Kazakhstani Students' Sense of Belonging in School: An Analysis of PISA 2018 Data

Understanding Kazakhstan Students' Sense of Belonging in School: An Analysis of the Relational and Contextual Antecedents using PISA 2018 Data

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Ethical Approval

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October 2020

Dear Adilbek Baizhakhanov,

This letter now confirms that your research project entitled: Understanding Kazakhstan Students' Sense of Belonging in School: An Analysis of the Relational and Contextual Antecedents using PISA 2018 Data has been approved by the Graduate School of Education Ethics Committee of Nazarbayev University.

You may proceed with contacting your preferred research site and commencing your participant recruitment strategy.

Yours sincerely,

Assistant Professor Matthew Courtney, PhD

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Understanding Kazakhstan Students' Sense of Belonging in School: An Analysis of the Relational and Contextual Antecedents using PISA 2018 Data

Abstract

Belonging is the feeling of being at home in a community, where you can be sure that you can blend in and feel secure in your identity. In recent times, there has been concern about the dramatic rise in rates of alienation, loneliness, and feelings of "not" belonging in schools, and the impact of such sentiments on young people's well-being, mental health, and life opportunities. In times of isolation and lockdown because of COVID 19, this field of enquiry seems to be even more important. Using a secondary analysis of PISA 2018 data, this thesis focuses on understanding students' sense of belongingness in Kazakhstan schools. Descriptive statistics suggested that a moderate degree of sense of belonging, perceived teacher support, and experience of bullying exists in Kazakhstan high schools. Using multilevel modelling, it was determined that school relations and sense of belonging do not vary extensively between schools in Kazakhstan, though substantive variation exists within schools. Finally, using a two-step approach, a measurement model for student school relations and sense-of-belonging was specified prior to testing a full structural model designed to identify the main relational and contextual antecedents of Kazakhstani students' sense of belonging in schools. Implications for policy and practice are provided.

Понимание чувства принадлежности к школе казахстанскими учащимися: анализ реляционных и контекстных предшественников с использованием данных PISA 2018

Абстракт

Принадлежность — это чувство дома в сообществе, где вы можете быть уверены, что сможете слиться и почувствовать себя в безопасности и развивается как личность. В последнее время возникло беспокойство по поводу резкого роста уровня отчужденности, одиночества и чувства «непринадлежности» в школе, а также влияния таких настроений на благополучие, психическое здоровье и жизненные возможности молодых людей. Во времена изоляции из-за COVID 19 это поле исследования кажется еще более важным. Эта диссертация, основанная на вторичном анализе данных PISA 2018, фокусируется на понимании чувства принадлежности учащихся к казахстанским школам. Описательная статистика свидетельствует о том, что в средних школах Казахстана существует умеренная степень чувства принадлежности, воспринимаемой поддержки учителей и опыта буллинга. Используя многоуровневое моделирование, было определено, что школьные отношения и чувство принадлежности не сильно различаются между школами в Казахстане. С использованием двухэтапного подхода перед тестированием полной структурной модели, разработанной для выявления основных реляционных и контекстных предшественников чувства принадлежности казахстанскими учащимися к школе, была указана модель измерения школьных отношений и чувства принадлежности. Приведены последствия для политики и практики.

Қазақстандық оқушылардың мектепке меншікті болу сезімін түсіну: PISA 2018 деректерін пайдалана отырып, қарым-қатынастық және контекстік алғышарттарын талдау

Аңдатпа

Меншікті болу - бұл қауымдастықта үйде болу сезімі, онда сіз жеке тұлға ретінде, қауіпсіз сезіне алатыныңызға сенімді бола аласыз. Соңғы кездері мектептерде жаттық, жалғыздық, «изоляция» деген сезімдердің күрт өсуі және мұндай сезімдердің жастардың әл-ауқатына, психикалық денсаулығына және өмір сүру мүмкіндіктеріне әсері туралы алаңдаушылық бар. COVID 19-ға байланысты оқшаулану кезінде бұл зерттеу одан да маңыздырақ болып көрінеді. PISA 2018 деректерінің қайталама талдауын пайдалана отырып, бұл дипломдық жұмыс Қазақстан мектептеріндегі оқушылардың меншікті болу сезімін түсінуге бағытталған. Сипаттамалық статистика Қазақстанның орта мектептерінде меншіктік сезімі, мұғалімнің қолдауы және буллинг деңгейінің қалыпты дәрежесі бар екенін көрсетті. Көпдеңгейлі модельдеуді пайдалана отырып, Қазақстандағы мектептер арасында мектептегі қарым-қатынастар мен меншіктік сезімі айтарлықтай ерекшеленбейтіні анықталды. Соңында, екі сатылы тәсілді пайдалана отырып, қазақстандық оқушылардың мектепке меншіктік сезімінің негізгі реляциялық және контекстік алғышарттарын анықтауға арналған толық құрылымдық модельді сынау алдында оқушылардың мектептегі қарым-қатынасы мен меншіктік сезімін өлшеу моделі нақтыланды. Мектеп саясаты мен тәжірибеге қатысты салдарлар берілген.

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1. Introduction

1.1 Background Information

1.1.1 Sense of Belongingness

Some stakeholders and school managers could underestimate the importance of sense of belongingness of students, yet it is one of the factors that has an effect on academic achievement and school engagement (Allen, 2006). Osterman (2010) also highlighting the importance of school belongingness as a psychological phenomenon that has far reaching impact on the behavior and motivation of students.

The school belonging term is derived from the academic work of Carol Goodenow in 1993 (pg. 23), and it is described as "the extent to which students feel personally accepted, respected, included, and supported by others in the school social environment". There are also several other terms used in academic community like school engagement, school attachment, school connectedness, and school membership. The negative form of this these terms are usually referred to as school alienation or school isolation.

1.2 Statement of Problem

The focus of this study is to identify the role that student social indicators have an effect on the perceived sense of belongingness of students in Kazakhstan. To achieve this, students' 2018 PISA survey responses relating to school belongingness will be utilized in this study alongside other factors that have an impact on students' social life.

Feeling happy with life, happiness, self-esteem, personal identity, friendships, acceptance, a positive relationship with teachers, and seeking aid have all been positively associated with a sense of belonging (Hamm & Faircloth, 2005; Nutbrown & Clough, 2009; Osterman, 2000).

Fighting, bullying, vandalism, absenteeism, school drop-out rates, disruptive behavior, and tobacco usage have all been connected with school alienation (Connel et al, 1995; Croninger & Lee, 2001; Goodenow and Grady, 1993). These studies show a strong relationship between school belongingness and the social behaviors of students. Another study conducted by the Kazakhstani National Center of Public Health (NCPH) in the 2017-2018 academic year suggested that only 55% of 11-year-old students like school a lot and it this rate decreases to 33% for 15 year-old students. The study of NCPH included 6,546 students from 110 schools across a total 14 regions of Kazakhstan.

However, the kind of factors that affect school belongingness is yet to be studied in Kazakhstan. Furthermore, because there is a general absence of secondary analysis of PISA data in Kazakhstan, this research might be considered a one-of-a-kind contribution. The secondary analysis of PISA 2018 data provides a useful way to explore the effect of different social factors on sense of belongingness among students of Kazakhstan.

1.3 Purpose of the Study

The purpose of this quantitative study is to identify the influence of social relationship factors on sense of belongingness to school among Kazakhstani students. These factors include teacher support, teacher empathy, adaptation of instruction, teacher enthusiasm, competition at school, cooperation at school, and experience of being bullied. The aim is to explore how these factors effect on the sense of belongingness of students. This study could reveal how teachers, schools, and policy makers might improve the well-being of students and support them at school.

1.4 Research Questions

RQ1: To What degree do Kazakhstani students experience a sense of belonging in Kazakhstan?

RQ2: To what degree do students' experience of (a) school relations and (b) sense of belongingness vary within and between schools in Kazakhstan?

RQ3: How are students' school relations best measured in Kazakhstan?

RQ4: What are the main relational and contextual antecedents of Kazakhstani students' sense of belonging in school?

1.5 Significance of the Study

Internationally and especially in USA, the research interest on sense of belonging is quite popular because of high rates of international students in USA and Europe school. However, Kazakhstani school students are mostly local pupils and this may be one of the factors that contributing to a low level of research interested in this topic. However, research into the sense of belongingness indicator could reveal important information about the school atmosphere and climate.

Furthermore, the research findings of such a study may be valuable to a variety of stakeholders, including administrators, policymakers, and instructors who are aiming to make changes to school policy with the primary goal of enhancing students' academic outcomes.

1.6 Organization of the Study

This first chapter explains the importance of sense of belongingness and how it influences social relationship and behavior among students. The chapter is comprised of the background of the study, statement of the problem, the purpose of the study, research questions, and the significance of the study.

There are five chapters in total in this thesis. These include a literature review that discusses the sense of belongingness factors, a methodology chapter that reports on the

corresponding tools and methods for measuring the impact on sense of belongingness, a results chapter that lists all statistical findings, a discussion chapter that explains the significance of the findings, and, finally, a conclusion chapter that summarizes all of the thesis' main points and implications.

2. Literature review

2.1 Introduction

Humans are complex beings both psychologically and physiologically. Every individual has his own unique psychological makeup, emotions, goals, and ambitions. At the same time, people feel an internal need to belong to a group; to be close to people around their environment; to have familiar, relevant, and satisfying social relationships (Baumeister & Leary, 1995; Lavigne, Vallerand, & Crevier-Braud, 2011); to take care of others and to be taken care of; to love and to be loved (Deci & Ryan, 2000). The desire to belong, as well as the desire to form healthy and loving relationships is universal (Baumeister & Leary, 1995).

While the sense of belonging has received little systematic attention in schools in Kazakhstan, it appears to be a significant factor in the development and management of interpersonal relationships. For students, feeling like they belong is a critical social and psychological necessity. The need for belonging holds an important position in Maslow's (1954) Hierarchy of Needs. Maslow's model consists of the following five needs: physiological (food and clothing), safety (e.g., job security), love and belonging (friendship), esteem, and self-actualization. Therefore, in the context of school, students naturally manifest a desire to acquire and maintain a sense of belongingness. Students' social connections with teachers and other students, as well as general patterns of student engagement in the school environment, are referred to as social connections. These factors may promote a sense of school belonging—the feeling of being welcomed, valued, included, and socially supported in the school setting (Goodenow, 1993), as opposed to discrimination and alienation. Researchers also discovered that belonging to a school has an important and positive impact on many motivational indicators such

as expectation of achievement, value of school work, and self-reported effort in school settings (Goodenow, 1993).

2.2 Analytical Framework of the PISA 2018 Survey

As this study makes use of secondary analysis of 2018 PISA survey data (OECD, 2019), it is useful to draw on the analytical framework of 2018, the "PISA 2018 Assessment and Analytical Framework" document, published by the OECD in 2019. This chapter reviews the analytical framework of well-being and social connections used in the PISA survey, administered in 2018.

Students spend a significantly large proportion of their time at school. Their school interactions and connections have a major effect on their overall quality of life. Schools foster students' health and well-being in addition to academic success (Jourdan et al., 2008). Therefore, it is important for students to improve not only academically but also in terms of their soft skills and emotional well-being. A quality school climate is linked to improved self-reported student health, well-being, and health behaviors in addition to higher academic achievement (Cohen et al., 2009; Jia et al., 2009), lower perceived stress (Torsheim & Wold, 2001), and more positive responses from students to school demands (Huebner et al, 2004). The PISA 2018 survey made specific efforts to measure subjective well-being in school to identify possible disparities in school well-being and general well-being (Huebner et al., 2005).

According to the PISA 2018 conceptual framework for school well-being, two major sub-dimensions are proposed: social connections and schoolwork. It is important to note that the majority of the proposed indicators are subjective because they are based on students' perceptions of their school life and environment rather than objective conditions. Instead of focusing on school facilities and security, the questionnaire concentrates on students' social interactions and workload, as other indicators might be already available in this sector (OECD,

2019). Attention will now be drawn to describing how student sense-of-wellbeing is conceptualized as specific themes in the PISA 2018 survey. This involves a description of social connections at school, student experience of bullying, and student peer-to-peer relationships. Each of these will now be described in turn.

2.2.1 Social Connections at School

Social connections for students pertain to student-student and student-teacher relationships. Broadly, this can be conceived as the general pattern of student interactions at school that contribute to the school climate. For multiple testing periods, PISA has included questions pertaining to students' a sense of belonging to the school in its core student questionnaire (OECD, 2019). The feeling of belonging at school is linked to indicators of life satisfaction as well as mental well-being (Gilman & Anderman, 2006). Prior research has suggested that student-teacher interactions and peer encouragement are significant predictors of student adjustment and teenage life satisfaction (Suldo et al., 2009).

According to the findings of the Health Behaviour in School-Aged Children (HBSC) study, students who view their school as welcoming are more likely to experience good health behaviors and social outcomes (Ravens-Sieberer, Kokonyei & Thomas, 2004; Due et al., 2003; Freeman et al., 2009; Vieno et al., 2007). Students who say they like school are less likely to be bullied, take less sexual risk, and drug usage is reported less frequently (Harel-Fisch, 2011; Dias, Matos & Goncalves, 2005; Fletcher, Bonell & Hargreaves, 2008). Disliking school, on the other hand, is associated with an increased risk of dropping out and a high rate of health issues (Archambault et al., 2009; Shochet et al., 2006).

In the PISA surveys, and similar studies, students' experiences of bullying are quantitative markers of unfavorable or unhealthy social interactions and a lack of social

cohesion. These questions pertain to students' subjective experience of bullying and the students are asked to state in which of the mentioned specific, clearly defined, and quantifiable phenomenon they have experienced bullying (OECD, 2019). A discussion about student experience of bullying now follows.

2.2.2 Student experience of being bullied

It is not a secret that bulling in schools has lots of negative effects on different aspects of students' life. Understanding the nature of bullying in school has been an important research focal area—some researchers claim that bullying could be a deficiency in the social problem-solving skills of students (Warden & MacKinnon, 2003). On the other hand, some studies have also suggested that students who bully others exhibit high social intelligence (Kaukiainen et al., 1999)—which enables them to exercise power, manipulate, and influence others. It should also be noted that students who themselves bullied others felt less safe and less of a sense of belonging to school (Goldweber, 2013). Therefore, both the bullied and those who experienced bullying feel less safe and less connected to school.

Some research also indicates a high level of sense of belonging may enhance student resolve against bullying (Duggins et al., 2016; Goldweber, 2013). In addition, a strong sense of belonging is linked with lower acts of bullying (Raskauskas et al., 2010), bullying victimization (Duggins et al., 2016), and internalizing the issues that come with being a victim of bullying (Goldweber, 2013). Most of research reveals a strong connection between an anti-bullying attitude and strong sense of belonging in schools. However, this area remains under-researched in Kazakhstan.

2.2.3 Peer-to-Peer Relationships

Student-student and student-teacher relationships, sense of discrimination, and sense of belonging are the main subjective measures of students' interactions at school according to PISA student questionnaire items (OECD, 2019). According to self-determination theory (one of the three core basic psychological needs), students' sense of belonging and social connectedness at school are positively linked to relatedness (Ryan & Deci, 2000).

One of the factors that has a positive effect on the sense of belongingness is cooperative attitude at school. According to Berman (1997), students with cooperative learning culture in schools were more effective in social problem solving and felt more committed to the well-being of others. To sum, research suggests that cooperation boosts the sense of belonging because students in classrooms work together to achieve common goal.

Compared to cooperation, competition, conversely, does not appear to have such a positive effect on students' sense of belongingness. Johnson et al. (1983), found evidence that cooperation at school has more positive interpersonal relationship effects than conditions that foster interpersonal competition and individualism.

2.2.4 Student-Teacher Relationships

The school environment is a multidimensional construct made up of shared ideas, values, and attitudes that affect student–student and student–teacher relationships and set the tone for acceptable and normative actions (Kuperminc, 1997). In this context, we will examine how other researchers explain the influence of teacher actions on students' sense of belonging.

Goodenow (1993), in his analysis explains three factors of belongingness: teacher support, positive relationship with classmates, and the general sense of belonging. Teacher support refers

to teachers who promote mutual respect, care, inspiration, kindness, justice, and autonomy (Allen, 2016). Allen (2016) summarizes research across 51 studies which includes over 67,000 participants. His work revealed a strong positive effect of teacher support on students' sense of belongingness. Therefore, we can assume that teacher support may have an important influence of the sense of belonging of students in the current study.

Other factors investigated in the current study include Teacher Empathy. Teacher empathy can be defined as the degree to which instructors attempt to truly understand their students' personal and social situations, feel care and concern in reaction to their positive and negative emotions, and express their comprehension and care to students through their actions (Meyers, 2019). Unfortunately, there is a scarcity of research on the connection between teacher empathy and school belonging in literature.

Teacher Enthusiasm is another factor of interest in the current research. An enthusiastic teacher could inspire and motivate students. For instance, Keller et al. (2015) describes three different ways by which teachers could improve student learning: they could attract students' attention in class; teachers could serve as role models; and, enthusiastic teachers can pass on their good feelings to their students through emotional expression. However, similarly, the effect of teacher enthusiasm on students' sense of belongingness is scarce.

2.3 Conclusion

To sum up, multiple factors could be associated with students' sense of belongingness at school. For instance, cooperation in school has been shown to be a strong predictor school belongingness. While competition in school has weaker positive effect on school relatedness. In addition, teacher support also appears to be an important corollary of school connectedness. On the other hand, student experience of being bullied has a negative relationship with students'

sense of belonging. Finally, the role of teacher enthusiasm and teacher empathy is not clear and represent a new line of enquiry for this current research project.

3. Methods

3.1 Introduction

This chapter will focus on the methods applied in this study to address the aforementioned research questions. The chapter will describe the research design, and sampling procedures, instruments, statistical procedures, as well as address ethical concerns and limitations.

3.1.1 Purpose of the Study

The purpose of this study is to explore students' sense of belongingness in Kazakhstani schools using the PISA 2018 survey results. There is strong evidence that a sense of protection, belonging, and well-being has an effect on student success and participation in school (Dyson, 2018; Moore D. et al, 2019). The research will analyze 2018 PISA survey data and examine how the sense of belongingness of students in school effects their overall well-being. Therefore, this paper will focus on how different social connections influence sense of belongingness in Kazakhstan schools. Given the dearth of related research in the field in Kazakhstan, the following four research questions are proposed:

3.1.2 Research Questions:

RQ1: What level of quality of school relationships exists in Kazakhstani schools?

RQ2: To what degree do students' experience of (a) school relations and (b) sense of belongingness vary within and between schools in Kazakhstan?

RQ3: How are students' school relations best measured in Kazakhstan?

RQ4: What are the main relational and contextual antecedents of Kazakhstani students' sense of belonging in school?

3.2 Research Design and Rationale

According to Creswell (2014), "some quantitative research problems require that you explain how one variable affects another. By explaining the relation among variables, you are interested in determining whether one or more variables might influence another variable" (p. 27). In this study, there are multiple independent variables (mostly focused on social relationships) and one dependent variable of interest, the sense of belongingness of students. The independent variables in this study capture school climate and they are all taken from the 2018 PISA student and school surveys. The dependent variables in this study include the sense of belongingness item scores from the publicly available PISA 2018 student datasets.

Individual level variables are defined as those that vary for each student, for example individual student experience of being bullied; whereas school-level variables are defined as those that vary for each respective student in that school, for example the extent to which a school reports to implement certain equity-related policies. Therefore, because of the nested nature of data in this study, multilevel modelling was employed as the primary method of analysis (Bates, Maechler, Bolker, & Walker, 2015). However, in the case that there would not be sufficient between-school variation in school climate and associated variables of interest, the appropriate method would default to a single-level form of multivariate analysis.

3.2.1 The Rationale for Choosing PISA Data

A significant number of students do not feel socially linked to their school. For example, in certain countries and economies, a significant minority groups of 15-year-old students indicated a lack of attachment to their schools and a sense of loneliness or isolation (OECD, 2019). Therefore, the analysis of 15-year-old Kazakhstani student data based on the PISA survey is worthy of enquiry. Specifically, it is worthwhile to investigate the importance of contextual factors and patterns of

belongingness and school engagement among Kazakhstani students who took part in the PISA exams.

Since gaining independence in 1991, the Kazakhstani educational system evolved rapidly and integrated with international organizations. According to Yakavets & Dzhadrina (2014), "The key strategic step toward 'entering' the world education arena was Kazakhstan's participation in international studies (e.g., PISA and TIMSS). Importantly, the results have raised some issues that key policy makers and educational officials were not able to ignore…" (p. 48). Kazakhstani policymakers always paid attention to international studies as it could negatively affect the prestige of the republic.

As PISA has developed and improved since its inception, policymakers started to use the PISA data as a benchmark. The 2018 PISA test assessed not only hard skills (e.g., critical thinking, math, science) but also examined social issues, which is important for school climate and well-being. Despite Kazakhstan's vested interest in international surveys and student assessments, little empirical work has been undertaken to explore the results and the types of school and pedagogical conditions that might be associated with improved student experiences. The few studies that have focused on making use of PISA data in Kazakhstan have generally focused on identifying the drivers of academic success (e.g., Muratkyzy, 2020). Therefore, an examination of the drivers of students' sense of belonging in Kazakhstan represents an important new field of research.

3.3 Research Site

As secondary analysis was applied to the 2018 PISA data, therefore there is no specific study site. In fact, a multi-stage cluster sampling design was used for sampling schools in Kazakhstan. Schools, and, subsequently students, therefore, were drawn from urban and rural areas across the

country (Schleicher, 2018). Thus, this study takes into account the vast majority of schools in the territory of Kazakhstan and reflects a representative sample of 15-year-old students.

3.4 Sample and Data Preparation

As stated previously, this study makes use of secondary data analysis of 2018 PISA results and there was no need for the author to gather data directly. Data were obtained from the OECD official website ("PISA 2018 Database", n.d.) and multi-stage cluster sampling method was used. However, special data preparation steps were applied to the PISA 2018 data, downloaded in SPSS .sav format.

3.4.1 Data Extraction and Preparation

For this study, the author used the open-source R statistic software for data preparation and analysis of PISA data. In R (R Core Team, 2020), the SPSS files in .sav format were read into the R program with the assistance of the haven package (Wickham & Miller, 2020). The participants of the survey were the 19,507 anonymized 15-year-old school students from 616 schools throughout Kazakhstan. Kazakhstani school and student data were extracted and merged by "CNTSCHID" which included the common prefix number of "398" for Kazakhstan. Following the selection of the two relevant data sets, they were merged to obtain the complete data for Kazakhstan. This data included 19,507 students from 616 schools and 1,314 variables. Since the "ESCS" was thought to be a significant indicator of student success, it was included in the analyses, along with student gender.

Furthermore, after reviewing all student level data relating to "social connections", 6,725 students and 52 schools were excluded due to missing data and singleton responses (i.e., cases of only one student respondent from a school). This resulted in a remaining 12,782 students nested in 564 schools for the final *descriptive statistics* for this study.

Schools of less than 10 students were also omitted to allow for the potential anomalous effects from an extremely limited numbers of students in schools (Lai & Kwok, 2014). Therefore, the final data for conducting the *main multi-level analyses* included 442 schools with 12,044 students.

As a result of data preparatory procedures, only the variables of interest in terms of "social connections", as well as some general school level variables, were chosen for analysis. A total of 58 variables were selected.

Both semantically negative questions (i.e., those that ask for levels of student agreement with negatively worded statements) were reverse coded. In Table 1, all of the semantically negative questions are denoted by the letter "R". As a consequence, all of the means for each variable and scale will have an equivalent interpretable meaning.

3.5 Data Collection Instruments

For this study, I was interested in the sense of belongingness variable as an outcome. Thus, sense of belongingness is the dependent variable and the other social connection variables were classified as independent variables. The student independent variables will now be discussed further.

3.5.1 Instrument: Student Questionnaire

The student-level independent variables included in this study (completed by individual Kazakhstani students) are presented in Table 1.

The student questionnaire covers 28 questions related to student's social connection, including: (1) Percieved Teacher Support, (2) Teacher Empathy, (3) Adaptation of instruction, (4) Teacher Enthusiasm, (5) Perseption of Competition and (6) Cooperation at school, and (7) Experience of Being Bullied.

Table 1 provides a review of the student-level independent variables included in this study. Response options for the variables include both frequency and agreement formats as detailed in the table note.

Table 1

Student-Level Independent Variables from the PISA Dataset [Instrument 1]

#	PISA Item ID	Scale
		(1) Perceived Teacher Support [1] (R)
1	ST100Q01TA	The teacher shows an interest in every student's learning
2	ST100Q02TA	The teacher gives extra help when students need it
3	ST100Q03TA	The teacher helps students with their learning
4	ST100Q04TA	The teachers continue teaching until the students understand
		(2) Teacher Empathy [3]
5	ST211Q01HA	The teacher made me feel confident in my ability to do well in the class
6	ST211Q02HA	The teacher listened to my view on how to do things
7	ST211Q03HA	I felt that my teacher understood me
		(3) Adaption of Instruction [2]
8	ST212Q01HA	The teacher adapts the lesson to my class's needs and knowledge
9	ST212Q02HA	The teacher provides individual help when a student has difficulties understanding a topic or task
10	ST212Q03HA	The teacher changes the structure of the lesson on a topic that most students find difficult to understand
		(4) Teacher enthusiasm[3]
11	ST213Q01HA	It was clear to me that the teacher liked teaching us.
12	ST213Q02HA	The enthusiasm of the teacher inspired me.
13	ST213Q03HA	It was clear that the teacher likes to deal with the topic of the lesson.
14	ST213Q04HA	The teacher showed enjoyment in teaching.
		(5) Perception of Competition at School[5]
15	ST205Q01HA	Students seem to value competition
16	ST205Q02HA	It seems that students are competing with each other
17	ST205Q03HA	Students seem to share feeling that competing with each other is important
18	ST205Q04HA	Students feel that they are being compared with others
		(6) Perception of Cooperation at School [5]
19	ST206Q01HA	Students seem to value cooperation.
20	ST206Q02HA	It seems that students are coop with each other
21	ST206Q03HA	Students seem to share feeling that cooperation with each other is important
22	ST206Q04HA	Students feel that they are encouraged to cooperate with others
		(7) Student's experience of being bullied [6]
23	ST038Q03NA	Other students left me out of things on purpose
24	ST038Q04NA	Other students made fun of me.
25	ST038Q05NA	I was threatened by other students.
26	ST038Q06NA	Other students take/destroyed things that belonged to me.
27	ST038Q07NA	I got hit or pushed around by other students.
28	ST038Q08NA	Other students spread nasty rumors about me.
		(8) Sense of belongingness [4]
29	ST034Q02TA	I make friends easily at school.
30	ST034Q03TA	I feel like I belong at school.
31	ST034Q05TA	Other students seem to like me.
		(9) Sense of Isolation[4] (Reversed items for Sense of belonging scale) (R)
32	ST034Q01TA	I feel like an outsider (or left out of things) at school.
33	ST034Q04TA	I feel awkward and out of place in my school.
34	ST034Q06TA	I feel lonely at school.

Note. [1]Denotes scales using [1]1= Every lesson, [1]2 = Most lessons, [1]3= Some lessons, [1]4= Never or hardly ever;
[2]Denotes scales using [2]1 = Never or almost never, [2]2 = Some lessons, [2]3 = Most lessons, [2]4 = Every lesson or almost every lesson;
[3]Denotes scales using [3]1= Strongly disagree, [3]2= Disagree [3]3= Agree, [3]4= Strongly agree;
[4]Denotes scales using [4]1= Strongly agree, [4]2= Agree [4]3= Disagree, [4]4= Strongly disagree;
[5]Denotes scales using [5]1= Not at all true, [5]2= Slightly true, [5]3= Very true, [5]4= Extremely true;
[6]Denotes scales using [6]1= Never or almost never, [6]2= A few times a year, [6]3= A few times a month, [6]4= Once a week or more;
(R) – the indicator was reversed for modelling;

3.7 Data Analysis Methods

The data analysis methods subsection provides a review of the initial assessment of the data, an exploration of withing and between school variation, measurement of students' social relationships and sense of belonging, and how the analysis identifies the experiences that drive Kazakhstani students' sense of belonging.

3.7.1 Initial Assessment of Data

Preparation of the data included the process of assessing its completeness. In addition, an examination for skewness of each variable followed. Normality transformations required the use of the optimum exponent where necessary (Box & Cox, 2008) (see Appendix for all data preparation and analysis).

3.7.2 Exploring Within- and Between-School Variation in Students Sense of Belonging

The first research (RQ1) question asks, To what degree do students' experience of (a) school relations and (b) sense of belongingness vary within and between schools in Kazakhstan?

To answer this question, each of the related variables were examined in terms of the degree to which they varied within- and between different schools in the Kazakhstani sample. This was undertaken with the assistance of the R lme4 statistical package (Bates, D. et al., 2015).

3.7.3 Measuring Student Experience of School Relations and Sense of Belonging`

After determining the degree to which the variables of interest varied as a consequence of schools, a measurement model was specified to determine how student experience of school relations and student sense of belonging might best be measured. This was undertaken with the assistance of the R lavaan statistical package (Rosseel, Y., 2012) using the CFA (confirmatory factor analysis) function. Model fit was determined in accordance with the following criteria: the $\chi 2/df$ ratio (under

3.83) and associated non-statistically significant *p* value Walker (2013), SRMR (below .08) (Hu & Bentler, 1999), RMSEA (below .08) Browne and Cudeck (1989, 1992) and Byrne (2001), CFI (above .90), and gamma hat (above .90) (Byrne, 2001). In addition, Cronbach's alpha values (above .70) for factors' construct validity are also reported throughout this study. In addition, discriminant validity was checked with reference to the AVE-SV rule (Ab Hamid et al., 2017).

3.7.4 Kazakhstani Students Level of Sense of Belonging

RQ3 asks, To What degree are Kazakhstani students experience a sense of belonging in Kazakhstan? After determining the measurement model, an examination of the overall degree of students' sense of belonging for each factor was undertaken by an examination of means and standard deviations (*SDs*) for each factor. This way, the levels of agreement with each validated item in each factor can be interpreted.

3.7.5 Identifying the Experiences that Drive Student Sense of Belonging in Kazakhstan

RQ4 asks, what are the main relational and contextual antecedents of Kazakhstani students' sense of belonging in school? To answer this question, structural equation modelling (SEM) was employed. This is a useful technique because it is effective tool to represent data visually and is useful for testing theory. In addition, SEM is multi-equation regression model which is differs from traditional multivariate linear model (Fox, J., 2012). SEM enables the specification of both independent and dependent variables in a single model. This way, it is possible to determine the school relationship factors that have most significant effect on students' sense of belongingness. For this question, two structural models will be run. The first will include relational antecedents while the second will also include student socio-economic status (ESCS) and student academic

performance (means of first five plausible values for Math, Science, and Reading) as control variables.

3.8 Ethical Concerns and Risks of Research

This study's thesis was conducted in accordance with the NUGSE code of ethics. The financial cost of participation was not included in the study. The study did not focus on a specific school, but rather on generating broad conclusions.

Since this study relies on secondary data sources, the risks to participants are extremely low. It also did not present any challenges to participants and did not involve any vulnerable human subjects (Ispambetova, 2018). Finally, the findings describe general trends in the data without identifying any specific school or individual.

3.9 Limitations

The possible limitations of this research could be the superficiality of the data, as it only takes into account a cross-sectional research design. The results may not reflect a complete picture of the sense of belongingness level in schools. In addition, triangulation of the gathered data is suggested for in-depth analysis of the situation. Though, this was not undertaken.

3.10 Conclusion

This methodology chapter described the sampling and data analysis used in PISA. The use of secondary data, the data preparatory procedures, and the statistical procedures used to answer four questions of this research.

4. Results

4.1 Introduction

This chapter presents the findings of the research. The purpose of the study is to identify the role of school climate on student academic achievement based on the following four questions:

RQ1: What level of quality of school relationships exists in Kazakhstani schools?

RQ2: To what degree do students' experience of (a) school relations and (b) sense of belongingness vary within and between schools in Kazakhstan?

RQ3: How are students' school relations best measured in Kazakhstan?

RQ4: What are the main relational and contextual antecedents of Kazakhstani students' sense of belonging in school?

The research questions were answered by utilizing PISA OECD 2018 dataset. All the findings are described in detail in the following sections.

4.2 Analysis Steps

To determine the social relationship components, the Student Questionnaire from PISA 2018 (OECD, 2019) was synthesized. Based on the sample of 12,991 pupils, descriptive statistics were performed after data preparation. However, schools with fewer than 10 pupils were excluded due to the risk of erroneous results from small school samples, resulting in a total of 12,044 students for the final analysis. Confirmatory factor analysis (CFA) was performed to assess the validity of students' responses on social relationships. The main research questions, RQ3 and RQ4, were answered by using CFA and the full SEM model, respectively, for which the final model ultimately validated and identified the main drivers of students' sense of belongingness in Kazakhstan.

4.3 Results

This chapter presents the results for each of the four research questions:

RQ1: A moderate level of school relationships exist for Kazakhstani 15-year-old students.

RQ2: Variance in student perceived school relations varies largely within schools but not between schools in Kazakhstan.

RQ3: A nine-factor single level measurement model provides a useful representation of student-perceived school relation factors in Kazakhstan.

RQ4: There are several negative and positive factors affecting students' Sense of Belongingness in Kazakhstani schools.

4.4 RQ1: What Level of Quality of School Relationships Exists in Kazakhstani Schools?

To answer this question and analyse the data descriptive statistics were used (Thompson, 2006). All the factors used in this research represented in Table 2. Student questionnaire covers 34 school relationship questions and descriptive statistics for gender and ESCS. In addition, there are PVMMATH, PVMSCIE, PVMREAD variables for general reference (readers may compare these averages to official averages).

It can be observed that all school relationship factors have min and max values in Table 1. According to the table, the min = 1 and the max = 4. It is noted that *M* (mean) for all items pertaining to factors of a negative nature range from (*M* = 1.33 to *M* = 2.02). For example, the means for student Experience of bullying (ST038) range between *M* = 1.33 and *M* = 1.62).

Table 2. Descriptive Statistics for Within-School (Student-Level) Variables

Variable ID	Description	Min	Max	Mean	SD	Skewness	ICC	Coding
ST004D01T	Gender	1	2	1.49	0.49	0.032	0.045	1,2
	Perceived Teacher Support[1](R)							
ST100Q01TA	**A.** Frequency of teacher showing an interest in every student's learning	1	4	1.80	0.88	-0.824	0.048	1
ST100Q02TA	**B.** Frequency of teacher giving extra help when students need it	1	4	1.68	0.84	-1.000	0.027	1
ST100Q03TA	**C.** Frequency of teacher helping students with their learning	1	4	1.54	0.78	-1.351	0.036	1
ST100Q04TA	**D.** Frequency of teacher continuing teaching until the students understands	1	4	1.63	0.82	-1.141	0.027	1
	Teacher Empathy[3]							
ST211Q01HA	**A.** The teacher made me feel confident in my ability to do well in the course	1	4	2.88	0.92	-0.767	0.034	3
ST211Q02HA	**B.** The teacher listened to my view on how to do things	1	4	2.81	0.90	-0.660	0.030	3
ST211Q03HA	**C.** I felt that my teacher understood me.	1	4	2.89	0.92	-0.753	0.034	3
	Adaptation of Instruction[2]							
ST212Q01HA	**A**. The teacher adapts the lessons to my classes needs and knowledge.	1	4	2.92	0.89	-0.424	0.036	2
ST212Q02HA	**B.** The teacher provides individual help when a student has difficulties.	1	4	2.97	0.88	-0.465	0.049	2
ST212Q03HA	**C.** The teacher changes the structure of the lesson on a topic	1	4	2.55	0.94	0.064	0.025	2
	Teacher Enthusiasm[3]							
ST213Q01HA	**A.** It was clear to me that the teacher liked teaching us.	1	4	3.01	0.81	-0.844	0.062	3
ST213Q02HA	**B.** The enthusiasm of the teacher inspired me.	1	4	2.93	0.83	-0.646	0.060	3
ST213Q03HA	**C.** It was clear that the teacher likes to deal with the topic of the lesson.	1	4	3.04	0.76	-0.913	0.032	3
ST213Q04HA	**D.** The teacher showed enjoyment in teaching.	1	4	3.02	0.81	-0.823	0.035	3
	Sense of Belonging[4]							
ST034Q01TA	**A.** I feel like an outsider (or left out of things) at school.	1	4	1.96	0.85	-0.742	0.012	4
ST034Q04TA	**D.** I feel awkward and out of place in my school.	1	4	2.02	0.79	-0.666	0.008	4
ST034Q06TA	**F.** I feel lonely at school.	1	4	1.96	0.85	-0.741	0.013	4
	Sense of Isolation[4](R)							
ST034Q02TA	**B.** I make friends easily at school.	1	4	2.10	0.78	-0.527	0.013	4
ST034Q03TA	**C.** I feel like I belong at school.	1	4	2.21	0.79	-0.395	0.025	4
ST034Q05TA	**E.** Other students seem to like me.	1	4	2.22	0.74	-0.490	0.012	4
	Competition at school[5]							
ST205Q01HA	**A.** Students seem to value competition	1	4	2.54	0.85	-0.156	0.053	5
ST205Q02HA	**B.** It seems that students are competing with each other	1	4	2.55	0.85	-0.158	0.058	5
ST205Q03HA	**C.** Students seem to share feeling that comp with each other is important	1	4	2.47	0.87	-0.093	0.056	5
ST205Q04HA	**D.** Students feel that they are being compared with others	1	4	2.54	0.90	-0.142	0.045	5
	Cooperation at school[5]							
ST206Q01HA	**A.** Students seem to value cooperation.	1	4	2.83	0.80	-0.521	0.060	5
ST206Q02HA	**B.** It seems that students are cooperating with each other	1	4	2.89	0.76	-0.512	0.058	5
ST206Q03HA	**C.** Students seem to share feeling that cooperating with each other is important	1	4	2.89	0.76	-0.517	0.059	5
ST206Q04HA	**D.** Students feel that they are encouraged to cooperate with others	1	4	2.86	0.79	-0.507	0.061	5
	Experience of being Bullied[6]							
ST038Q03NA	**A.** Other students left me out of things on purpose	1	4	1.62	0.90	1.212	0.015	6
ST038Q04NA	**B.** Other students made fun of me.	1	4	1.44	0.81	1.747	0.018	6
ST038Q05NA	**C.** I was threatened by other students.	1	4	1.34	0.73	2.136	0.051	6
ST038Q06NA	**D.** Other students took away or destroyed things that belonged to me.	1	4	1.36	0.76	2.058	0.045	6

Table 2. Descriptive Statistics for Within-School (Student-Level) Variables (Continued…)

Variable ID	Description	Min	Max	Mean	SD	Skewness	ICC	Coding
ST004D01T	Gender	1	2	1.49	0.49	0.032	0.045	1,2
ST038Q07NA	**E.** I got hit or pushed around by other students.	1	4	1.33	0.75	2.187	0.055	6
ST038Q08NA	**F.** Other students spread nasty rumors about me	1	4	1.45	0.83	1.733	0.031	6
ESCS	Index of economic, social and cultural status	-4.59	3.99	-0.24	0.84	-0.181	0.240	
PVMMATH	Mean of PV1MATH-PV5MATH	158	741	454	85	0.16	0.046	
PVMSCIE	Mean of PV1SCIE-PV5SCIE	197	711	429	82	0.48	0.416	
PVMREAD	Mean of PV1READ-PV5READ	183	716	419	86	0.37	0.400	

Note. 1= Female, 2= male; coding scheme defined below:

[1]Denotes scales using [1]1= Every lesson, [1]2 = Most lessons, [1]3= Some lessons, [1]4= Never or hardly ever;

[2]Denotes scales using [2]1 = Never or almost never, [2]2 = Some lessons, [2]3 = Most lessons, [2]4 = Every lesson or almost every lesson;

[3]Denotes scales using [3]1= Strongly disagree, [3]2= Disagree [3]3= Agree, [3]4= Strongly agree;

[4]Denotes scales using [4]1= Strongly agree, [4]2= Agree [4]3= Disagree, [4]4= Strongly disagree;

[5]Denotes scales using [5]1= Not at all true, [5]2= Slightly true, [5]3= Very true, [5]4= Extremely true;

[6]Denotes scales using [6]1= Never or almost never, [6]2= A few times a year, [6]3= A few times a month, [6]4= Once a week or more;

(R): the indicator was reversed for modelling.

4.5 RQ2: To What Degree do Students' Experience of (a) School Relations and (b) Sense of Belongingness Vary Within and Between Schools in Kazakhstan?

Concerning, the variation between schools, the ICC level was quite low for all school relation factors and raged between 1% to 6%. The lowest ICC level was for Sense of belongingness (ST034) and the highest was for Cooperation at school (ST206). Therefore, the design effect was likewise minimal. Multilevel modelling of the data for the measurement and structural models was not essential because the intra-class correlation coefficients and design effects were quite low (e.g., ICCs were less than.10), as shown in Table 2. As a result, the data was subjected to single-level structural equation modelling. Substantively, this means that there is no significant difference between schools in terms of school relationship factors (substantive variation exists within schools only). This finding is important for our research as we understand that there are no systemic relationship-dependent effects between the schools and student perception of school relationship largely varies between schools in Kazakhstan. This result itself will be considered in the discussion part of this paper.

4.6 RQ3: How are Students' School Relations Best Measured in Kazakhstan?

This section provides a description of inter-factor correlation matrix for the measurement model that best represents student perception of school relation in Kazakhstani schools. Table 3 presents inter-factor correlation matrix with nine indicators including sense of belongingness and sense of isolation. According to the requirements of AVE-SE rule for discriminant validity, all the factors met the criteria of AVE > 50 rule. AVEs of all factors were quite high ranging from 0.53-0.78 which suggests convergent validity and, importantly, that all factors differentiate from each other.

Overall, the correlation between factors were significant except for the relation between Perception of Competition at School ("ST205") and Sense of Isolation ("ST034"). The relationship

between these two factors were statistically insignificant. One can say that there is no relationship between these two factors.

Figure 1 illustrates the standardized item-factor loadings. All the loadings are statistically significant and all the *p* values are less then 0.001 (*p* value < 0.001).

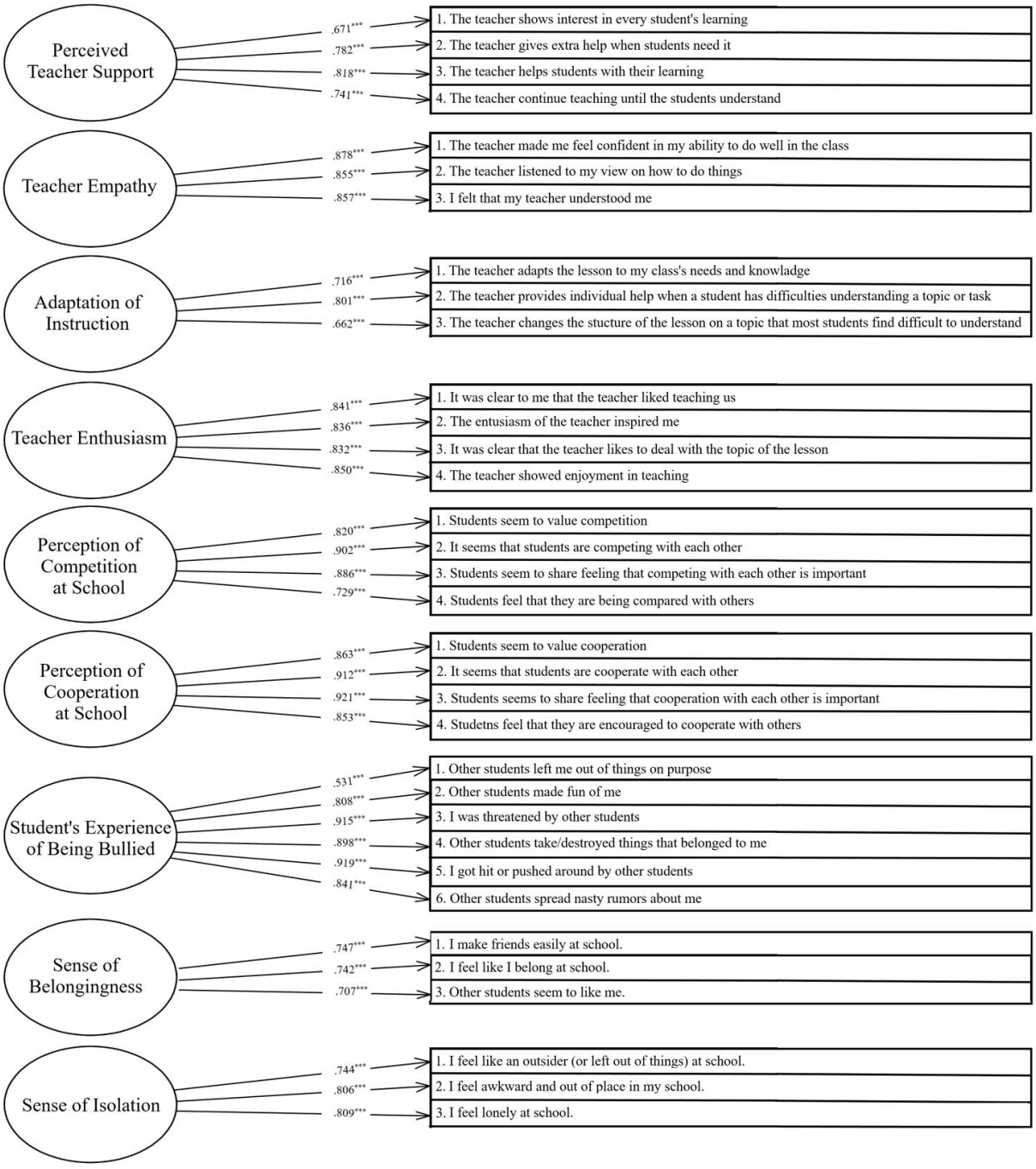
Table 3. Inter-Factor Correlation Matrix for the Measurement Model of Student-Perceived School Relation Factors

	Perceived Teacher Support r(r^2)	Teacher Empathy r(r^2)	Adaption of Instruction r(r^2)	Teacher enthusiasm r(r^2)	Perception of Competition at School r(r^2)	Perception of Cooperation at School r(r^2)	Student's experience of being bullied r(r^2)	Sense of belongingness r(r^2)	Sense of isolation r(r^2)
AVE	**.56**†	**.74**†	**.53**†	**.70**†	**.70**†	**.78**†	**.68**†	**.53**†	**.61**†
Perceived Teacher Support	**1**								
Teacher Empathy	**-0.228***** (0.052)	**1**							
Adaption of Instruction	**-0.436***** (0.190)	**0.428***** (0.183)	**1**						
Teacher enthusiasm	**-0.334***** (0.111)	**0.547***** (0.299)	**0.462***** (0.213)	**1**					
Perception of Competition at School	**-0.065***** (0.004)	**0.057***** (0.003)	**0.133***** (0.017)	**0.095***** (0.009)	**1**				
Perception of Cooperation at School	**-0.245***** (0.060)	**0.203***** (0.041)	**0.279***** (0.077)	**0.283***** (0.080)	**0.274***** (0.075)	**1**			
Student's experience of being bullied	**0.116***** (0.013)	**-0.095***** (0.008)	**-0.112***** (0.012)	**-0.097***** (0.009)	**0.074***** (0.005)	**-0.121***** (0.014)	**1**		
Sense of belongingness	**-0.174***** (0.030)	**-0.139***** (0.019)	**-0.165***** (0.027)	**-0.165***** (0.027)	**-0.038**** (0.001)	**-0.202***** (0.040)	**0.155***** (0.024)	**1**	
Sense of isolation	**-0.157***** (0.024)	**0.144***** (0.020)	**0.166***** (0.027)	**0.165***** (0.024)	**0.012** ns (0.0001)	**0.226***** (0.051)	**-0.202***** (0.040)	**-0.474***** (0.224)	**1**

Note. ***p < .001, **p < .01, *p < .05, ns$p$ > .05; † Factor meets requirements for AVE-SE rule for discriminant validity: AVE > 50; Related inter-factor variance (r^2) < AVE

Figure 1

Item-Factor Loadings for the Measurement Model of Student-perceived School Relation Factors



Note. ***$p < .001$, **$p < .01$, *$p < .05$, $^{ns}p > .05$

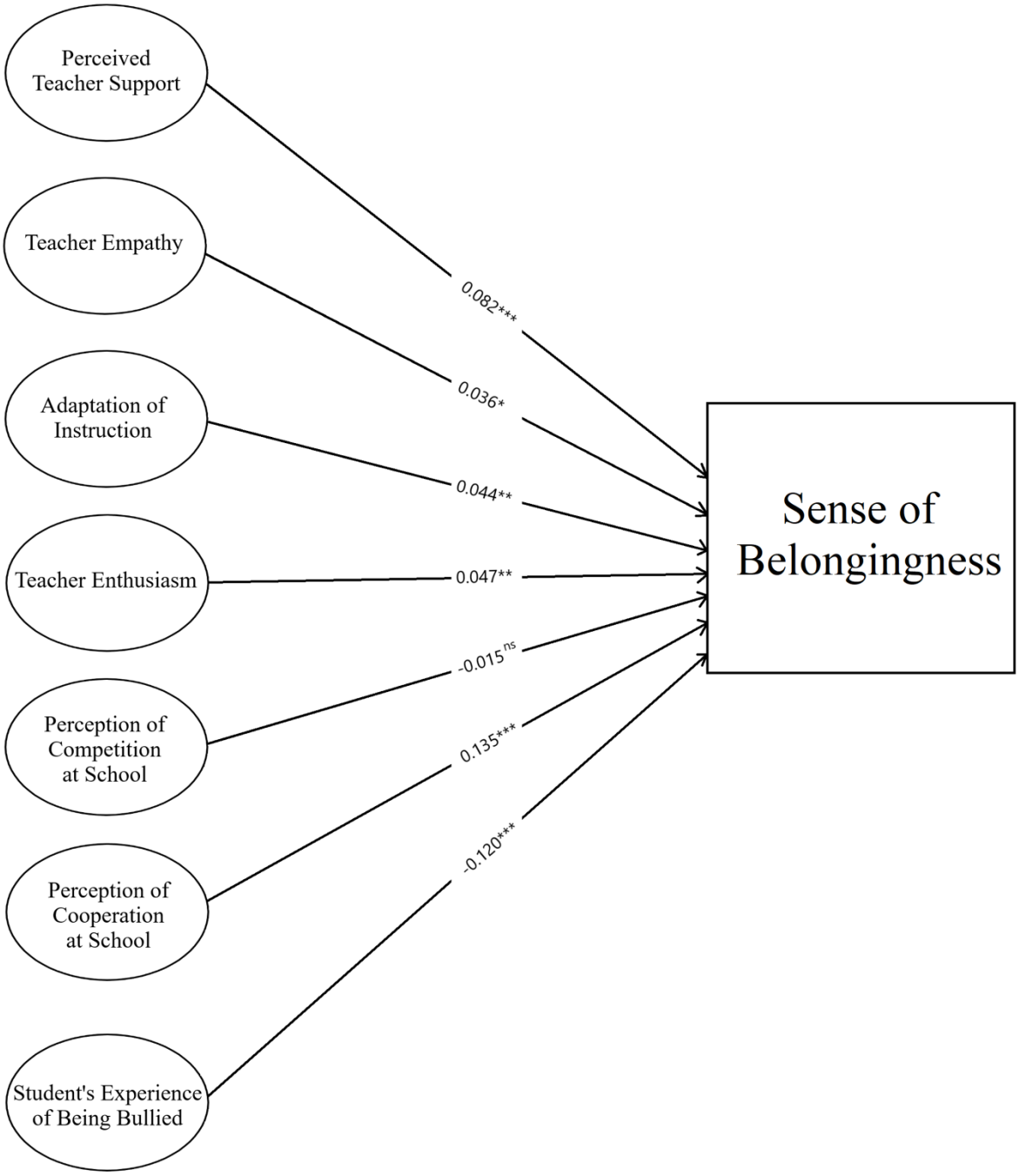
4.7 RQ4: What are the Main Relational and Contextual Antecedents of Kazakhstani Students' Sense of Belonging in School?

In the structural model, the seven factors are represented as independent variables and Sense of Belongingness was modelled as the dependent variable. Analysis suggests that six factors, namely, Perceived Teacher Support, Teacher Empathy, Adaptation of Instruction, Teacher Enthusiasm, Perception of Cooperation at school, and Student's Experience of Being Bullied were significant for the Sense of Belongingness indicator. The Perception of Competition at School factors was found to be insignificant for the dependent variable of interest, Sense of Belongingness (*Figure 2*). Results suggest that Perception of Cooperation at school has the strongest effect with $b = 0.135$ ($p < .001$). Students' experience of bullying has a substantive negative effect on Sense of Belongingness with $b = -0.120$ ($p < .001$).

The second largest positive effect on the outcome was Perceived Teacher Support with $b = 0.085$ ($p < .001$). Other factors have a moderate effect on Sense of Belongingness, for instance, Teacher Enthusiasm, Adaptation of Instruction, and Teacher Empathy with $b = 0.047$ ($p < .01$), $b = 0.044$ ($p < .01$), and $b = 0.036$ ($p < .05$), respectively.

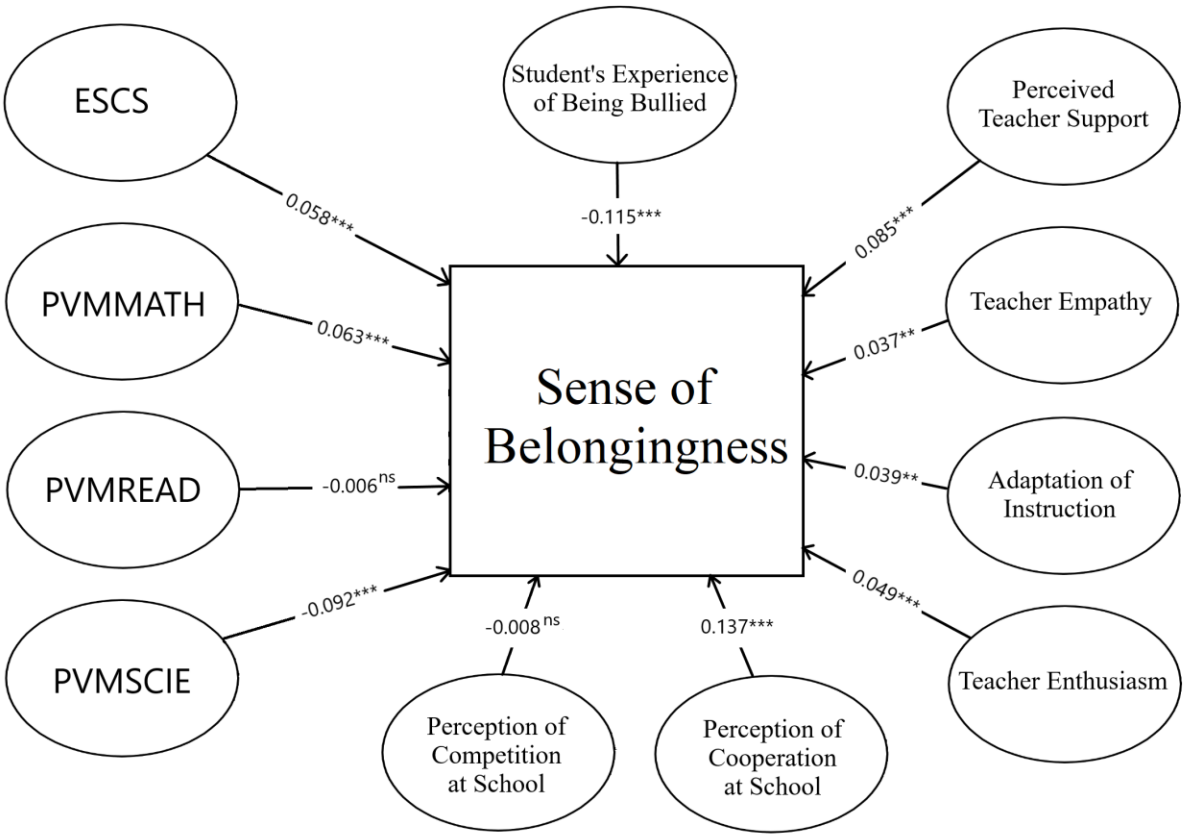
Figure 3 analysis illustrates the results for the final model that includes the socio-economic and academic related control variables. Results suggest that ESCS had a small effect on students' sense of belonging with $b = 0.058$ ($p < .001$). In addition, PVMMATH also had a smaller positive effect with $b = 0.063$ ($p < .001$). Finally, PVMREAD has no effect ($b = -0.006$, $p > .05$) on Sense of Belongingness and PVMSCIE has a negative effect with $b = -0.092$ and $p < .001$). Overall, the inclusion of the control variables had no substantive effect on the size of the coefficients in the model.

Figure 2
Model for School Relation Factors on Sense of Belongingness in Kazakhstan



Note. All standardized item-factor correlations for the measurement model can be seen in Table 3; full results for the structural model are available from the author; ***Note***. ***$p < .001$, **$p < .01$, *$p < .05$, $^{ns}p > .05$.

Figure 3: Model for Student Academic Performance and ESCS on Sense of Belongingness in Kazakhstan



Note. Full results for the final structural model with Academic Performance and ESCS included as control variables;
Note. ***$p < .001$, **$p < .01$, *$p < .05$, $^{ns}p > .05$.

4.8 Model fit

All model fit indices were interpreted in accordance with the methodology section of this manuscript (subsection 3.7.3). The χ^2/df ratio was 4,206.497/497=8.462, which was statistically significant ($p < .001$), though this was not deemed problematic due to the large sample size. The comparative fit index and Tucker-Lewis Index both produced the same number and exceeded the accepted values of .90 with estimates of CFI = .98, TLI = .97. Finally, RMSEA = .025, with (L = 0.024 and U = 0.026). After including Academic Performance and ESCS factors in the final model, following changes were occurred: The χ^2/df ratio increased and showed 7,022.733/526 = 13.349; there was a slight decrease in CFI with CFI = .967 and TLI =.963; there was a slight increase in SRMR = .053; there was a slight increase in RMSEA with RMSEA = .032.

Table 4
Model Fit Indices for Measurement and Structural Model

Model	*N*	X^2	*df*	X^2/df	*P*	CFI	TLI	SRMR	RMSEA
CFA & SEM	12,044	4,206.497	497	8.462	< .001	.980	.977	.023	.025(L=.024, U =.026)
SEM with Academic performance and ESCS	12,044	7,022.733	526	13.349	< .001	.967	.963	.053	.032(L=.031, U =.033)

Note. *N* = number of observations; χ^2 = Chi-squared; *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis Index; SRMR = Standardized Root Mean Square Residual; RMSEA = root mean square error of approximation; U = upper 90% confidence interval; L=lower 90% confidence interval

Therefore, the model fit indices suggest that all models represent an acceptable fit to the data and provide for a valid contribution to theory associated with the factors effecting students' Sense of Belongingness in Kazakhstani schools.

4.9 Summary of the Findings

This chapter explained important findings about Sense of Belongingness factors in Kazakhstani schools. The results were provided according to four research questions. The data was obtained from PISA 2018 surveys for 15-years-old students. Results suggested that a moderate level of

Sense of Belongingness exists in Kazakhstani schools. In addition, the findings also revealed that school relations do not differ in any systematic way between schools. For the main research question, RQ4, results suggest that there are several negative and positive factors affecting the Sense of Belongingness of Kazakhstani students. For instance, Student's Experience of Being Bullied has strong negative effect and Perception of Cooperation at school has strong positive effect. Therefore, findings reveal a new view on the factors affecting Sense of Belongingness for Kazakhstani students. The following chapter discusses the research findings in relation to the literature reviewed in this manuscript.

5. Discussion

5.1 Introduction

This chapter elaborates on the results of this study aimed to explain the influence of school relations on students' sense of belongingness. This chapter covers four questions and includes a total five sections. The first section describes how students' experience school relations in Kazakhstani schools. The second section discussed how this experience varies within and between school in Kazakhstan. The third section reveals how Kazakhstani school relations are best conceptualized and measured in Kazakhstan. The fourth section provides discussion vis-a-vis the main question of this thesis pertaining to how school relations influence students' sense of belongingness in Kazakhstan. Finally, the final section of the chapter summarizes the main conclusions and ideas.

5.2 RQ1: What level of Quality of School Relationships Exists in Kazakhstani Schools?

According to the findings, the student self-reported levels of teacher support tended to be positive. This means that teachers are more likely to sympathize with each student and their learning experience, and provide extra help when necessary. Students also claim that their teachers encourage them to learn and that they continue to teach until they have fully grasped the material. Overall, teachers were deemed to be encouraging, and students were happy with the help they received from their teachers.

Furthermore, the majority of students found their teacher to be appreciative of their efforts. The passion of their teachers seemed to encourage the students. Students often claim that teachers have a passion for both the class topic and instruction.

On the other hand, Kazakhstani pupils did not place a great emphasis on competitiveness. Collaboration was regarded higher than competition, which is frequently associated and correlated with cooperation.

Also, student safety appears to be a source of concern. Several times a year, incidents such as ridiculing, threatening, destroying or taking away items, and beating or pushing were reported. Despite the fact that the results did not reveal and substantively high level of student bullying, it can be stated that being bullied many times a year is a frequent occurrence for the average student in Kazakhstan.

Finally, to note, there were a few differences between students' responses and the OECD average. For example, in Kazakhstan, 79% percent of kids said they felt lonely at school, compared to 84% percent in the OECD. More research into the meaning of this difference and what might cause it is needed in Kazakhstan. In terms of students feeling like outsiders, the results were nearly identical, with 79% percent and 80% percent, respectively, with OECD countries having a little advantage.

5.3 RQ2: To what degree do students' experience of (a) school relations and (b) sense of belongingness vary within and between schools in Kazakhstan?

As demonstrated by the low ICC estimates, student-level school climate factors have a lot of variety within schools and don't seem to vary much between schools (in terms of differences in school averages). Therefore, it can be stated that, in terms of school belongingness, the majority of schools are unlikely to differ systematically. However, this seems to differ from the overall findings in the official OECD report which states that students' sense of belonging differs depending on location: rural or urban, and school type: public or private school (OECD, 2019b).

The preliminary findings here suggest that such systemic differences between school types do not exist though further research could be undertaken to confirm this.

5.4 RQ3: How are Students' School Relations Best Measured in Kazakhstan?

A nine-factor measurement model for student-perceived school relationships was specified to represent the observed data. Construct validity was supported by the measurement model, which was well-fitting and met the requirements for convergent and discriminant validity.

The size and direction of the inter-factor correlations suggest that students provided genuine responses that matched with the theory. The correlations were often minor, indicating that each element was unique.

The key finding for RQ3 is that the defined measurement model gives a well-fitting representation of the observed data, and the current study's findings can be applied to a larger target population of Kazakhstani 15-year-olds. Further work can also be undertaken in other post-Soviet countries to confirm the structure of this approach to the measurement of these contracts.

5.5 RQ4: What are the Main Relational and Contextual Antecedents of Kazakhstani Students' Sense of Belonging in School?

The structural models reveal the main drivers of school belongingness for 15-year-old Kazakhstani students. The focus of this section will be on the factors that differ and extent our current understanding of the drivers of student belonging. For instance, Teacher Support showed a strong effect on students' sense of belonging. However, it is only the second most important factor after the Cooperation at School factor. Therefore, it could be concluded that support from peers and teachers strongly boost Sense of Belongingness at school. Meanwhile Students' Experience of Being Bullied factor has strong negative effect on belonging.

Other factors like Teacher Enthusiasm and Adaptation of Instruction also have positive effect on Sense of Belongingness. This overall makes sense as the supportive attitude of teachers has positive effect and this hypothesis supported by literature review. Despite Teacher Empathy exhibiting a positive effect on belongingness, the effect itself is generally smaller and less significant than the other effects.

Taking in account these findings, one can say that Kazakhstani teachers and policymakers should focus on supporting students by including more cooperative activities, focusing on improving student support from teachers, and implementing socially and culturally appropriate anti-bullying programs in schools.

5.6 Summary

The findings of this thesis mostly support previous studies. Cooperation at School and Teacher Support have strong positive effect on belonging as supported by literature review. Findings here extend this body of research by identifying that Teacher Enthusiasm, Adaptation of Instruction, and Teacher Empathy factors also play an important, though more moderate, role for improving students' sense of belonging in Kazakhstan. Finally, the negative effect of being bullied also was predictable from literature review.

6. Conclusion and Implications

6.1 Summary of research findings

The purpose of this quantitative study was to examine the influence of school relationships factors on the sense of belongingness of Kazakhstani students. Upon reviewing the research questions and findings, some concluding remarks are offered.

The majority of the students found their teachers to be helpful and enthusiastic, according to descriptive statistics reported at the student level. Students ranked collaboration higher than competition, and some said they didn't feel like they belonged at school and had been bullied.

Notably, the study's findings imply that a student's school relationship experience is generally individual and varied inside the school rather than systemic to certain schools or school systems. As a result, Kazakhstani schools appear to have quite comparable composite school relation ratings.

Students' experiences of the school social environment in Kazakhstan is conceptualized using a single-level nine-factor measuring model for student experience of school relations. Generally, results from the main models supported previous theories. However, the positive effects of teacher empathy and teacher enthusiasm were new in this paper. Therefore, this finding seems to be important for further investigations.

Despite the majority of school relation factors being statistically significant, this research revealed that *most* significant factors positively effecting sense of belongingness were Cooperation at School and Teacher Support factors. And Students' Experience of Being Bullied had the most negative effect on belonging.

6.2 Recommendation for Future Research

It is recommended that future research involve studies that triangulate the findings associated with students' sense of belonging in Kazakhstan. As this paper focused only on secondary analysis of PISA survey, further mixed methodologies could be usefully applied to extend and confirm the nature of belongingness in Kazakhstani schools. In addition, the anti-bulling attitude of students could be examined because it could have strong positive effect on students' sense of belonging. In the Kazakhstani context, it is possible that bullying may also occur on the part of the teacher and this may be an issue. Therefore, further investigation of this phenomenon could be useful.

6.3.1 Recommendation for Administrations

Previously we explained the importance of sense of belongingness for healthy development of students and enhancement of their academic achievements. Hence, government and school policy planners, administrators, and teacher leadership should conduct activities and programs that mitigate and prevent student bullying and develop related attitudes against such behavior from students. Developing supportive environments in schools could also be useful.

6.3.2 Recommendation for Ministry of Education

Teachers, school leaders, and administrators might benefit from specialized training courses designed and delivered by the Ministry of Education. These courses could be held at both schools and teacher education centers. The course's curriculum should emphasize the need of (1) anti-bullying attitudes and (2) the necessity to create a pleasant environment through preventing bullying situations. The importance of the above-mentioned theories may also be discussed during classes. Furthermore, the Ministry of Education may organize or accept student-led efforts to establish specific clubs aimed at fostering anti-bullying attitudes. Such programs could also

include instruction and activities on fostering cooperation in schools and the value and appropriateness of certain supportive teacher behaviors toward students.

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Appendix

```
################################### START FROM HERE ######################################
getwd()
setwd("/Users/adilbek/Documents/PISAresearch")

# Install packages
if (!require("haven")) {
  install.packages("haven", dependencies = TRUE)
  library(haven)
}

if (!require("car")) {
  install.packages("car", dependencies = TRUE)
  library(car)
}

if (!require("lme4")) {
  install.packages("lme4", dependencies = TRUE)
  library(lme4)
}

if (!require("optimx")) {
  install.packages("optimx", dependencies = TRUE)
  library(optimx)
}
# e1071 for estimating variable skewness
if(!require("e1071")){
  install.packages("e1071", dependencies=T)
  library(e1071)
}

# lavaan package: latent variable analysis
# e1071 for estimating variable skewness
if(!require("lavaan")){
  install.packages("lavaan", dependencies=T)
  library(lavaan)
```

```
}

#### Using your merged data, retain only the variables to use in your study (create new df)
kaz.merged <- read.csv("kaz.merged.csv")
dim(kaz.merged)

#### Calculate some school averages
school.ESCS <- tapply(kaz.merged$ESCS, kaz.merged$CNTSCHID, FUN=function(x)mean(x, na.rm=T))
freq.std.sch <- unname(table(kaz.merged$CNTSCHID))
mean.ESCS <- rep(school.ESCS, freq.std.sch)

kaz.merged <- cbind.data.frame(kaz.merged, mean.ESCS)

project.var.logic <- colnames(kaz.merged) %in% c("CNTSCHID", #school ID
                                        "ST004D01T",  #gender
                                        "ST034Q01TA", #sense of belongingness
                                        "ST034Q02TA", #sense of belongingness
                                        "ST034Q03TA", #sense of belongingness
                                        "ST034Q04TA", #sense of belongingness
                                        "ST034Q05TA", #sense of belongingness
                                        "ST034Q06TA", #sense of belongingness
                                        "ST100Q01TA", #perceived teacher support
                                        "ST100Q02TA", #perceived teacher support
                                        "ST100Q03TA", #perceived teacher support
                                        "ST100Q04TA", #perceived teacher support
                                        "ST211Q01HA", #teacher empathy
                                        "ST211Q02HA", #teacher empathy
                                        "ST211Q03HA", #teacher empathy
                                        "ST212Q01HA", #adaptation of instruction
                                        "ST212Q02HA", #adaptation of instruction
                                        "ST212Q03HA", #adaptation of instruction
                                        "ST213Q01HA", #teacher enthusiasm
                                        "ST213Q02HA", #teacher enthusiasm
                                        "ST213Q03HA", #teacher enthusiasm
                                        "ST213Q04HA", #teacher enthusiasm
                                        "ST038Q03NA", #student's experience of being bullied
                                        "ST038Q04NA", #student's experience of being bullied
                                        "ST038Q05NA", #student's experience of being bullied
                                        "ST038Q06NA", #student's experience of being bullied
                                        "ST038Q07NA", #student's experience of being bullied
```

```
                    "ST038Q08NA", #student's experience of being bullied
                    "CREACTIV",   #extra-curricular activities
                    "SC013Q01TA", #school type
                    "SC001Q01TA", #school location
                    "SCHSIZE",    #school size
                    "CLSIZE",     #class size
                    "ESCS",       #School economic, social and cultural status
                    "ST206Q01HA", #Perception of cooperation at school
                    "ST206Q02HA", #Perception of cooperation at school
                    "ST206Q03HA", #Perception of cooperation at school
                    "ST206Q04HA", #Perception of cooperation at school
                    "ST205Q01HA", #Perception of competition at school
                    "ST205Q02HA", #Perception of competition at school
                    "ST205Q03HA", #Perception of competition at school
                    "ST205Q04HA", #Perception of competition at school
                    "PV1MATH",    #math
                    "PV2MATH",    #math
                    "PV3MATH",    #math
                    "PV4MATH",    #math
                    "PV5MATH",    #math
                    "PV1READ",    #reading
                    "PV2READ",    #reading
                    "PV3READ",    #reading
                    "PV4READ",    #reading
                    "PV5READ",    #reading
                    "PV1SCIE",    #science
                    "PV2SCIE",    #science
                    "PV3SCIE",    #science
                    "PV4SCIE",    #science
                    "PV5SCIE",    #science
                    "mean.ESCS")  #mean ESCS

print(project.var.logic)
project.var.df <- kaz.merged[, project.var.logic]
dim(project.var.df)

p <- function(x){sum(is.na(x))/length(x)*100}
apply(project.var.df, 2, p)

complete.cases <- sum(complete.cases(project.var.df))
```

```
percentage.complete <- complete.cases/ nrow(project.var.df) *100
print(percentage.complete) #66.59661

remove1 <- na.omit(project.var.df)
dim(remove1)  # 12991    58
19507-12991 #6516 removed
print("CNTSCHID")

#### Examine variation of variables within each school (this is necesasary for modelling)
# First check for singletons
unique(remove1$CNTSCHID)
remove1$ST004D01T[remove1$CNTSCHID == 39800001]
remove1$ST004D01T[remove1$CNTSCHID == 39800055] # no variation because singleton
# identify the singleton schools
singleton.schools <- names(which(sort(table(remove1$CNTSCHID)) == 1))
print(singleton.schools)
length(singleton.schools)  # 19 singleton schools
# Remove singleton schools
sum(remove1$CNTSCHID %in% singleton.schools)
not.singleton.v <- !remove1$CNTSCHID %in% singleton.schools   # reverse the logical with not (!)
sum(not.singleton.v)
# Remove singletons
remove1 <- remove1[not.singleton.v, ]
dim(remove1)  # 12971    58
12991-12971

#### Checking for variaiton in gender
gender.sd.vector <- tapply(remove1$ST004D01T, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
single.sex.sch.v <- names(which(sort(gender.sd.vector) == 0))
print(single.sex.sch.v)
not.single.sex.v <- !remove1$CNTSCHID %in% single.sex.sch.v
remove1 <- remove1[not.single.sex.v, ]
dim(remove1)  # 12782    58
12971-12782   # Removed 189 single sex school students

19507-12782
#### Other veriables ####

#### Checking variaiotn in ST034Q01TA
belong1.sd.vector <- tapply(remove1$ST034Q01TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
```

```
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12755 58
12782-12755  # removed 27 students who exhibited no variation in ST034Q01TA in their schools

#### Checking variaiotn in ST034Q02TA
belong1.sd.vector <- tapply(remove1$ST034Q02TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12738 58
12755-12738  # removed 17 students who exhibited no variation in ST034Q02TA in their schools

#### Checking variaiotn in ST034Q03TA
belong1.sd.vector <- tapply(remove1$ST034Q03TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12730 58
12738-12730  # removed 8 students who exhibited no variation in ST034Q03TA in their schools

#### Checking variaiotn in ST034Q04TA
belong1.sd.vector <- tapply(remove1$ST034Q04TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12692 58
12730-12692  # removed 38 students who exhibited no variation in ST034Q04TA in their schools

#### Checking variaiotn in ST034Q05TA
belong1.sd.vector <- tapply(remove1$ST034Q05TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
```

```
dim(remove1) # 12679 58
12692-12679  # removed 13 students who exhibited no variation in ST034Q05TA in their schools

#### Checking variaiotn in ST034Q06TA
belong1.sd.vector <- tapply(remove1$ST034Q06TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12657 58
12679-12657  # removed 22 students who exhibited no variation in ST034Q06TA in their schools

#### Checking variaiotn in ST100Q01TA #percieved teacher support
belong1.sd.vector <- tapply(remove1$ST100Q01TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12656 58
12657-12656  # removed 1 students who exhibited no variation in ST100Q01TA in their schools

#### Checking variaiotn in ST100Q02TA #percieved teacher support
belong1.sd.vector <- tapply(remove1$ST100Q02TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12636 58
12656-12636  # removed 20 students who exhibited no variation in ST100Q02TA in their schools

#### Checking variaiotn in ST100Q03TA #percieved teacher support
belong1.sd.vector <- tapply(remove1$ST100Q03TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12627 58
12636-12627  # removed 9 students who exhibited no variation in ST100Q03TA in their schools

#### Checking variaiotn in ST100Q04TA #percieved teacher support
```

```
belong1.sd.vector <- tapply(remove1$ST100Q04TA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12617 58
12627-12617  # removed 10 students who exhibited no variation in ST100Q04TA in their schools

#### Checking variaiotn in ST038Q03NA #student's experience of being bullied
belong1.sd.vector <- tapply(remove1$ST038Q03NA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12557 58
12617-12557  # removed 60 students who exhibited no variation in ST038Q03NA in their schools

#### Checking variaiotn in ST038Q04NA #student's experience of being bullied
belong1.sd.vector <- tapply(remove1$ST038Q04NA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12350 58
12557-12350 # removed 207 students who exhibited no variation in ST038Q04NA in their schools

#### Checking variaiotn in ST038Q05NA #student's experience of being bullied
belong1.sd.vector <- tapply(remove1$ST038Q05NA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12199 58
12350-12199  # removed 151 students who exhibited no variation in ST038Q05NA in their schools

#### Checking variaiotn in ST038Q06NA #student's experience of being bullied
belong1.sd.vector <- tapply(remove1$ST038Q06NA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
```

```
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12176 58
12199-12176  # removed 23 students who exhibited no variation in ST038Q06NA in their schools

#### Checking variaiotn in ST038Q07NA #student's experience of being bullied
belong1.sd.vector <- tapply(remove1$ST038Q07NA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12140 58
12176-12140  # removed 36 students who exhibited no variation in ST038Q07NA in their schools

#### Checking variaiotn in ST038Q08NA #student's experience of being bullied
belong1.sd.vector <- tapply(remove1$ST038Q08NA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12107 58
12140-12107  # removed 33 students who exhibited no variation in ST038Q08NA in their schools

#### Checking variaiotn in ST206Q01HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST206Q01HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12100 58
12107-12100  # removed 7 students who exhibited no variation in ST206Q01HA in their schools

#### Checking variaiotn in ST206Q02HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST206Q02HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12095 58
12100-12095  # removed 5 students who exhibited no variation in ST206Q02HA in their schools
```

```
#### Checking variaiotn in ST206Q03HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST206Q03HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12090 58
12095-12090  # removed 5 students who exhibited no variation in ST206Q03HA in their schools

#### Checking variaiotn in ST206Q04HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST206Q04HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12090 58
12090        # removed 0 students who exhibited no variation in ST206Q04HA in their schools

#### Checking variaiotn in ST205Q01HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST205Q01HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12423 58
12090        # removed 0 students who exhibited no variation in ST205Q01HA in their schools

#### Checking variaiotn in ST205Q02HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST205Q02HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12416 58
12423-12416  # removed 7 students who exhibited no variation in ST205Q02HA in their schools

#### Checking variaiotn in ST205Q03HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST205Q03HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
```

```
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12090-12083  # removed 7 students who exhibited no variation in ST205Q03HA in their schools

#### Checking variaiotn in ST205Q04HA #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$ST205Q04HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in ST205Q04HA in their schools

#### Checking variaiotn in PV1MATH #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV1MATH, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV1MATH in their schools

#### Checking variaiotn in PV2MATH #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV2MATH, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV2MATH in their schools

#### Checking variaiotn in PV3MATH #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV3MATH, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV3MATH in their schools
```

```
#### Checking variaiotn in PV4MATH #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV4MATH, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV4MATH in their schools

#### Checking variaiotn in PV5MATH #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV5MATH, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV5MATH in their schools

#### Checking variaiotn in PV1READ #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV1READ, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV1READ in their schools

#### Checking variaiotn in PV2READ #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV2READ, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV2READ in their schools

#### Checking variaiotn in PV3READ #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV3READ, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
```

```
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV3READ in their schools

#### Checking variaiotn in PV4READ #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV4READ, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV4READ in their schools

#### Checking variaiotn in PV5READ #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV5READ, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV5READ in their schools

#### Checking variaiotn in PV1SCIE #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV1SCIE, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV1SCIE in their schools

#### Checking variaiotn in PV2SCIE #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV2SCIE, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
```

```
12083       # removed 0 students who exhibited no variation in PV2SCIE in their schools

#### Checking variaiotn in PV3SCIE #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV3SCIE, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV3SCIE in their schools

#### Checking variaiotn in PV4SCIE #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV4SCIE, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV4SCIE in their schools

#### Checking variaiotn in PV5SCIE #Perception of cooperation at school
belong1.sd.vector <- tapply(remove1$PV5SCIE, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12083 58
12083       # removed 0 students who exhibited no variation in PV5SCIE in their schools

#### Checking variaiotn in ST211Q01HA #teacher empathy
belong1.sd.vector <- tapply(remove1$ST211Q01HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12078 58
12083-12078  # removed 5 students who exhibited no variation in ST211Q01HA in their schools

#### Checking variaiotn in ST211Q02HA #teacher empathy
belong1.sd.vector <- tapply(remove1$ST211Q02HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
```

```
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12072 58
12078-12072  # removed 6 students who exhibited no variation in ST211Q02HA in their schools

#### Checking variaiotn in ST211Q03HA #teacher empathy
belong1.sd.vector <- tapply(remove1$ST211Q03HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12067 58
12072-12067  # removed 5 students who exhibited no variation in ST211Q03HA in their schools

#### Checking variaiotn in ST212Q01HA #adaptation of inst
belong1.sd.vector <- tapply(remove1$ST212Q01HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12067 58
12067       # removed 0 students who exhibited no variation in ST212Q01HA in their schools

#### Checking variaiotn in ST212Q02HA #adaptation of inst
belong1.sd.vector <- tapply(remove1$ST212Q02HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12067 58
12067       # removed 0 students who exhibited no variation in ST212Q02HA in their schools

#### Checking variaiotn in ST212Q03HA #adaptation of inst
belong1.sd.vector <- tapply(remove1$ST212Q03HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
```

```
dim(remove1) # 12067 58
12067       # removed 0 students who exhibited no variation in ST212Q03HA in their schools

#### Checking variaiotn in ST213Q01HA #teacher enthusiasm
belong1.sd.vector <- tapply(remove1$ST213Q01HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12067 58
12067       # removed 0 students who exhibited no variation in ST213Q01HA in their schools

#### Checking variaiotn in ST213Q02HA #teacher enthusiasm
belong1.sd.vector <- tapply(remove1$ST213Q02HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12067 58
12067       # removed 0 students who exhibited no variation in ST213Q02HA in their schools

#### Checking variaiotn in ST213Q03HA #teacher enthusiasm
belong1.sd.vector <- tapply(remove1$ST213Q03HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12061 58
12067-12061  # removed 6 students who exhibited no variation in ST213Q03HA in their schools

#### Checking variaiotn in ST213Q04HA #teacher enthusiasm
belong1.sd.vector <- tapply(remove1$ST213Q04HA, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
belong1.0.v <- names(which(sort(belong1.sd.vector) == 0))
belong1.no0.v <- !remove1$CNTSCHID %in% belong1.0.v
remove1 <- remove1[belong1.no0.v, ]
dim(remove1) # 12044 58
12061-12044  # removed 17 students who exhibited no variation in ST213Q04HA in their schools

######## Just to check ########
```

```
#### Checking variaiotn in CREACTIV #extra-curricular activities
belong1.sd.vector <- tapply(remove1$CREACTIV, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
12044  # removed   students who exhibited no variation in CREACTIV in their schools

#### Checking variaiotn in CLSIZE #class size
belong1.sd.vector <- tapply(remove1$CLSIZE, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
12044  # removed   students who exhibited no variation in CLSIZE in their schools

#### Checking variaiotn in ESCS #class size
belong1.sd.vector <- tapply(remove1$ESCS, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
12044  # removed   students who exhibited no variation in ESCS in their schools

#### Checking variaiotn in mean.ESCS #class size
belong1.sd.vector <- tapply(remove1$mean.ESCS, remove1$CNTSCHID, FUN=function(x)sd(x, na.rm=T))
sort(belong1.sd.vector)
12044  # removed   students who exhibited no variation in mean.ESCS in their schools

print(belong1.sd.vector)

############################################## NULL ##############################################
# Get ICC statistic for each variable
##################################################################################################
NULL.MODEL <- lme4::lmer(ST004D01T ~ 1                                  ## There are no predictors, only group mean fixed, ~1
                  + (1 | CNTSCHID),                    ## Scores vary only within and between the schools (CNTSCHID)
                  data = remove1,                      ## The dataframe
                  REML=F,
                  control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                              optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                       ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
```

```
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 4,51% of the variation in ST004D01T scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST034Q01TA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 0.0120% of the variation in ST034Q01TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST034Q02TA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 0.0136% of the variation in ST034Q02TA scores are related to school students are in

#############################################################################################
```

```
NULL.MODEL <- lme4::lmer(ST034Q03TA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 0.0257% of the variation in ST034Q03TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST034Q04TA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 0.008% of the variation in ST034Q04TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST034Q05TA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
```

```
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                     ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 0.0125% of the variation in ST034Q05TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST034Q06TA ~ 1                         ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                       ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                         ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                     ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 0.0134% of the variation in ST034Q06TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST100Q01TA ~ 1                         ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                       ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                         ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                     ## Need to extract variance components
```

```
Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 0.0484% of the variation in ST100Q01TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST100Q02TA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0275% of the variation in ST100Q02TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST100Q03TA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
```

```
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0361% of the variation in ST100Q03TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST100Q04TA ~ 1                          ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0275% of the variation in ST100Q04TA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST038Q03NA ~ 1                          ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0151% of the variation in ST038Q03NA scores are related to school students are in
```

```
#############################################################################################
NULL.MODEL <- lme4::lmer(ST038Q04NA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0181% of the variation in ST038Q04NA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST038Q05NA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0513% of the variation in ST038Q05NA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST038Q06NA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
```

```
                data = remove1,                         ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                     ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0459% of the variation in ST038Q06NA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST038Q07NA ~ 1                         ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                       ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                         ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                     ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0553% of the variation in ST038Q07NA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST038Q08NA ~ 1                         ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                       ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                         ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
```

```
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0315% of the variation in ST038Q08NA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST206Q01HA ~ 1                          ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0603% of the variation in ST206Q01HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST206Q02HA ~ 1                          ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
```

```
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0586% of the variation in ST206Q02HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST206Q03HA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.059% of the variation in ST206Q03HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST206Q04HA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
```

```
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0614% of the variation in ST206Q04HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST205Q01HA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0539% of the variation in ST205Q01HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST205Q02HA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0581% of the variation in ST205Q02HA scores are related to school students are in

#############################################################################################
```

```
NULL.MODEL <- lme4::lmer(ST205Q03HA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0567% of the variation in ST205Q03HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST205Q04HA ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0450% of the variation in ST205Q04HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(CREACTIV ~ 1                      ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ##** The dataframe
                REML=F,
```

```
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                            optCtrl = list(method = "nlminb")))       # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                          ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.0450% of the variation in CREACTIV scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ESCS ~ 1                                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                    ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                      ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                            optCtrl = list(method = "nlminb")))       # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                          ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 0.2395% of the variation in ESCS scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(PV5SCIE ~ 1                                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                    ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                      ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                            optCtrl = list(method = "nlminb")))       # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                          ##** Need to extract variance components
```

```
Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 37.2% of the variation in PV5SCIE scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(PV4SCIE ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                              ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 37.6% of the variation in PV4SCIE scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(PV3SCIE ~ 1                    ##** There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                ##** Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ##** The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
##** Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                              ##** Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
```

```
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) #* therefore, 36.7% of the variation in PV3SCIE scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(PV2SCIE ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))    # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                              ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 36.3% of the variation in PV2SCIE scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(PV1SCIE ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))    # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                              ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 37.5% of the variation in PV1SCIE scores are related to school students are in
```

```
#############################################################################################
NULL.MODEL <- lme4::lmer(ST211Q01HA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))    # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 3,41% of the variation in ST211Q01HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST211Q02HA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))    # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 3,09% of the variation in ST211Q02HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST211Q03HA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
```

```
                data = remove1,                         ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                     ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 3,42% of the variation in ST211Q03HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST212Q01HA ~ 1                         ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                       ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                         ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                     ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 3,60% of the variation in ST212Q01HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST212Q02HA ~ 1                         ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                       ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                         ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
```

```
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 4,99% of the variation in ST212Q02HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST212Q03HA ~ 1                          ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 2,57% of the variation in ST212Q03HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST213Q01HA ~ 1                          ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                  ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                    ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
```

```
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 6,27% of the variation in ST213Q01HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST213Q02HA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                 ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 6,06% of the variation in ST213Q02HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST213Q03HA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                 ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
```

```
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 3,23% of the variation in ST213Q03HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ST213Q04HA ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))    # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 3,56% of the variation in ST213Q04HA scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(ESCS ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))    # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 24,0% of the variation in ESCS scores are related to school students are in
```

```
############################################################ PVMMATH
#################################################################
# You also need to find the mean PV value for each of the three subjects
which(colnames(remove1) == "PV1MATH") # 43
which(colnames(remove1) == "PV5MATH") # 47
# So, find mean PV for math and add to the remove1 dataframe
PVMMATH <- apply(remove1[, 43:47], 1, FUN=function(x)mean(x, na.rm=T))  # here PVMMATH is the mean of the three values
remove1 <-cbind.data.frame(remove1, PVMMATH)
colnames(remove1)

############################################################ PVMSCIE ##########################################################################
which(colnames(remove1) == "PV1SCIE") # 53
which(colnames(remove1) == "PV5SCIE") # 57
PVMSCIE <- apply(remove1[, 53:57], 1, FUN=function(x)mean(x, na.rm=T))  # here PVMSCIE is the mean of the three values
remove1 <-cbind.data.frame(remove1, PVMSCIE)
colnames(remove1)

############################################################ PVMREAD
#################################################################
which(colnames(remove1) == "PV1READ") # 48
which(colnames(remove1) == "PV5READ") # 52
PVMREAD <- apply(remove1[, 48:52], 1, FUN=function(x)mean(x, na.rm=T))  # here PVMREAD is the mean of the three values
remove1 <-cbind.data.frame(remove1, PVMREAD)
colnames(remove1)

#########################################################################################################
NULL.MODEL <- lme4::lmer(PVMMATH ~ 1                                ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                    ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                 ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
```

```
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 4,64% of the variation in PVMMATH scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(PVMSCIE ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                 ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                 ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 41,6% of the variation in PVMSCIE scores are related to school students are in

#############################################################################################
NULL.MODEL <- lme4::lmer(PVMREAD ~ 1                    ## There are no predictors, only group mean fixed, ~1
                + (1 | CNTSCHID),                  ## Scores vary only within and between the schools (CNTSCHID)
                data = remove1,                 ## The dataframe
                REML=F,
                control = lme4::lmerControl(optimizer = "optimx", calc.derivs = FALSE,
                                optCtrl = list(method = "nlminb")))      # These are special model controls to get a solution quickly.
## Optimises the log likelihood when producing estimates
summary(NULL.MODEL)                                 ## Need to extract variance components

Var.comp <- print(VarCorr(NULL.MODEL),comp="Variance")
Var.comp <- as.data.frame(Var.comp)
BTW.School <- Var.comp$vcov[1]
WTN.Country <- Var.comp$vcov[2]
total.var <- BTW.School + WTN.Country
Level2.ICC <- BTW.School / total.var
print(Level2.ICC) # therefore, 40,0% of the variation in PVMREAD scores are related to school students are in
```

```
########################################################## PVMMATH
#################################################################
# You also need to find the mean PV value for each of the three subjects
which(colnames(remove1) == "PV1MATH") # 43
which(colnames(remove1) == "PV5MATH") # 47
# So, find mean PV for math and add to the remove1 dataframe
PVMMATH <- apply(remove1[, 43:47], 1, FUN=function(x)mean(x, na.rm=T))  # here PVMMATH is the mean of the three values
remove1 <-cbind.data.frame(remove1, PVMMATH)
colnames(remove1)

########################################################## PVMSCIE ###########################################################
which(colnames(remove1) == "PV1SCIE") # 53
which(colnames(remove1) == "PV5SCIE") # 57
PVMSCIE <- apply(remove1[, 53:57], 1, FUN=function(x)mean(x, na.rm=T))  # here PVMSCIE is the mean of the three values
remove1 <-cbind.data.frame(remove1, PVMSCIE)
colnames(remove1)

########################################################## PVMREAD
#################################################################
which(colnames(remove1) == "PV1READ") # 48
which(colnames(remove1) == "PV5READ") # 52
PVMREAD <- apply(remove1[, 48:52], 1, FUN=function(x)mean(x, na.rm=T))  # here PVMREAD is the mean of the three values
remove1 <-cbind.data.frame(remove1, PVMREAD)
colnames(remove1)

########################################################## Recode ############################################################

remove1$ST034Q02TA <- recode(remove1$ST034Q02TA, "1 = 4 ; 2 = 3 ; 3 = 2 ; 4 = 1") #Sense of isolation
remove1$ST034Q03TA <- recode(remove1$ST034Q03TA, "1 = 4 ; 2 = 3 ; 3 = 2 ; 4 = 1")
remove1$ST034Q05TA <- recode(remove1$ST034Q05TA, "1 = 4 ; 2 = 3 ; 3 = 2 ; 4 = 1")

remove1$ST100Q01TA <- recode(remove1$ST100Q01TA, "1 = 4 ; 2 = 3 ; 3 = 2 ; 4 = 1") #Perceived teacher support
remove1$ST100Q02TA <- recode(remove1$ST100Q02TA, "1 = 4 ; 2 = 3 ; 3 = 2 ; 4 = 1")
remove1$ST100Q03TA <- recode(remove1$ST100Q03TA, "1 = 4 ; 2 = 3 ; 3 = 2 ; 4 = 1")
remove1$ST100Q04TA <- recode(remove1$ST100Q04TA, "1 = 4 ; 2 = 3 ; 3 = 2 ; 4 = 1")

########################################################## SKEWNESS
#################################################################
```

```
apply(remove1, 2, function(x)skewness(x))

##################################################### Standard Deviation/Mean ###################################################

# The 'apply' function allows you to apply a function to rows(1) or columns(2):
# Note. when using the apply function, use the

summary(remove1)
options(scipen = 9999999)      # removes scientific notatoin for numbers
apply(remove1, 2, mean)        # This works but is not 'full proof' if there is some missing data.
apply(remove1, 2, FUN=function(x)mean(x, na.rm=T))  # This approach manages missing data
apply(remove1, 2, FUN=function(x)sd(x, na.rm=T))  # This approach manages missing data

##################################################### Measurment model ##########################################################

model <- '
        Teach.sup =~ ST100Q01TA + ST100Q02TA + ST100Q03TA + ST100Q04TA
        Adapt.ins =~ ST212Q01HA + ST212Q02HA + ST212Q03HA
        Teach.emp =~ ST211Q01HA + ST211Q02HA + ST211Q03HA
        Teach.enth =~ ST213Q01HA + ST213Q02HA + ST213Q03HA + ST213Q04HA
        Exp.bull =~ ST038Q03NA + ST038Q04NA + ST038Q05NA + ST038Q06NA + ST038Q07NA + ST038Q08NA
        Comp.sch =~ ST205Q01HA + ST205Q02HA + ST205Q03HA + ST205Q04HA
        Coop.sch =~ ST206Q01HA + ST206Q02HA + ST206Q03HA + ST206Q04HA
        Sense.of.belong =~ ST034Q02TA + ST034Q03TA + ST034Q05TA
        Sense.of.belongR =~ ST034Q01TA + ST034Q04TA + ST034Q06TA
       '
fit <- lavaan::cfa(model = model,
                   data = remove1,
                   std.lv=T,
                   estimator="MLR")

summary(fit, fit.measures=TRUE)     # Chi-square = 4206.497, df = 491,
4206.497/491 # 8.567 is the chi-square/df ratio
pchisq(8.567, df=1, lower.tail=FALSE) # 0.003423107 is the chi-square to p value ratio p value
# SRMR 0.023
# RMSEA 0.028(lower 90%CI 0.028, upper 90% CI 0.29)
# CFI 0.981,

estim <- parameterestimates(fit, standardized=TRUE)
options(max.print=1000000)
```

```
print(estim)

#########################################################################

lambda<-c(0.671,0.782,0.818,0.741)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.5699925 Teacher supp

lambda<-c(0.716,0.801,0.662)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.5308337 Adapt inst

lambda<-c(0.878,0.855,0.858)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.7460243 Teacher empth

lambda<-c(0.841,0.836,0.832,0.850)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.7052252 Teacher enth

lambda<-c(0.532,0.809,0.915,0.898,0.919,0.841)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.6888293 Exp bull

lambda<-c(0.820,0.902,0.886,0.729)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.7006102 Comp sch

lambda<-c(0.863,0.912,0.920,0.853)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.7876305 Coop sch

lambda<-c(0.747,0.742,0.707)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.5361407 Sense of belong

lambda<-c(0.744,0.806,0.809)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.6192177 Sense of belongR
```

```
######################################### Sem model Belong ##########################################

model <- '
        Teach.sup =~ ST100Q01TA + ST100Q02TA + ST100Q03TA + ST100Q04TA
        Adapt.ins =~ ST212Q01HA + ST212Q02HA + ST212Q03HA
        Teach.emp =~ ST211Q01HA + ST211Q02HA + ST211Q03HA
        Teach.enth =~ ST213Q01HA + ST213Q02HA + ST213Q03HA + ST213Q04HA
        Exp.bull =~ ST038Q03NA + ST038Q04NA + ST038Q05NA + ST038Q06NA + ST038Q07NA + ST038Q08NA
        Comp.sch =~ ST205Q01HA + ST205Q02HA + ST205Q03HA + ST205Q04HA
        Coop.sch =~ ST206Q01HA + ST206Q02HA + ST206Q03HA + ST206Q04HA
        Sense.of.belong =~ ST034Q02TA + ST034Q03TA + ST034Q05TA
        Sense.of.belongR =~ ST034Q01TA + ST034Q04TA + ST034Q06TA

        Sense.of.belong ~ Teach.sup + Adapt.ins + Teach.emp + Teach.enth + Exp.bull + Comp.sch + Coop.sch
        Sense.of.belongR ~ Teach.sup + Adapt.ins + Teach.emp + Teach.enth + Exp.bull + Comp.sch + Coop.sch
      '
fit <- lavaan::sem(model = model,
                   data = remove1,
                   std.lv=T,
                   estimator="MLR")

summary(fit, fit.measures=TRUE)
# Chi-square = 4206.497, df = 491,
4206.497/491 # 8.567 is the chi-square/df ratio
pchisq(8.567, df=1, lower.tail=FALSE) # 0.003423107 is the chi-square to p value ratio p value
# SRMR 0.023
# RMSEA 0.028(lower 90%CI 0.028, upper 90% CI 0.29)
# CFI 0.981,

estim <- parameterestimates(fit, standardized=TRUE)
options(max.print=1000000)
print(estim)

######################################### Academic and Economic Model ###################################

remove1$PV1MATH <- scale(remove1$PV1MATH)
remove1$PV2MATH <- scale(remove1$PV2MATH)
remove1$PV3MATH <- scale(remove1$PV3MATH)
remove1$PV4MATH <- scale(remove1$PV4MATH)
```

```
remove1$PV1READ <- scale(remove1$PV1READ)
remove1$PV2READ <- scale(remove1$PV2READ)
remove1$PV3READ <- scale(remove1$PV3READ)
remove1$PV4READ <- scale(remove1$PV4READ)
remove1$PV5READ <- scale(remove1$PV5READ)

remove1$PV1SCIE <- scale(remove1$PV1SCIE)
remove1$PV2SCIE <- scale(remove1$PV2SCIE)
remove1$PV3SCIE <- scale(remove1$PV3SCIE)
remove1$PV4SCIE <- scale(remove1$PV4SCIE)
remove1$PV5SCIE <- scale(remove1$PV5SCIE)

remove1$ESCS <- scale(remove1$ESCS)

model <- '
        Teach.sup =~ ST100Q01TA + ST100Q02TA + ST100Q03TA + ST100Q04TA
        Adapt.ins =~ ST212Q01HA + ST212Q02HA + ST212Q03HA
        Teach.emp =~ ST211Q01HA + ST211Q02HA + ST211Q03HA
        Teach.enth =~ ST213Q01HA + ST213Q02HA + ST213Q03HA + ST213Q04HA
        Exp.bull =~ ST038Q03NA + ST038Q04NA + ST038Q05NA + ST038Q06NA + ST038Q07NA + ST038Q08NA
        Comp.sch =~ ST205Q01HA + ST205Q02HA + ST205Q03HA + ST205Q04HA
        Coop.sch =~ ST206Q01HA + ST206Q02HA + ST206Q03HA + ST206Q04HA
        Sense.of.belong =~ ST034Q02TA + ST034Q03TA + ST034Q05TA

        Sense.of.belong ~ Teach.sup + Adapt.ins + Teach.emp + Teach.enth + Exp.bull + Comp.sch + Coop.sch + PVMMATH + PVMREAD + PVMSCIE + ESCS
       '
fit <- lavaan::cfa(model = model,
                   data = remove1,
                   std.lv=T,
                   estimator="MLR")

summary(fit, fit.measures=TRUE)     # Chi-square = 7834.620, df = 175,
7834.620/175 # 44.769 is the chi-square/df ratio
pchisq(44.769, df=1, lower.tail=FALSE) # 0.0000000000221 is the chi-square to p value ratio p value
# SRMR 0.023
# RMSEA 0.028(lower 90%CI 0.028, upper 90% CI 0.29)
# CFI 0.981,

estim <- parameterestimates(fit, standardized=TRUE)
options(max.print=1000000)
```

```
print(estim)

################################### AVE Academic ##########################################

lambda<-c(0.875,0.870,0.878,0.875)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.76475 Math

lambda<-c(0.964,0.963,0.964,0.965,0.964)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.92929 Reading

lambda<-c(0.930,0.927,0.929,0.930,0.929)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.86304 Science

lambda<-c(0.754,0.737,0.705)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.53623 Sense of belong

lambda<-c(0.744,0.807,0.807)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 0.61867 Sense of belongR

lambda<-c(0.841)
AVE<-sum(lambda^2)/(sum(lambda^2)+sum(1-(lambda^2)))
print(AVE)              # AVE 1.0 Mean.ESCS
```