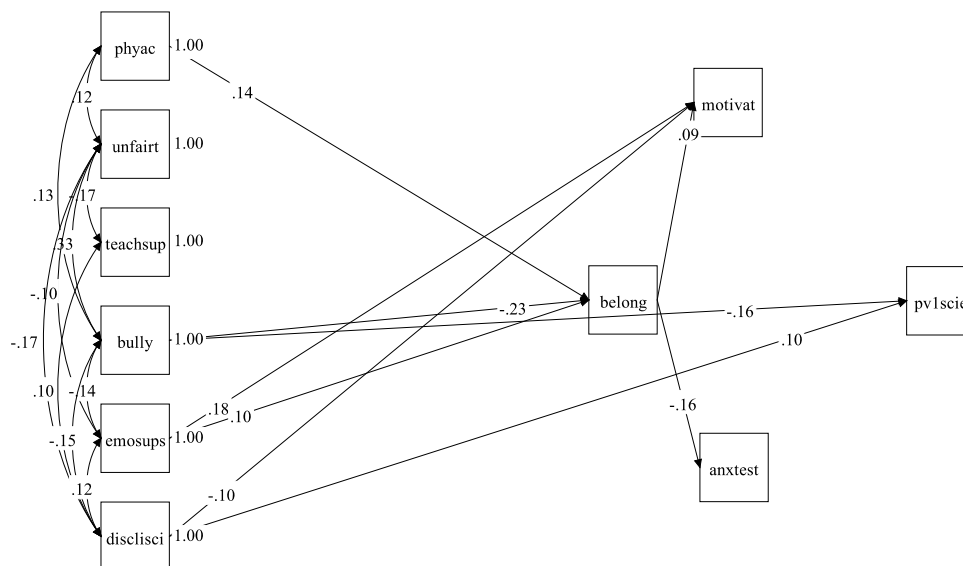
Group 4: Disadvantaged Low-Achievers

Figure 17 Model Results: Group 4

The third group of disadvantaged students, the disadvantaged low-achievers, show a similar pattern but have, unlike academically resilient students, two variables that have a direct effect on students' achievement. Again, no significant indirect effects on achievement are reported.

Direct Effects on Achievement

BULLY: -.16, p = 0.001

DISCLISCI: .10, p = 0.013

Similarities to the model results of academically resilient students can be detected again, as PHYAC, BULLY and EMOSUPS all have an effect on BELONG (.14, p = 0.001 & -.23, p = 0.000 & .10, p = 0.004). Additionally, EMOSUPS and DISCLISCI again show a significant effect on MOTIVAT (.18, p = 0.000 & -.10, p = 0.018) and BELONG a negative effect on ANXTEST (-.16, p = 0.000).

Unlike the model of academically resilient students, this model does not show any significant effect of UNFAIRT on ANXTEST (0.08, p = 0.1 > 0.05, therefore non-significant) but shows a significant effect of BELONG on MOTIVAT (.09, p = 0.022) that was not detected in Model 2.

Group 5: Medium ESCS High-Achievers

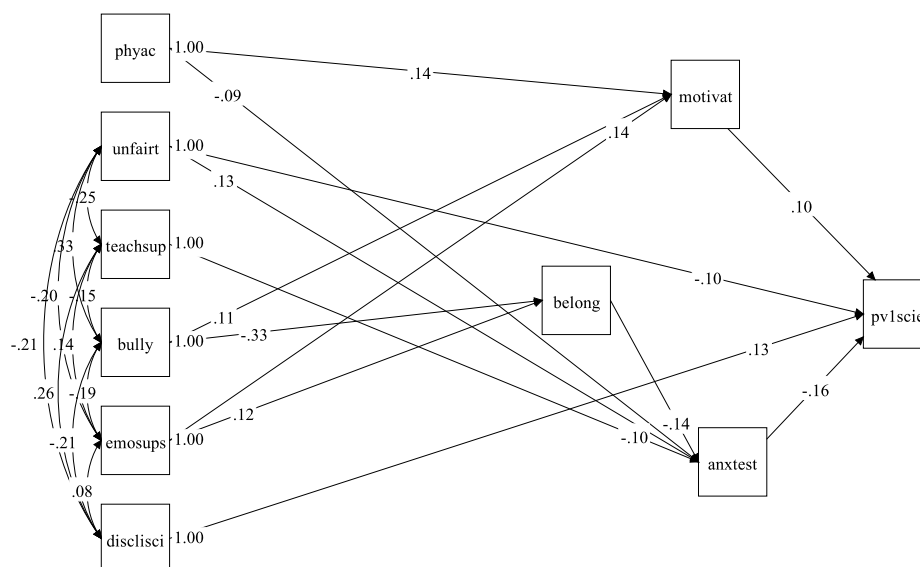*Figure 18 Model Results: Group 5*

The model with students with an average socio-economic background and high achievement detects multiple direct as well as indirect effects on students achievement. At this point, it is important to note that not all indirect effects that can be seen in the graphic above are in fact significant. Therefore, please pay attention to the estimates and p-values displayed below.

Direct Effects on Achievement

UNFAIRT: -.10, p = 0.007

DISCLISCI: .13, p = 0.001

MOTIVAT: .10, p = 0.014

ANXTEST: -.16, p = 0.000

Indirect Effects

TEACHSUP through ANXTEST on PV1SCIE: .016, p = 0.042

EMOSUPS through MOTIVAT on PV1SCIE: .013, p = 0.044

EMOSUPS through BELONG through ANXTEST on PV1SCIE: .003, p = 0.044

PHYAC through MOTIVAT on PV1SCIE: .014, p = 0.043

PHYAC through ANXTEST on PV1SCIE: .015, p = 0.028

BULLY through BELONG through ANXTEST on PV1SCIE: -.007, p = 0.017

UNFAIRT through ANXTEST on PV1SCIE: -.021 p = 0.022

<u>**Non-Significant Indirect Effects**</u>

BULLY through MOTIVAT on PV1SCIE: .011 p = 0.098 > 0.05

Similarities to academically resilient students can be seen in the effect of BULLY and EMOSUPS on BELONG (-.33, p = 0.000 & .12, p = 0.002), the positive effect of EMOSUPS on MOTIVAT (.14, p = 0.000), the effect of UNFAIRT on ANXTEST (13, p = 0.005) as well as the effect of BELONG on ANXTEST (-.14, p = 0.002).

Group 6: Medium ESCS Medium-Achievers
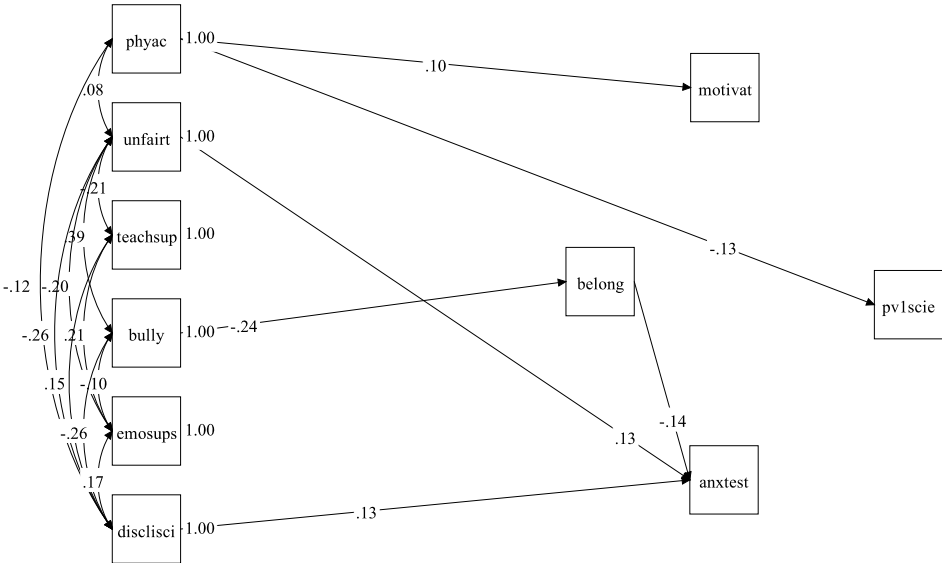
Figure 19 Model Results: Group 6

The model of students with an average socio-economic background and medium achievement displayed above shows only one significant effect on achievement.

Direct Effects on Achievement

PHYAC: -.13, p = 0.002

Group 7: Medium ESCS Low-Achievers
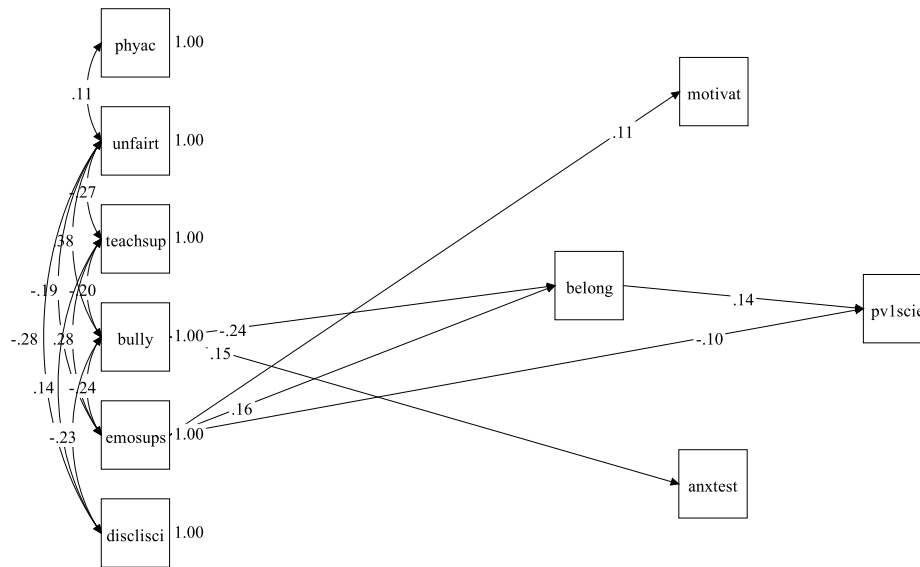
Figure 20 Model Results: Group 7

The model of students with an average socio-economic background and low achievement shows few effects between variables overall but both direct and indirect effects on achievement.

Direct Effects on Achievement

EMOSUPS: -.10, p = 0.038

BELONG .14, p = 0.002

Indirect Effects

BULLY through BELONG on PV1SCIE: -.034, p = 0.003

EMOSUPS through BELONG on PV1SCIE: .023, p = 0.009

Rather surprisingly, parental emotional support (EMOSUPS) shows a negative effect on achievement (PV1SCIE) but a positive indirect effect on achievement when mediated though the students sense of belonging (BELONG). This could be interpreted as reversed causality, as low-achieving students might need more emotional support by the parents.

Group 8: Advantaged High-Achievers

Figure 21 Model Results: Group 8

The model of students with an advantaged socio-economic background and high achievement show various direct and indirect on achievement.

Direct Effects on Achievement

ANXTEST on PV1SCIE -.16, p = 0.000

MOTIVAT on PV1SCIE .10, p = 0.002

Indirect Effects on Achievement

PHYAC through MOTIVAT on PV1SCIE .011, p = 0.029

PHYAC through ANXTEST on PV1SCIE .017, p = 0.003

PHYAC through BELONG through ANXTEST on PV1SCIE .002, p = 0.030

UNFAIRT through ANXTEST on PV1SCIE -.020, p = 0.004

TEACHSUP through MOTIVAT on PV1SCIE .009, p = 0.050

BULLY through BELONG through MOTIVAT on PV1SCIE -.002, p = 0.048

BULLY through BELONG through ANXTEST on PV1SCIE -.005, p = 0.008

EMOSUPS through MOTIVAT on PV1SCIE .01, p = 0.040

EMOSUPS through BELONG through ANXTEST on PV1SCIE .002, p = 0.016

<u>Non-Significant Indirect Effects</u>

EMOSUPS through BELONG through MOTIVAT on PV1SCIE .001, p = 0.071 > 0.05

PHYAC through BELONG through MOTIVAT on PV1SCIE .001, p = 0.075 > 0.05

DISCLISCI through BELONG through MOTIVAT on PV1SCIE .001, p = 0.120 > 0.05

DISCLISCI through BELONG through ANXTEST on PV1SCIE .002, p = 0.055 > 0.05

<u>Other Significant Effects</u>

PHYAC on MOTIVAT .11, p = 0.001

TEACHSUP on MOTIVAT .09, p = 0.012

EMOSUPS on MOTIVAT .10, p = 0.005

BELONG on MOTIVAT .10, p = 0.006

PHYAC on BELONG .11, p = 0.001

BULLY on BELONG -.23, p = 0.000

EMOSUPS on BELONG .12, p = 0.000

DISCLSCI on BELONG .09, p = 0.010

PHYAC on ANXTEST -.11, p = 0.000

UNFAIRT on ANXTEST .13, p = 0.000

BELONG on ANXTEST -.13, p = 0.000

Similar to the group of academically resilient students, the model of advantaged high-achievers does as well report significant effects of physical activity, parental emotional support and bullying on student's sense of belonging. A significant effect of teacher's unfairness, parental emotional support as well as students' sense of belonging on test anxiety can be found both for

disadvantaged and advantaged high-achievers. Parental emotional support is the only variable that reports a significant effect on motivation in both models.

Group 9: Advantaged Medium-Achievers

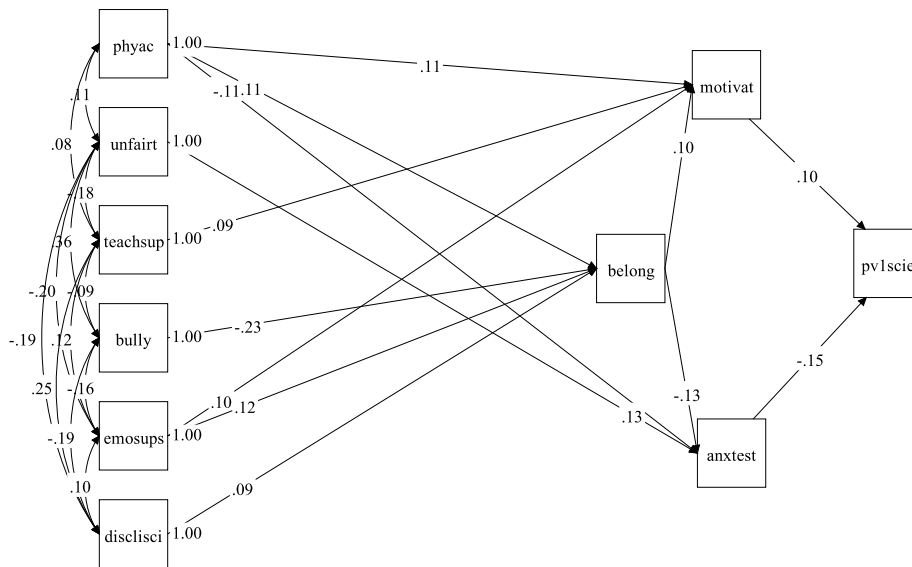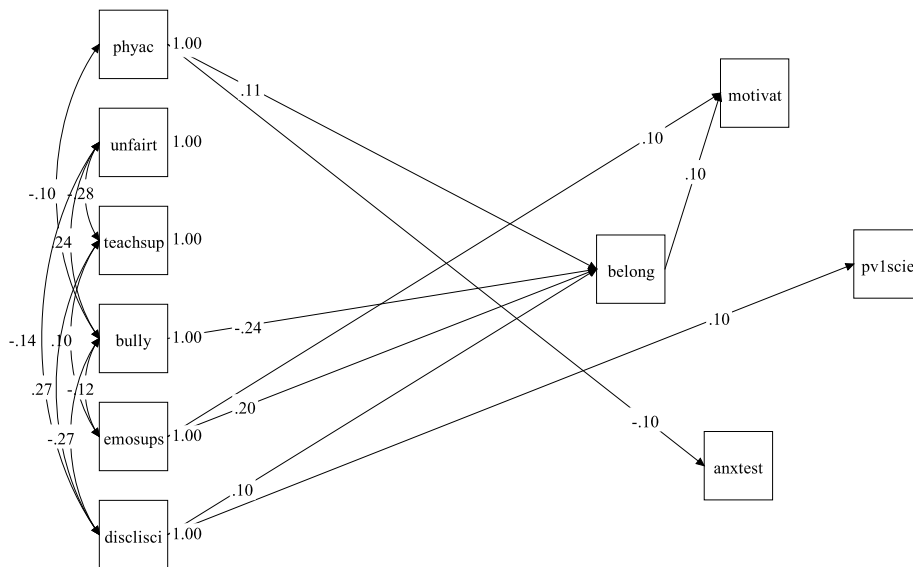*Figure 22 Model Results: Group 9*

The model of students with an advantaged socio-economic background and medium achievement shows only one variable with a significant direct effect on achievement and no significant indirect effects on achievement.

Direct Effect on Achievement

DISCLISCI 0.1, p = 0.042

Group 10: Advantaged Low-Achievers
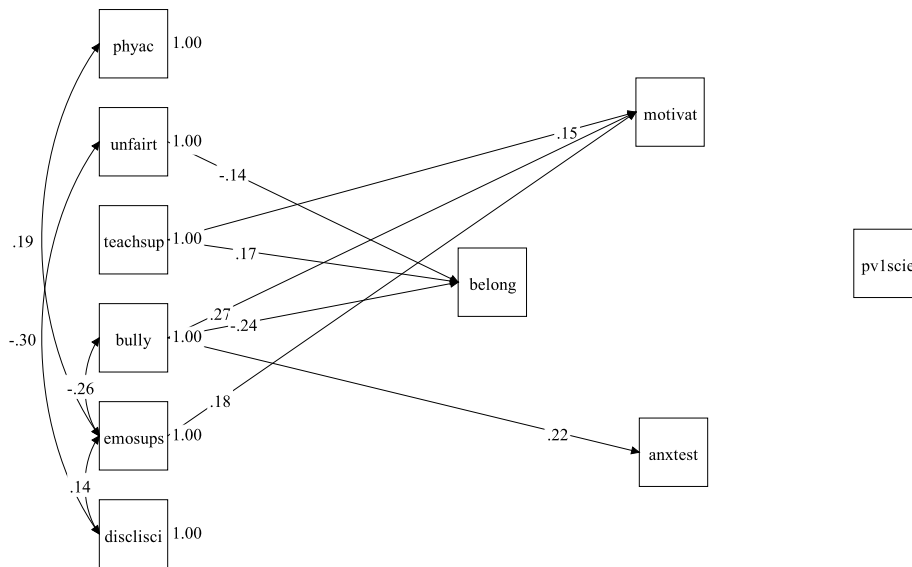
Figure 23 Model Results: Group 10

The group of advantaged low-achievers shows neither direct nor indirect significant effects on achievement.

6.3 Summary of Model Results

To sum up, the following table shows all significant indirect and direct effects of aspects of well-being on achievement.

Table 12 Summary of all significant direct and indirect effects on achievement

Group	Direct effects on achievement	Indirect effects on achievement
Group 1: all students	ANXTEST -.19, p = 0.000 DISCLSCI .17, p = 0.000 EMOSUPS -.03, p = 0.029 MOTIVAT .10, p = 0.000 PHYAC .03, p = 0.039 TEACHSUP -.07, p = 0.000 UNFAIRT -.10, p = 0.000	BULLY through ANXTEST -.016, p = 0.000 BULLY through MOTIVAT .006, p = 0.003 BULLY thr. BELONG thr. MOTIVAT -.002, p = 0.000[8] BULLY thr. BELONG thr. ANXTEST -.006, p = 0.000 DISCLISCI thr. BELONG thr. MOTIVAT .001, p = 0.002 DISCLISCI thr. BELONG thr. ANXTEST .002, p = 0.000 EMOSUPS though MOTIVAT .013, p = 0.000 EMOSUPS thr. BELONG thr. MOTIVAT .001, p = 0.000

[8] For easier readability, *thr.* is used as an abbreviation for *through*.

		EMOSUPS thr. BELONG thr. ANXTEST .003, p = 0.000 PHYAC through MOTIVAT.007, p = 0.000 PHYAC through ANXTEST.014, p = 0.000 PHYAC thr. BELONG thr. MOTIVAT .001, p = 0.000 PHYAC thr. BELONG thr. ANXTEST .002, p = 0.000 TEACHSUPS through MOTIVAT .007, p = 0.000 TEACHSUPS thr. BELONG thr. MOTIVAT .001, p = 0.004 TEACHSUPS thr. BELONG thr. ANXTEST .001, p = 0.001 UNFAIRT through ANXTEST -.024, p = 0.000
Group 2: Academically Resilient Students	No significant direct effects	No significant indirect effects
Group 3: Disadvantaged Medium-Achievers	PHYAC -.09, p = 0.042	No significant indirect effects
Group 4: Disadvantaged Low-Achievers	BULLY -.16, p = 0.001 DISCLISCI .10, p = 0.013	No significant indirect effects
Group 5: Medium ESCS High-Achievers	ANXTEST -.16, p = 0.000 DISCLISCI .13, p = 0.001 MOTIVAT .10, p = 0.014 UNFAIRT -.10, p = 0.007	BULLY thr. BELONG thr. ANXTEST -.007, p = 0.017 EMOSUPS through MOTIVAT .013, p = 0.044 EMOSUPS thr. BELONG thr. ANXTEST .003, p = 0.044 PHYAC through ANXTEST .015, p = 0.028 PHYAC through MOTIVAT .014, p = 0.043 TEACHSUP through ANXTEST .016, p = 0.042 UNFAIRT through ANXTEST -.021 p = 0.022
Group 6: Medium ESCS Medium-Achievers	PHYAC -.13, p = 0.002	No significant indirect effects
Group 7: Medium ESCS Low-Achievers	BELONG .14, p = 0.002 EMOSUPS -.10, p = 0.038	BULLY through BELONG -.034, p = 0.003 EMOSUPS through BELONG .023, p = 0.009
Group 8: Advantaged High-Achievers	ANXTEST -.16, p = 0.000 MOTIVAT .10, p = 0.002	BULLY thr. BELONG thr. ANXTEST -.005, p = 0.008 BULLY thr. BELONG thr. MOTIVAT -.002, p = 0.048 EMOSUPS through MOTIVAT .01, p = 0.040 EMOSUPS thr. BELONG thr. ANXTEST .002, p = 0.016 PHYAC through ANXTEST .017, p = 0.003 PHYAC through MOTIVAT .011, p = 0.029 PHYAC thr. BELONG thr. ANXTEST .002, p = 0.030 TEACHSUP through MOTIVAT .009, p = 0.050 UNFAIRT through ANXTEST -.020, p = 0.004
Group 9: Advantaged Medium-Achievers	DISCLISCI 0.1, p = 0.042	No significant indirect effects
Group 10: Advantaged Low-Achievers	No significant direct effects	No significant indirect effects

It becomes apparent that there are not many significant direct and indirect effects of aspects of well-being on achievement when focusing on the nine subgroups. As the main objective of this study is to analyze academically resilient students, whose group does not show any direct nor indirect effects of well-being on achievement, special attention is now paid to the comparison with other disadvantaged student groups as well as other high-achievers.

Comparison of all models of disadvantaged students

As can be seen in the models of groups 2, 3 and 4, there are a few similarities when comparing students from disadvantaged backgrounds. A significant, negative effect of bullying on students' sense of belonging, as well a positive effect of physical activity and parental emotional support on students' sense of belonging can be detected in all three groups. Additionally, all groups of disadvantaged students report a negative effect of students' sense of belonging on test anxiety, suggesting that the feeling of belonging to school lowers student's test anxiety.

While the model of academically resilient students (Group 2) does not show any significant effect on achievement, the other two groups of disadvantaged students do. Group 3, the disadvantaged medium-achievers, reports a negative effect of physical activity on achievement, while Group 4, the disadvantaged low-achievers, reports that bullying has a negative effect on achievement, while the disciplinary climate at school affects students' achievement positively. None of the three groups displays a significant effect of belonging to school and achievement.

Comparison of all models of high-achievers

The comparison of all models of high-achieving students (Group 2, 5 and 8) shows that the model of academically resilient students reports the least amount of significant effects. Nevertheless, these few effects can mostly be found in the other two models as well. In all three models, bullying has a significant, negative effect on students' sense of belonging while parental emotional support has a significant positive effect on the sense of belonging in all three models. A significant effect of perceived teacher's unfairness, as well as students' sense of belonging on test anxiety, can be found for disadvantaged, advantaged and average ESCS high-

achievers. Parental emotional support is the only variable with a significant effect on motivation in all three models. Similar to the comparison of all disadvantaged students, the comparison of all high-achievers shows, again, no significant effect of students' sense of belonging to school on achievement.

While the models of high-achieving students from an average socio-economic background and advantaged high-achieving students both show multiple direct and indirect effects of different aspects of well-being on achievement (bullying, parental emotional support, physical activity, teacher support as well as the perceived unfair treatment by the teacher), these effects cannot be found for socio-economically disadvantaged high-achievers.

7 Discussion

7.1 Results

Returning to the research questions posed in Chapter 4, the research results will now be shortly displayed and discussed in systematical order.

Q1. How do academically resilient students compare to other student groups concerning their level of well-being?

The results of this study show that there are indeed significant differences in the level of well-being when comparing academically resilient students with other subgroups. For some aspects, a clear pattern can be detected when, for instance, different levels of achievement are being compared across student subgroups from similar socio-economic backgrounds. Study results suggest that high-achievers, including academically resilient students, tend to report higher motivation and lower test anxiety than their lower-achieving peers within the same socio-economic background group (disadvantaged, average ESCS or advantaged). Similar results were achieved for the disciplinary climate and perceived unfairness of the teacher: higher levels of achievement were associated with higher levels of disciplinary climate at school as well as lower levels of perceived unfairness. Academically resilient students often reported higher levels than their disadvantaged lower achieving peers across various aspects of well-being. However, they reported lower levels of well-being than more socio-economically advantaged

high-achievers (see MOTIVAT, ANXTEST, BELONG, DISCLSCI), indicating that there may not only be inequity in achievement but also in student well-being in Germany that needs to be addressed.

This result is crucial as it suggests that socio-economically disadvantaged students face more severe challenges at school than the ones that usually are addressed and therefore, the well-being of disadvantaged students should receive at least equally as much attention as their achievement. The "well-being gap" that this study found needs to be further researched and cannot be ignored. Returning to the definition of health by the World Health Organisation (WHO, 2006) that was stated in the theoretical framework of this study, "the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition" (p.1). The results of this study show, that this fundamental right is currently not being met across all socio-economic classes and that there are, indeed, differences and distinctions of backgrounds.

Nevertheless, the bivariate analysis that was done to answer this question is not conditioned nor able to provide inference nor to study effects. As it rather detects mean differences, no statements about effects or relationships can be made at this point.

Q2. What is the relationship between academic resilience and student's well-being?

The model results do not show any significant direct nor indirect effects of any of the measured aspects of student well-being on academic achievement when it comes to the subgroup of academically resilient students. It could be argued that the crucial factors influencing the high achievement of socio-economically disadvantaged students may not lie at the individual level.

As stated in the theoretical framework of this study (see Chapter 3), Bronfenbrenner's (1979) developmental approach is focusing on the individual child and its interaction with its environment that is structured on different levels. In the present study, different relationships and roles of the student (microsystem), their interrelation (mesosystem) and socio-economic aspects (exosystem) are focused on. Nevertheless, only a few aspects are included in the study and other important factors may be missing. As this study, for instance, does not include the view of the parent, teacher or school, other factors might be crucial when it comes to promoting

both academic resilience and well-being and further research is necessary to find a more satisfactory answer.

It can additionally be debated and hypothesized that the effect might be contrary, meaning that students' academic achievement may have a significant impact on their well-being and not the other way around. Additional research would be useful to test this hypothesis.

Q3. Do an academically resilient student's sense of belonging to school and psychological well-being (anxiety & motivation) have a mediating effect between other aspects of well-being and academic achievement?

As no direct or indirect effects on achievement were detected for the group of academically resilient students, there are no mediating effects. Nevertheless, other aspects of well-being did show an effect on a student's sense of belonging, motivation, and anxiety, which could indicate that there are important structures and relations underlying the well-being of academically resilient students.

Returning to Bronfenbrenner's developmental theory explained in the theoretical framework (Chapter 3), the mesosystem refers to the relationship between microsystems and describes "the interrelations among two or more settings in which the developing person actively participates" (Bronfenbrenner, 1979, p. 25). In the case of this study, this interrelation between micro-systems is to some extent mirrored, as, for instance, parental emotional support has a significant positive effect on a student's sense of belonging to school. Hence, even though no mediating effects on achievement were detected, the relationship among different social settings (i.e. school and family) were displayed nonetheless, indicating that the promotion of one aspect of well-being may have a positive effect on another.

Q4: How do academically resilient students compare to their peers concerning the effect of different aspects of well-being on achievement?

While the model of academically resilient students did not show any significant effect of well-being on achievement, the other two groups of disadvantaged as well as the other two groups

of high-achieving students did. The model of medium-achieving students from disadvantaged backgrounds showed a negative effect of physical activity on achievement (-.09, p = 0.042) while the model of low-achieving students from disadvantaged backgrounds displayed a negative effect of bullying (-.16, p = 0.001) and a positive effect of disciplinary climate (.10, p = 0.013) on achievement. When it comes to the high achievers from an average ESCS-background, both the perceived unfairness of the teacher and test anxiety showed a significant negative effect on achievement (-.10, p = 0.007 & -.16, p = 0.000), as well as a positive effect of the disciplinary climate (.13, p = 0.001) and motivation (.10, p = 0.014) on achievement. The group of advantaged high-achievers displayed a negative effect of test anxiety (-.16, p = 0.000) and a positive effect of motivation (.10, p = 0.002) on achievement.

These results indicate that well-being does affect the achievement of some student groups and therefore, besides the indisputable reasons of supporting students well-being for its own sake, money and time should be invested in the promotion of student well-being as it may also have a positive impact on the academic achievement of a student, which in turn, may affect future vocational possibilities. Additionally, further research is needed in order to find plausible reasons for the group differences that this study found. Why is it that different aspects of well-being do show significant effects on the achievement for some groups, while other groups show no significant effect at all? As mentioned before, other factors may provide crucial information to find an answer to this question.

Nevertheless, it can be argued that sample size differences may have impacted the results. The group of academically resilient students is the smallest with N = 360, whereas the other group sizes range from N = 653 (disadvantaged medium-achievers) to N = 1014 (advantaged high-achievers). As mentioned before, a smaller sample size may have less power to detect significant effects, thus leading to type II errors while larger groups are more prone to type I errors. It becomes apparent that even though this study provides a first overview of the topic, caution must be taken as there are limitations to the study which will further be presented in the following paragraph.

7.2 Limitations

Even though this study was done with the best care and attention, there are some limitations that need to be discussed. First and foremost, this study makes use of secondary data and is therefore limited to the measurement and data that is made available. Well-being is a complex concept and there are many, partly contradicting opinions on how to best measure it. As this study is limited to the definition and measurement of PISA, it can be argued that other important factors are left out or could have been measured to a more sufficient extent (i.e. physical well-being). Additionally, only the first plausible value for science was used in this analysis and thus, does not necessarily reflect upon a student's overall academic achievement. Nonetheless, I believe that PISA 2015, as well as this study, provides a fair overview of the topic. As it is rather questionable if the study indeed covered the whole complexity of well-being, it was made sure to speak of "aspects of well-being" instead of making claims about the overall well-being of a student.

Additionally, there is a variety of definition when it comes to academically resilient students. The term "resilience" itself can be found in some definitions of well-being (see Australian Catholic University and Erebus International, 2008) and might lead to confusion. Thus, it is important to stress again, that academic resilience and resilience itself, is not the same. This study defines academically resilient students as those who achieve high academically despite facing a socio-economic disadvantage. Hence, *Academically resilient students* and *disadvantaged high-achieving students* are terms that can be used interchangeably. There is, of course, a multiplicity of other risk factors in students' lives besides socio-economic challenges (such as being in a foster home) that would justifiably lead to classifying a student as academically resilient if they additionally show exceptionally high achievement. As this issue cannot be addressed in this study, it is important to bear in mind that this study only focuses on socio-economically disadvantaged students with high achievement. Additionally, it cannot be detected whether students classified as having a socio-economic disadvantage personally consider themselves as disadvantaged. To put it into Ricketts et al.'s words "What the researcher perceives as a risk may not be viewed as a risk by the child, and what the researcher perceives as a measure of good academic outcome may not be salient in the worldview of the child" (2017, p.80). These factors unfortunately cannot be incorporated in the analysis as no such questions are provided in the PISA 2015 questionnaire.

Not only the definition of the term but also the statistical measurement of academic resilience differs. It is argued that disadvantaged students that reach proficiency level 3 in PISA are academically resilient, as they are then performing similar to the majority and meet the standard and developmental expectations (Masten et al. 2006, p. 375). This study, in accordance with the OECD (2011), on the other hand, defines students who are in the top third of the achievement distribution in science and bottom third in the German ESCS-distribution as academically resilient and therefore focuses on higher achieving students. This group is beating the odds academically and is achieving very high and thus, can provide crucial information about their great success story.

It was decided upon only focusing on one country - Germany - in this study, because cultural differences could have influenced the understanding, interpretation, and response to questions (modesty vs. heaping). Nevertheless, as the group of academically resilient students is still culturally diverse (15.1% second generation, 2.2% first-generation immigrants), the issue of cultural bias, even though minimized cannot be fully eliminated.

Additionally, as mentioned previously, caution must not only be taken because of the different group sizes that can influence and falsify statistical inference but also because cross-sectional data is de facto not meant to draw a causal inference.

7.3 Ethical Considerations

Along with the limitations of this study come ethical considerations that cannot be forgotten. Even though PISA data was used that is carefully selected and doesn't provide any identifying information, there still are ethical considerations worth mentioning.

The study focused on the well-being of academically resilient students and if and how well-being affects academic achievement. Study results show, for instance, that academically resilient students show higher motivation than their lower-achieving peers. Thus, it could erroneously be argued that low-achievers are "just not motivated enough" and are solely responsible for their low academic success. It is important to underline that this study does not promote any such inference and does not aim at identifying a person, group or system to blame

for achievement differences but rather focuses on the possibilities on how academic resilience can be promoted.

7.4 Future Research

Despite these limitations and ethical consideration, I believe that this study provides a fair first attempt at filling the research gap of the well-being of academically resilient students. Even though it is debatable if inference can be drawn from this study, it does shed light onto social and educational issues and the success story of disadvantaged high-achievers who we can surely learn from. Thus, I propose that future research should focus on this matter.

Germany's population is constantly changing and more students from different countries around the globe are joining the German school system. Therefore, it would be interesting to repeat this study with the PISA 2018 data set which will be made available for the general public in early December 2019. As this study only used cross-sectional data on the individual student level, future research should not only include longitudinal data allowing to draw inference but also teacher and school levels so that a more complete picture is created.

8 Conclusion

The well-being of academically resilient students, also called socio-economically disadvantaged high-achievers, marks a severe gap in research that this study contributes to filling. First, the sample of the German 2015 PISA dataset was divided into nine subgroups with three different levels of achievement and three different levels of socio-economic background to provide the base for an in-depth comparison. The group of academically resilient students was defined as those who fall in the top third of Germany's performance distribution and the bottom third of the country's ESCS-distribution. A multi-dimensional tool, including physical, psychological and social dimensions, was used to measure student well-being.

The secondary data analysis then consisted of the bivariate analysis of means and path analysis within the Structural Equation Modeling (SEM) framework. Research results highlighted that

the subgroup of academically resilient students did report significantly different on various aspects of well-being when compared to their peers. High achievers in this study, including academically resilient students, tended to report higher levels on different aspects of well-being. However, academically resilient students often seem to fall behind more socio-economically advantaged high-achievers when it comes to, for example, their level of motivation, test anxiety, sense of belonging to school, and disciplinary climate at school. This can be seen as an indicator that Germany not only has a problem with equity when it comes to achievement but also student well-being as advantaged students tend to report higher levels of well-being.

In the path analysis that followed the bivariate analysis, the group of academically resilient students, contrary to other subgroups, showed no significant effect of any aspect of well-being on achievement. These results indicate that factors influencing students' achievement may not be in the individual level of student well-being but could include factors on teacher- or school level. Thus, it is being proposed that future research should go beyond the individual student level and extend the analysis.

Additionally, limitations concerning the inference as well as the validity and reliability were discussed, leading to the conclusion that the study results need to be considered with caution and a longitudinal study in the future may provide more meaningful results. However, this study does shed light on an underrepresented topic and it is important to stress that the well-being of students in general, and academically resilient students in particular, should be an important priority, both in research and at the actual educational setting. The crucial results of this study indicate not only a "well-being gap" in Germany but also point at the importance of well-being as an influential factor on achievement for some student groups that needs to be further researched. Thus, this dissertation is ending in a call to all educational researchers to consider devoting their future research to the unfortunately still fairly unexplored topic of the well-being of academically resilient students.

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Appendices

APPENDIX I: SPSS Syntax for grouping

***1. Goal:** Identifying academically resilient students (Top third in the countries distribution of performance/achievement, bottom third in ESCS)
*look at Min, Max and percentiles to create Index variables for ESCS and PV1SCIE

*1.1 ESCS

```
FREQUENCIES VARIABLES=ESCS
  /NTILES=3
  /STATISTICS=VARIANCE MINIMUM MAXIMUM MEAN
  /ORDER=ANALYSIS.
```

*Min: - 4.161
*Max: 3.6877
*33.3333 percentile: - 0.3294
*66.666 percentile: 0.5608

*Group 1: bottom third: min to -0.3294
*Group 2: -0.3295 to 0.5608
*Group 3: 0.5609 to max

```
RECODE ESCS (MISSING=-99) (Lowest thru -0.3294=1) (-0.3295 thru 0.5608=2) (0.5609
thru Highest=3) INTO ESCSidx.
VARIABLE LABELS  ESCSidx 'ESCS index'.
EXECUTE.
```

*1.2 Performance (Plausible Value 1 in Science as this was central target at PISA 2015)

```
FREQUENCIES VARIABLES=PV1SCIE
  /NTILES=3
  /STATISTICS=VARIANCE MINIMUM MAXIMUM MEAN
  /ORDER=ANALYSIS.
```

*Min: 175.599
*Max: 814.68
*33,3333 percentile: 469.75667
*66,666 percentile: 559.87933

*Group 1: bottom third: min to 469.75667
*Group 2: 469.75667 to 559.87933

*Group 3: 559.87933 to max

RECODE PV1SCIE (MISSING=-99) (Lowest thru 469.75667=1) (469.75668 thru 559.87933=2) (559.87934 thru Highest=3) INTO SCidx.
VARIABLE LABELS SCidx 'Science Plausible Value 1 Index'.
EXECUTE.

*2 Grouping
*calculating with only ESCS =1 = bottom third of the distribution
*SCidx Score 1 therefore means disadvantaged low achiever, 2 = disadvantaged "middle" achiever, 3 = disadvantaged high achiever = resilient student
*all others as missing data = -99

*2.1 Disadvantaged Students
IF (ESCSidx=1) DisAch=SCidx.
EXECUTE.

RECODE DisAch (MISSING=-99).
EXECUTE.

*2.2 Advantaged Students
*Advantaged Students, number 1 indicating advantaged low achievers, 2 = adv. middle 3= adv. high achievers

IF (ESCSidx=3) AdvAch=SCidx.
EXECUTE.

RECODE AdvAch (Missing = -99).
EXECUTE.

***2.3 Average ESCS Students**
*"middle class"/ average third in the ESCS distribution , number 1 indicating average ESCS and low achievement, 2 = average ESCS and average achievement, 3 = average ESCS and high achievement

IF (ESCSidx=2) AvgAch=Scidx.
EXECUTE.

RECODE AvgAch (Missing = -99).
EXECUTE.

APPENDIX II: Mplus Syntax

Model 1: All Students

TITLE: 2004 all students updated model 5.0
 DATA: FILE IS 1704 working file Mplus.dat;
  VARIABLE: NAMES ARE   CNTSTUID DisAch AdvAch AvgAch gender LANGN
PV1SCIE PV1READ PV1MATH COOPERATE CPSVALUE LifeSat MOTIVAT ANXTEST
PhyAc BELONG unfairT TEACHSUP BULLY EMOSUPS DISCLISCI;

    MISSING IS all (-99);
    USEVARIABLES = PV1SCIE MOTIVAT ANXTEST PhyAc
    BELONG unfairT TEACHSUP BULLY EMOSUPS DISCLISCI;
    CLUSTER=CNTSTUID;

 ANALYSIS: type = complex;
   ESTIMATOR=MLR;

  MODEL:

 PV1SCIE ON MOTIVAT ANXTEST PhyAc BELONG unfairT TEACHSUP BULLY
 EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT BELONG ON unfairT
 Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT ON BELONG;

 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI WITH
 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

  OUTPUT: stdyx SAMPSTAT ;

MODEL INDIRECT:
PV1SCIE IND TeachSup;
PV1SCIE IND EmoSups;
PV1SCIE IND Disclisci;
PV1SCIE IND PhyAc;
PV1SCIE IND Bully;
PV1SCIE IND unfairT;

Model 2: Disadvantaged Students

TITLE: 2004 Disadvantaged updated model
 DATA: FILE IS 1704 working file Mplus.dat;
  VARIABLE: NAMES ARE   CNTSTUID DisAch AdvAch AvgAch gender LANGN
PV1SCIE PV1READ PV1MATH COOPERATE CPSVALUE LifeSat MOTIVAT ANXTEST
PhyAc BELONG unfairT TEACHSUP BULLY EMOSUPS DISCLISCI;

> **MISSING** IS all (-99);
> **GROUPING IS** DisAch (1=LOW 2=MIDDLE 3= HIGH);
> **USEVARIABLES** = PV1SCIE MOTIVAT ANXTEST PhyAc
> BELONG unfairT TEACHSUP BULLY EMOSUPS DISCLISCI;
> **CLUSTER**=CNTSTUID;

 ANALYSIS: type = complex;
        ESTIMATOR=MLR;

 MODEL:

 PV1SCIE ON MOTIVAT ANXTEST PhyAc BELONG unfairT TEACHSUP BULLY
 EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT BELONG ON unfairT
 Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT ON BELONG;

 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI WITH
 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

 OUTPUT: stdyx SAMPSTAT MODINDICES ;

MODEL INDIRECT:

PV1SCIE IND TeachSup;
PV1SCIE IND EmoSups;
PV1SCIE IND Disclisci;
PV1SCIE IND PhyAc;
PV1SCIE IND Bully;
PV1SCIE IND unfairT;

Model 3: Average ESCS

TITLE: 2004 Average updated model 5.0

 DATA: FILE IS 1704 working file Mplus.dat;

  VARIABLE: NAMES ARE CNTSTUID DisAch AdvAch AvgAch gender LANGN PV1SCIE PV1READ PV1MATH COOPERATE CPSVALUE LifeSat MOTIVAT ANXTEST PhyAc BELONG unfairT TEACHSUP BULLY EMOSUPS DISCLISCI;

        MISSING IS all (-99);

        GROUPING IS AvgAch (1=LOW 2=MIDDLE 3= HIGH);

        USEVARIABLES = PV1SCIE MOTIVAT ANXTEST PhyAc

        BELONG unfairT TEACHSUP BULLY EMOSUPS DISCLISCI;

        CLUSTER=CNTSTUID;

 ANALYSIS: type = complex;

        ESTIMATOR=MLR;

  MODEL:

 PV1SCIE ON MOTIVAT ANXTEST PhyAc BELONG unfairT TEACHSUP BULLY

 EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT BELONG ON unfairT

 Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT ON BELONG;

 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI WITH

 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

  OUTPUT: stdyx SAMPSTAT ;

MODEL INDIRECT:

PV1SCIE IND TeachSup;

PV1SCIE IND EmoSups;

PV1SCIE IND Disclisci;

PV1SCIE IND PhyAc;

PV1SCIE IND Bully;

PV1SCIE IND unfairT;

Model 4: Advantaged Students

TITLE: 2004 Advantaged updated model 5.0
 DATA: FILE IS 1704 working file Mplus.dat;
 VARIABLE: NAMES ARE CNTSTUID DisAch AdvAch AvgAch gender
 LANGN PV1SCIE PV1READ PV1MATH COOPERATE CPSVALUE LifeSat
 MOTIVAT ANXTEST PhyAc BELONG unfairT TEACHSUP BULLY EMOSUPS
DISCLISCI;

MISSING IS all (-99);
GROUPING IS AdvAch (1=LOW 2=MIDDLE 3= HIGH);
USEVARIABLES = PV1SCIE MOTIVAT ANXTEST PhyAc
BELONG unfairT TEACHSUP BULLY EMOSUPS DISCLISCI;
CLUSTER=CNTSTUID;

 ANALYSIS: type = complex;
        ESTIMATOR=MLR;

 MODEL:

 PV1SCIE ON MOTIVAT ANXTEST PhyAc BELONG unfairT TEACHSUP BULLY
 EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT BELONG ON unfairT
 Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

 ANXTEST MOTIVAT ON BELONG;

 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI WITH
 unfairT Bully PhyAc TEACHSUP EMOSUPS DISCLISCI;

 OUTPUT: stdyx SAMPSTAT ;

MODEL INDIRECT:

PV1SCIE IND TeachSup;
PV1SCIE IND EmoSups;
PV1SCIE IND Disclisci;
PV1SCIE IND PhyAc;
PV1SCIE IND Bully;
PV1SCIE IND unfairT;