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CONSTRUCTING SCALES AND INDEXES

IN NATIONAL SURVEYS OF STUDENT ACHIEVEMENT (NSSA) DATA

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CONSTRUCTING SCALES AND INDEXES IN NATIONAL SURVEYS OF STUDENT ACHIEVEMENT (NSSA) DATA

Developed under the project "Disparities in school achievement from a person and variable-oriented perspective: A prototype of a learning analytics tool NO-GAP"

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INTRODUCTION

In the context of digitalization and complex challenges facing contemporary educational systems and institutions, data collected in educational settings have a potential to become a central resource for educational organizations and other stakeholders. In relation to that, there is a growing need for systematic documentation and guidance on the possibilities of the existing educational datasets, collected and archived by public agencies, governmental, or academic institutions.

The current methodological guide explores some of the analytical possibilities provided by the National Surveys of Student Achievement (NSSA) data, collected in Lithuanian secondary schools during 2012-2016. The NSSAs are nationwide studies of academic achievement among students in schools providing comprehensive education. The NSSA data, based on nationally representative stratified two-stage nested samples, include standardized student achievement tests in math, reading, and other school subjects, as well as student and teacher self-report questionnaires on learning and teaching experiences and environment. The NSSAs were used to regularly monitor and improve the state of secondary education, provide insights on the quality of comprehensive education, and foster a culture of progress in the assessment of students' achievement. While the NSSAs have not been regularly conducted after 2016, the archived data from accomplished studies provide broad possibilities for analyzing patterns and factors of student achievement from the end of elementary school through middle school.

The data is open access and can be downloaded from the Lithuanian Data Archive for Social Sciences and Humanities (LiDA)[1]. The website of the National Agency for Education provides background documentation and empirical reports on the NSSAs[2]. While the NSSA data has been open access since its collection, their use in educational research has been limited. To facilitate the use of open-access NSSA data, we have developed this guide, which provides basic methodological guidance, as well as some ideas for analysis.

The aim of the current methodological guide is to explore the possibilities of traditional scaling approaches, and some alternatives, with the NSSA data in order to come up with a number of ready-made, reliable indicators for the analysis of student achievement in the context of socio-economic disparities, which increasingly affect educational systems worldwide (Chmielewski, 2019). The indicators described in this guide are oriented towards the analysis of achievement gaps related to socio-economic disparities among the Lithuanian students. The indicators cover students' socio-economic background, academic achievement, students' experiences and perceptions of school and home environment, as well as their relationships with teachers and parents.

The focus on socio-economic disparities stems from the project that the guide is an integral part of. The project "Disparities in school achievement from a person and variable-oriented perspective: A prototype of a learning analytics tool NO-GAP" (2020-2023)[3] focused on developing a prototype of an analytical tool for monitoring and analysis of achievement gaps related to student socio-economic background. The work covered the development of a theoretical model, its operationalization, and application on available educational data. In this respect, the NSSA data

[1] https://lida.dataverse.lt/dataverse/SurveyData_SMT_NMPT

[2] https://www.nsa.smm.lt/stebesenos-ir-vertinimo-departamentas/tyrimai/nacionaliniai-tyrimai/nacionaliniai-mokiniu-pasiekimu-tyrimai-nmpt/

[3] https://nogap.ktu.edu/

provided wide possibilites for exploring the operationalization of the main indicators related to the aims of the project, but also for a broader analysis of educational achievement gaps in Lithuania.

The scales and indexes in this guide, except for the indicators of student achievement, were developed specifically for the purposes of the NO-GAP project. The guide is organized into sections based on the main indicators, which can be constructed or retrieved from the NSSA datasets.

The first section addresses the indicators of student achievement and presents the analyses of their structure and measurement invariance in the NSSAs. The second section presents two different approaches for constructing the indicator of student socio-economic background. The third section presents several indicators of student motivational, emotional, and social functioning at school, which could be constructed by aggregating the NSSA items. The fourth section presents three aggregate indicators for assessing students' perceptions of teacher behaviors at school. The final section presents aggregate indicators for assessing support and relationships in students' family.

Each section presents a brief theoretical overview of the construct assessed, possible operationalization of the construct in the NSSA data, methodological principles of forming construct indicators, their descriptive statistics, and finally, aspects of validity and reliability of the composite score reflecting a construct. While most of the constructed indicators are based on the traditional psychometric approach to scale construction (specifically, exploratory and confirmatory factor analysis, Schmitt, 2011), in one instance we have also applied an alternative method. Specifically, in the case of student's socio-economic background indicators, we used multiple correspondence analysis (Greenacre, 2017).

With regard to the validity and reliability of the measures described in this guide, we follow the classical conceptualization of construct validity, as formulated by Cronbach & Meehl (1995), who suggested that construct validity could be examined by studying the internal structure of the measure (e.g., by means of factor analysis), as well as by applying a nomological net to demonstrate the discriminant validity of the measure (specifically, examining whether the associations between observed constructs in the study follow the predicted and theoretically meaningful ways). To explore the validity of more complex measures in NSSA data (specifically, achievement tests and socio-economic background indicators), we have also relied on more recent approach of structural equasion modeling (specifically, confirmatory factor analysis and invariance testing) (Zumbo 2005).

The analytical tools used to process the data were selected based on the functionality and availability of statistical procedures necessary for the planned analyses. Confirmatory factor analysis and invariance testing was conducted using Mplus 8.5. Several R packages were used for multiple correspondence analysis. Descriptive statistics, correlation analysis, and exploratory factor analysis were conducted using SPSS. The SPSS syntax files for the analyses reported in the guide are deposited in LiDA alongside the open data files, while the R and Mplus scripts are available by contacting the archive[4].

[4] https://lida.dataverse.lt/dataverse/InstitutionData_HiEd_KTU_NOGAP_Derivative

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1. INSTRUMENTS AND STRATEGY FOR ASSESSING ACADEMIC ACHIEVEMENT

1.1. Overview of NSSA Assessment Strategy and Participants

National Surveys of Student Achievement (NSSAs) are designed to provide country-level information about school students' achievement, which can be used to inform evidence-based decisions for improving educational policy and practices. While central to the NSSAs is an extensive assessment of achievements, these assessments are also accompanied by student and teacher questionnaires, which collect information about the social and educational context of learning. So far, four NSSAs were implemented: in 2012, 2014, 2015, and in 2016. These assessments are discussed further.

Each of the four NSSAs was designed to provide a valid measurement of students' achievement in a particular domain, which is included in the national curricula. While the general approach to developing the achievement test was similar from one cycle (yearly study) to the next, each cycle had a unique goal that shaped the way the achievement test was designed. Throughout the four NSSA studies, six different domains of achievement were targeted. However, some of these were targeted consistently throughout the four studies, while others were targeted less consistently. Mathematics and reading skills domains were targeted consistently throughout the four years of study, writing skills were targeted three times, sciences and social studies – twice, and language structure – only once. Moreover, each of the NSSA studies was constructed with a focus on a few specific domains. That is, each NSSA study included major and minor assessment domains, which varied across the three cycles of NSSA. Major domains were those that were considered most important at some particular cycle of NSSA and thus were studied, analyzed, and reported in official school achievement reports more extensively. Assessments in major domains also involved more participants (school students). Minor domains were those that were considered less important and were not addressed in official reports. Minor assessments also involved fewer participants. However, minor domains did serve some other specific objectives. Table 1.1 summarized these domains.

Table 1.1. Major and Minor Educational Domains Targeted in Different NSSAs.

Achievement Domain	Year of the Study			
	2012	2014	2015	2016
Math	Major	Major	Minor	Major
Reading	Major	Major	Minor	Major
Writing	Major	Not Targeted	Minor	Minor
Language Structure	Minor	Not Targeted	Not Targeted	Not Targeted
Social Studies	Not Targeted	Minor	Major	Not Targeted
Sciences	Not Targeted	Minor	Major	Not Targeted

The 2012 NSSA targeted achievement in mathematics (math), reading (in Lithuanian language), writing (in Lithuanian), and perception of language structure (short: language structure). Math, reading, and writing were major assessment domains. As such, more participants (school students) took part in these assessments. Language structure was considered as a minor domain, and consequently, fewer participants took part in these assessments. Assessments

of achievement in the language structure domain were also not addressed in the official achievement assessment reports.

The 2014 NSSA targeted achievement in math and reading (in Lithuanian), sciences, and social studies. Math and reading were major assessment domains. Consequently, the majority of participants took part in these assessments. Sciences and social studies were considered minor domains and were targeted primarily for experimental purposes. As such, fewer participants took part in these tests, and achievement in these domains was also not addressed in the official achievement assessment reports.

The 2015 NSSA targeted achievement in science (biology, chemistry, and physics), social studies (history, geography, and civic education), math, and reading (in Lithuanian). Science and social studies were major assessment domains. Consequently, the majority of participants took part in these assessments. Math and reading were considered minor domains. As such, fewer participants took part in these tests, and achievement in these domains was also not addressed in the official achievement assessment reports.

The 2016 NSSA targeted achievement in math, reading (in Lithuanian), and writing (in Lithuanian). Math and reading were considered major domains, while writing was considered a minor domain.

Depending on the goals of each NSSA cycle, the assessments were conducted with fourth-, sixth-, and eighth-grade students. In particular, in 2012, 2014, and 2015, NSSA assessments were carried out with fourth- and eighth-grade students, while the 2016 cycle assessed only sixth-grade students. Considering that the NO-GAP study focuses mostly on middle school students, we did not involve or analyze fourth-grade students. As such, Table 1.2 summarizes the number of students that took part in different NSSAs and the percentage that took part in domain-specific assessments, excluding the fourth-grade students for 2012, 2014, and 2015 datasets.

Table 1.2. The Number of Students that Took Part in Different NSSAs and the Percentage that Took Part in Domain-Specific Assessments.

Achievement Domain	Year of the Study			
	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
Mathematics	2988 (67%)	1702 (45%)	876 (25%)	2253 (83%)
Reading	2986 (67%)	1669 (44%)	873 (25%)	2250 (83%)
Writing	2984 (67%)	Not Targeted	437 (13%)	906 (33%)
Language Systems	2480 (55%)	Not Targeted	Not Targeted	Not Targeted
Social Sciences	Not Targeted	1257 (33%)	2172 (62%)	Not Targeted
Natural Sciences	Not Targeted	1256 (33%)	2606 (75%)	Not Targeted
Total number of participants	4479	3763	3482	2710
Number of participating schools	160	148	147	115

1.1.1 Assessment Design, the Overlap Between Different Assessment Domains, and Missing Values

A major challenge for the extensive achievement assessment carried out in NSSA studies is a burden on schools and participants. In particular, the extensive assessment of achievement skills in multiple domains requires lengthy and time-consuming assessments. To reduce the burden on schools, teachers, and students, each NSSA study used

a random allocation of domain-specific assessments. In particular, each NSSA cycle uses a sampling approach that involves packaging different domain-specific assessments into a set of several student achievement booklets. The design of assessments and allocation of domain-specific assessment tasks into specific booklets varies from one cycle of NSSA to another. However, different booklets are always randomly distributed to students within each participating school.

One major implication of such an approach is that not all students who participate in the NSSA cycle are assessed in all of the achievement domains. For example, in 2012 (see Table X), 4479 8th-grade students participated in the NSSA study. However, only 67% (n = 2988) were assessed in terms of mathematics achievement. As the allocation of different booklets is always random in each school, the percentage of students who are being evaluated in some specific domain is very similar in each school. Such a strategy ensures a rather accurate estimate of school-level achievement. However, it is not possible to very accurately estimate student-level achievement scores in each domain for each participant of the NSSA studies due to missing values on an individual level for some of the participants and some achievement domains.

Analyzing such data presents some challenges. In particular, as it is possible to aggregate the individual achievement scores to get an accurate estimate of school achievement, studying contextual predictors of achievement at the school level is rather straightforward. However, studying predictors at both the school and individual levels is more complex. Using the listwise deletion approach to deal with missing data will result in a substantial loss of statistical power and, in general, it is not a recommended strategy (Enders, 2011). Using FIML (Full Information Maximum Likelihood) is a recommended option in such a situation, however, it may not be usable with some datasets. In particular, building a model with one outcome (e.g., math achievement) and not losing any information due to missing values is possible. However, building a model with several outcomes (achievement scores in multiple domains) may not be possible with some of the NSSA datasets due to low covariance coverage for some of the domain-specific achievement scores.

The design of the 2012 NSSA study included and distributed booklets in a way that each domain-specific assessment was paired with another domain-specific assessment in at least 33% of cases. As such, it is possible to estimate a covariance between each domain of assessment (see Table 1.3). Thus, considering that booklets were distributed completely at random within each school, the 2012 dataset offers a possibility to analyze each domain-specific assessment separately and in concert, using FIML estimation. However, as language structure was a minor (experimental) achievement domain, the general recommendation is to analyze the scores on math, reading, and writing assessments.

Table 1.3. Overlapping Measurements in 2012 NSSA Study, for 8th Grade Students.

Achievement	Math	Reading	Writing	Language Structure
Mathematics	2988	1495	1493	1998
Reading	33%	2986	1491	1475
Writing	33%	33%	2984	1487
Language Structure	45%	33%	33%	2480

- Note: The number on the diagonal indicates the number of participants who took a particular achievement test. Numbers above the diagonal indicate the number of participants who took a particular pair of tests. The number below the diagonal indicates covariance coverage (i.e., the percentage of participants who took a particular pair of tests).

The design of the 2014 NSSA study included and distributed booklets in a way that not all domain-specific assessment were paired with another. In particular, social studies and sciences were minor and experimental achievement domains, and these were not paired with each other in a particular booklet. As such, it is not possible to estimate a covariance between the achievement scores in these domains (see Table 1.4). In this situation, it is generally recommended to investigate only math and reading scores, which were the primary assessment domains. These two domains can also be analyzed together using the FIML estimation. It is also possible to analyze social studies and sciences as outcomes of particular predictors; however, such analyses should be carried out separately for each of the two domains and not analyzed in concert with other domain-specific achievement scores.

Table 1.4. Overlapping Measurements in 2014 NSSA Study, for 8th Grade Students.

Achievement	Math	Reading	Social Studies	Sciences
Mathematics	1702	432	424	423
Reading	11%	1669	425	417
Social Studies	11%	11%	1257	0
Sciences	11%	11%	0%	1256

- Note: The number on the diagonal indicates the number of participants who took a particular achievement test. Numbers above the diagonal indicate the number of participants who took a particular pair of tests. The number below the diagonal indicates covariance coverage (i.e., the percentage of participants who took a particular pair of tests).

The design of the 2015 NSSA study targeted five domains, of which three were minor ones. As such, it also included and distributed booklets in a way that not all domain-specific assessments were paired with another. In particular, social studies and sciences were major domains, while the remaining three (math, reading, and writing) were minor ones and served other purposes. While the two primary domains were assessed in 50% of the participants of the 2015 NSSA study, the remaining ones were not paired in many cases (see Table 1.5). As such, it is only possible to estimate a covariance between a few of the domains. Using this dataset, it is generally recommended to investigate only sciences and social studies as the outcomes of some predictors. These two domains can also be analyzed in concert, using the FIML estimation. However, for other domains, such analyses should be carried out using only a single domain as the outcome variable.

Table 1.5. Overlapping Measurements in 2015 NSSA Study, for 8th Grade Students.

Achievement	Math	Reading	Writing	Social Studies	Sciences
Mathematics	876	441	0	435	0
Reading	13%	873	0	0	432
Writing	0%	0%	437	0	437
Social Studies	50%	0%	0%	2172	1737
Sciences	0%	98%	100%	80%	2606

- Note: The number on the diagonal indicates the number of participants who took a particular achievement test. Numbers above the diagonal indicate the number of participants who took a particular pair of tests. The number below the diagonal indicates covariance coverage (i.e., the percentage of participants who took a particular pair of tests).

Lastly, the design of the 2016 NSSA study targeted only three domains and distributed booklets in a way that each domain-specific assessment was paired with another domain-specific assessment in at least 33% of cases. As such, it is possible to estimate a covariance between each domain of assessment (see Table 1.6). Thus, considering that

booklets were distributed completely at random within each school, the 2016 dataset offers the possibility to analyze each domain-specific assessment separately and in concert, using FIML estimation.

Table 1.6. Overlapping Measurements in 2016 NSSA Study, for 6th Grade Students.

Achievement	Math	Reading	Writing
Mathematics	2253	1798	453
Reading	66%	2250	452
Writing	17%	17%	906

- Note: The number on the diagonal indicates the number of participants who took a particular achievement test. Numbers above the diagonal indicate the number of participants who took a particular pair of tests. The number below the diagonal indicates covariance coverage (i.e., the percentage of participants who took a particular pair of tests).

Differences between schools account from 12% to 28% of the variance in academic achievement. For two main subjects – reading and mathematics – it accounts for 14% to 20% and 16% to 27% of the variance, respectively, for each subject (see ICC scores in Table 1.7).

Table 1.7. ICC (School) in 2012-2015 NSSA Study, for 8th Grade Students and 2016 NSSA Study, for 6th Grade Students.

Achievement	Year of the Study			
	2012	2014	2015	2016
Mathematics	0.218	0.155	0.273	0.207
Reading	0.178	0.171	0.197	0.136
Writing	0.150	-	0.203	0.121
Social Studies	-	0.203	0.173	-
Sciences	-	0.276	0.118	-
Language Structure	0.193	-	-	-

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating a portion of variance in student academic achievement accounted by school-level differences.

1.1.2 Booklet Design

A major consequence of NSSA's ambitious reporting goals is that many more questions are required for the assessment than can be answered by any student in the amount of testing time available. NSSA uses a matrix sampling approach that involves packaging the entire assessment pool of items (of each subject) into a set of several student achievement booklets (the number varies in different years and grades), with each student completing just one booklet. Each booklet has anchor items, providing a mechanism for linking together the student responses from the various booklets when data from all booklets are taken together. Booklets are distributed among students in participating classrooms randomly, aiming to ensure that the number of different booklets in each class is as equal as possible.

After the assessment has been administered and the data collected and processed, NSSA uses item response theory scaling methods to assemble a comprehensive picture of the achievement of the entire student population of a country from the combined responses of individual students to the booklets they are assigned. This approach reduces to manageable proportions what otherwise would be an impossible student burden, albeit at the cost of some complexity in booklet assembly, data collection, and data analysis.

Table 1.8. Number of Different Booklets for Each Achievement Domain

Achievement	Year of the Study			
	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
Mathematics	6	4	2	5
Reading	6	4	2	5
Writing	5	0	1	2
Language Systems	5	0	0	0
Social Sciences	0	3	5	0
Natural Sciences	0	3	6	0

1.2. Construction of Mathematics Achievement Scores

1.2.1 The Total Score of Mathematics Achievement

The total score on mathematics achievement is constructed similarly across different cycles of the NSSA study. In particular, it is constructed using the two-parameter logistic model (2PLM; Birnbaum, 1968) for the binary item responses. The 2PLM is a generalization of the Rasch model (Rasch, 1960), which assumes that the probability of a correct response to an item depends only on the difference between the students' trait level and the difficulty of the item. The model accounts for the possibility that responses to different items do not have the same weight in relation to the latent trait. This approach is in line with those models used in international research, such as TIMSS, PISA, or PIRLS.

The total score on mathematics achievement is standardized so that the mean of the score in a particular study is 500, and the standard deviation is 100.

1.2.2 Content-Specific Mathematics Achievement Scores

The mathematics achievement test targets mathematics skills in five content domains. Specifically, the test assesses skills in basic numbers and calculations, algebra, geometry, data and probability, and problem-solving. As such, the achievement test provides a possibility to estimate achievement in content-specific domains. The number of tasks included to assess each domain may vary from booklet to booklet and from one NSSA cycle to the next. However, the number of content domains is always equal across different NSSA cycles.

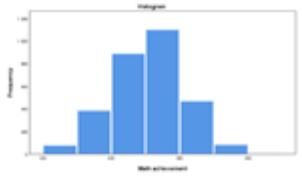
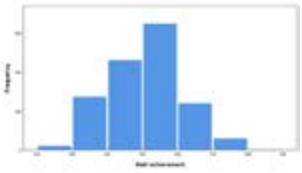
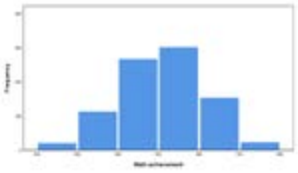
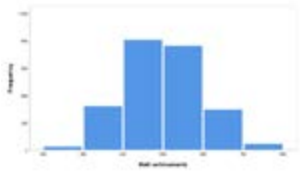
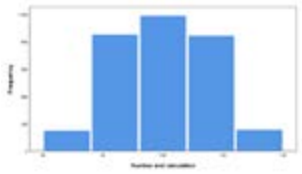
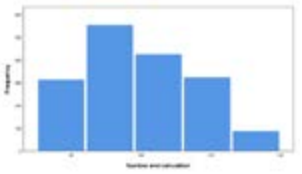
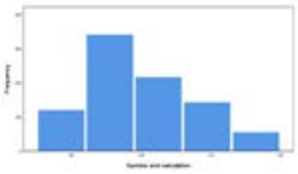
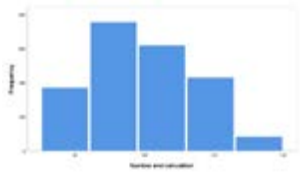
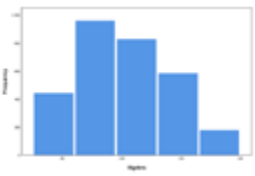
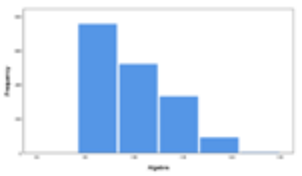
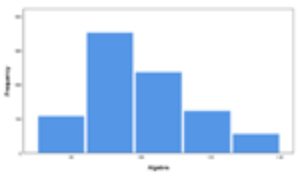
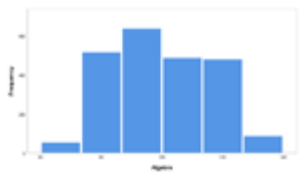
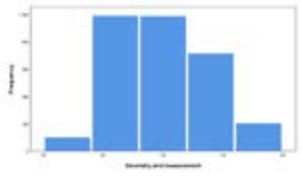
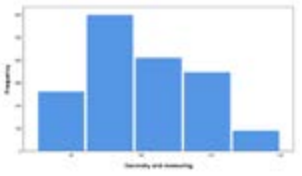
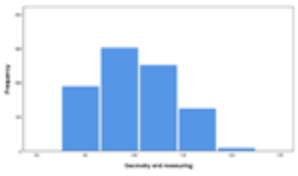
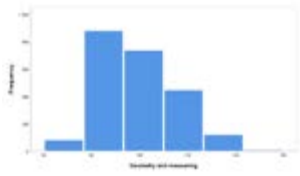
While tasks grouped into the five content domains are different, the scores obtained from different math achievement domains show very high consistency. Table 1.9 shows Cronbach's alpha coefficients, which are estimates of the consistency of the scores obtained from different math domains. These estimates indicate the very strong associations between scores in different domains for each of the booklets used; in every case, the alpha coefficient is higher than .85.

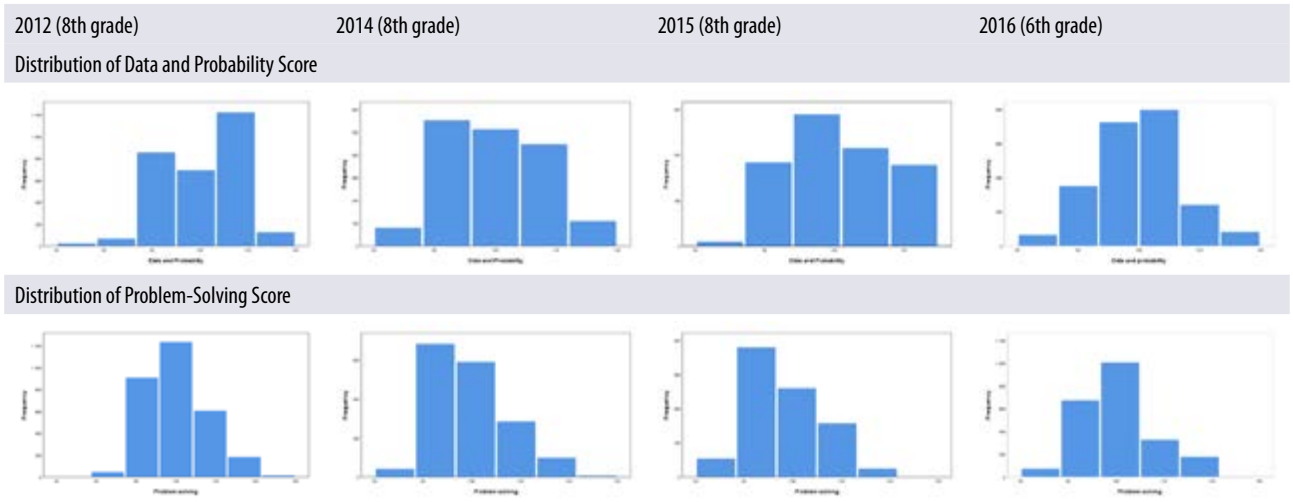
Table 1.9. Internal Consistency (Cronbach's Alpha) of Thematic Domains for Different Versions of Mathematics Achievement Test

Year	Booklet/Version of the Test								
	1	2	3	4	5	6	7	8	9
2012	.92	.87	-	-	.86	.88	.91	-	.87
2014	.90	-	.92	.90	-	.92	-	-	-
2015	.93	.92	-	-	-	-	-	-	-
2016	.85	.87	-	.86	.85	.84	-	-	-

The content domain-specific score on mathematics achievement is standardized so that the mean of the score in a particular study is 100 and the standard deviation is 15. The score is standardized for each booklet of the study; as such, this metric is identical across the studies and different booklets. Distribution plots of mathematics achievement scores are presented in Table 1.10 and descriptives - in Table 1.11.

Table 1.10. Distribution of Mathematics Achievement Scores

2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
Distribution of Total Math Test Score			
			
Distribution of Numbers and Calculations Score			
			
Distribution of Algebra Score			
			
Distribution of Geometry and Measurement Score			
			



Considering that NSSA uses a matrix sampling approach, which involves packaging the entire assessment pool of items into a set of several achievement booklets, it is important to know if the total achievement scores from different booklets are comparable. To evaluate the comparability of different booklets, we tested for measurement invariance. In particular, we tested if the variance composition of overall mathematics achievement is similar across different booklets. In other words, we investigated if each of the content domains contributes similarly to overall mathematics achievement. Considering that each booklet is standardized separately (the mean and variance of different booklets are identical), we only tested for metric invariance. That is, we tested the assumption that each content-specific domain score is similarly related to the overall mathematics achievement.

Confirmatory Factor Analysis (CFA) was conducted using Mplus 8.4 with the Maximum Likelihood Robust (MLR) estimator. It was used to investigate measurement invariance. The choice of MLR estimator was based on the recommendations by Rhemtulla and colleagues (2012), which suggest the use of MLR estimator when scores are not normally distributed. Considering that the chi-square model fit statistic is sensitive to sample size (Kline, 2015), we used alternative indicators of model-data fit. In particular, we used The Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and the Comparative Fit Index (CFI), to assess model-data fit. RMSEA and SRMR lower than .08 indicated an acceptable level of model-data fit. RMSEA and SRMR lower than .05 indicated a good fit. CFI higher than .90 indicated acceptable fit and CFI higher than .95 indicated good fit (Brown, 2015). Measurement invariance was tested by using a multiple-group approach, with different booklet numbers indicating groups. That is, using the MG approach we tested the fit of a single-dimension model for each booklet and then tested a second model, which imposed factor loading equality constraints across different booklets. The two models were compared using the "ΔCFI" criterion, e.g., if newly added constraints (e.g., factor loading equality constraints) resulted in the decrease of CFI greater than .01, it indicated that a certain level of invariance (e.g., metric) does not hold (Cheung & Rensvold, 2002).

The results of measurement invariance analysis indicated that, across different booklets, content domain-specific mathematics achievement scores were similarly associated with the latent variable measuring overall math achievement (see Table 1.12). In particular, metric invariance, which was tested by adding equality factor loading constraints across different booklets did not result in a substantial decrease of model fit (ΔCFI did not exceed the .01 threshold). In general, this result indicates that the scores obtained from different booklets can be used in a single analysis.

Table 1.11. Descriptive Statistics of Total and Content-Specific Score on Math Achievement.

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	2988	1702	875	2257
Total Math Test Score (Mean = 500; SD = 100)				
Min - Max	200 - 824	230 - 825	245 - 778	236 -798
Skewness (S.E.)	-0,055 (0.045)	0,087 (0,59)	-0,132 (0,083)	0,158 (0,052)
Kurtosis (S.E.)	-0,374 (0.09)	-0,550 (0,119)	-0,571 (0,165)	-0,277 (0,103)
Numbers and Calculations (Mean = 100; SD = 15)				
Min - Max	69 -134	72 - 139	78 - 139	74 - 140
Skewness (S.E.)	0,045 (0.045)	0,087 (0,59)	0,426 (0,083)	0,262 (0,052)
Kurtosis (S.E.)	-0,857 (0.09)	-0,550 (0,119)	-0,831 (0,165)	-0,840 (0,103)
Algebra (Mean = 100; SD = 15)				
Min - Max	70 - 139	77 - 149	74 - 138	69 - 132
Skewness (S.E.)	0,292 (0.045)	0,637 (0,59)	0,357 (0,083)	0,082 (0,052)
Kurtosis (S.E.)	-0,751 (0.09)	-0,302 (0,119)	-0,721 (0,165)	-0,786 (0,103)
Geometry and Measurement (Mean = 100; SD = 15)				
Min - Max	70 - 139	74-139	79 - 141	72 -150
Skewness (S.E.)	0,321 (0.045)	0,354 (0,59)	0,430 (0,083)	0,540 (0,052)
Kurtosis (S.E.)	-0,831 (0.09)	-0,775 (0,119)	-0,789 (0,165)	-0,201 (0,103)
Data and Probability (Mean = 100; SD = 15)				
Min - Max	53 - 127	66 -134	68 - 129	63 - 137
Skewness (S.E.)	-0,300 (0.045)	0,005 (0,59)	0,148 (0,083)	-0,051(0,052)
Kurtosis (S.E.)	-0,568 (0.09)	-0,713 (0,119)	-0,914 (0,165)	-0,280 (0,103)
Problem Solving (Mean = 100; SD = 15)				
Min - Max	58 - 157	74 - 150	72 - 143	74 - 144
Skewness (S.E.)	0,456 (0.045)	0,735 (0,59)	0,444 (0,083)	0,469 (0,052)
Kurtosis (S.E.)	0,145 (0.09)	-0,044 (0,119)	-0,274 (0,165)	-0,413 (0,103)

Table 1.12. Results of Measurement Invariance Analysis for Different Forms of Mathematics Achievement Assessment

Model Tested (model compared with)	Model Fit Statistics							Model Comparison				
	χ2	df	npar	p	CFI	RMSEA [90% CI]	SRMR	Δχ2	Δdf	P	ΔCFI	ΔRMSEA
The year 2012 (6 different forms of the test)												
Configural	55.237	30	90	.003	.997	.041 [.023 .058]	.013					
Weak (vs configural)	127.191	50	70	<.001	.990	.056 [.044 .068]	.110	73.677	20	<.001	-.007	.015
The year 2014 (4 different forms of the test)												
Configural	108.172	20	60	<.001	.991	.072 [.059 .086]	.014					
Weak (vs configural)	137.377	32	48	<.001	.990	.062 [.052 .073]	.061	25.503	12	.013	-.001	-.010
The year 2015 (2 different forms of the test)												
Configural	17.175	10	30	.071	.998	.040 [.000 .072]	.010					

Model Tested (model compared with)	Model Fit Statistics							Model Comparison				
	χ2	df	npar	p	CFI	RMSEA [90% CI]	SRMR	Δχ2	Δdf	P	ΔCFI	ΔRMSEA
Weak (vs configural)	24.976	14	26	.035	.996	.042 [.011 .069]	.067	7.907	4	.095	-.002	.002
The year 2016 (5 different forms)												
Configural												
Weak (vs configural)												

- Note: CFI - Comparative Fit Index; RMSEA – Root Mean Square Error of Approximation; SRMR – Standardized Root Mean Square Residual; CI – Confidence Interval. n_{par} – number of free parameters in the model.
- *** $p < .001$; ** $p < .01$; * $p < .05$.

1.3. Construction of Reading Achievement Scores

1.3.1 The Total Score of Readings Achievement

The total score on reading achievement is constructed similarly to the mathematics test. In particular, it constructed using the two-parameter logistic model (2PLM; Birnbaum, 1968) for the binary item responses. The model accounts for the possibility that responses to different items do not have the same weight in relation to the latent trait. This approach is in line with those models used in international research, such as TIMSS, PISA, or PIRLS.

The total score on reading achievement is standardized so that the mean score in a particular study is 500, and the standard deviation is 100.

1.3.2 Content-Specific Reading Achievement Scores

The reading achievement test targets readings skills in four content domains. In particular, the test assesses skills in the retrieval of explicitly stated information, inference making, analysis, and interpretation and evaluation. As such, the achievement test provides a possibility to estimate achievement in content-specific domains. The number of tasks included to assess each domain may vary from booklet to booklet and from one NSSA cycle to the next. However, the number of content domains is always equal across different NSSA cycles.

While tasks grouped into the four content-domains are different, the scores obtained from different math achievement domains show very high consistency. Table 1.13 shows Cronbach's alpha coefficients, i.e., estimates of consistency of the scores obtained from different math domains. These estimates indicate the very strong associations between scores in different domains for each of the booklets used, i.e., in every case alpha coefficient is higher than .85.

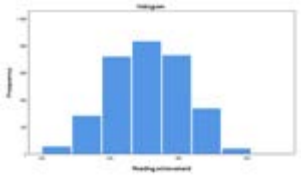
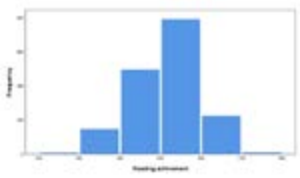
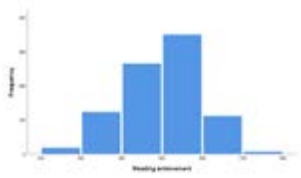
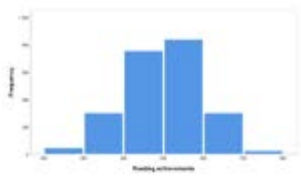
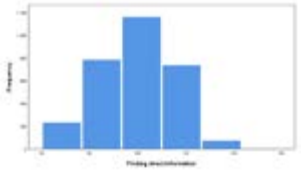
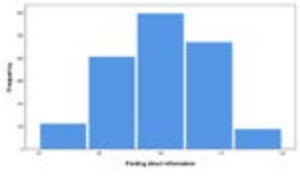
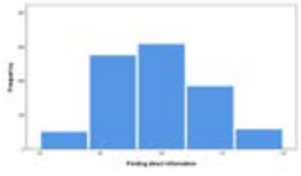
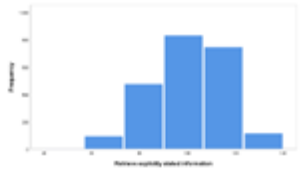
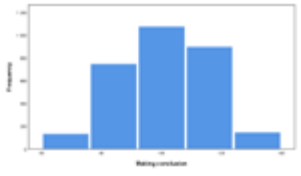
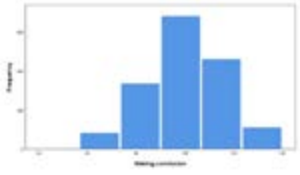
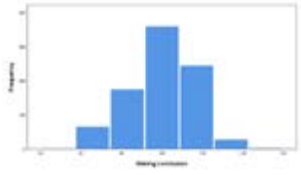
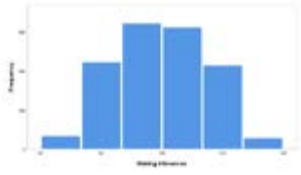
Table 1.13. Internal Consistency (Cronbach's Alpha) of Thematic Domains for Different Versions of Reading Achievement Test

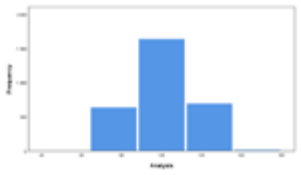
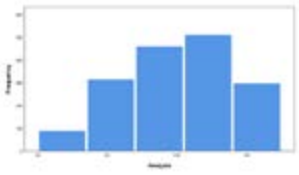
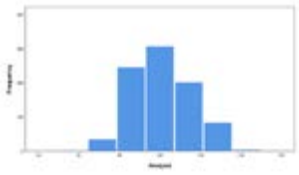
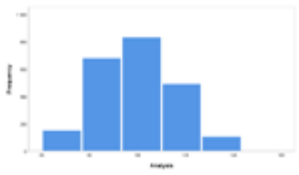
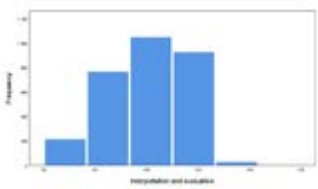
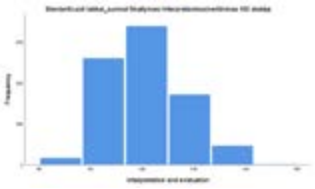
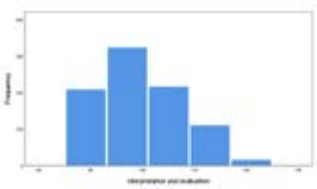
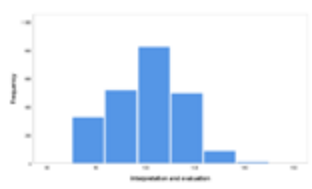
Year	Booklet/Version of the Test								
	1	2	3	4	5	6	7	8	9
2012	.85	.71	.82	.76	.82	-	-	.84	-
2014	.85	.82	-	-	-	-	.82	-	.84
2015	.85	-	.86	-	-	-	-	-	-
2016	.80	.83	.80	.78	-	.81	-	-	-

The content domain-specific score on reading achievement is standardized so that the mean of the score in a particular study is 100 and the standard deviation is 15. The score is standardized for each booklet of the study, as such, this metric is identical across the studies and different booklets. Distribution plots of reading achievement scores are presented in Table 1.14 and descriptives - in Table 1.15.

Considering that NSSA uses a matrix sampling approach, which involves packaging the entire assessment pool of items into a set of several achievement booklets, it is important to know if the total achievement scores from different booklets are comparable. To evaluate the comparability of different booklets, we tested for measurement invariance. In particular, we tested if the variance composition of overall reading achievement is similar across different booklets, i.e., we investigated if each of the content-domains contributes similarly to overall reading achievement. Considering that each booklet is standardized separately (the mean and variance of different booklets in identical), we only tested for metric invariance. That is we tested the assumption that each content-specific domain score is similarly related to the overall reading achievement.

Table 1.14. Distribution of Reading Achievement Scores

2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
Distribution of Total Reading Test Score			
			
Distribution of Retrieval of Explicitly Stated Information Score			
			
Distribution of Making Inferences Score			
			

2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
Distribution of Analysis Score			
			
Distribution of Interpretation and Evaluation Score			
			

The results of measurement invariance analysis indicated that, across different booklets, content domain-specific reading achievement scores were similarly associated with the latent variable measuring overall reading achievement. In particular, metric invariance, which was tested by adding equality factor loading constraints across different booklets did not result in a substantial decrease of model fit (ΔCFI did not exceed the -.01 threshold). In general, this result indicates that the scores obtained from different booklets can be used in a single analysis (see Table 1.16).

Following data collection, student responses to the items in each assessment are aggregated and converted to the NSSA scale metrics at each grade level to provide an overall picture of the assessment results.

Table 1.15. Descriptive Statistics of Total and Content-Specific Score on Reading Achievement.

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	2986	1669	873	2250
Total Reading Test Score (Mean = 500; SD = 100)				
Min - Max	286 - 789	273 - 749	206 - 729	201 - 777
Skewness (S.E.)	-0,320 (0.045)	-0,317 (0,06)	-0,237 (0,083)	-0,203 (0,052)
Kurtosis (S.E.)	0,001 (0.09)	-0,075 (0,12)	-0,368 (0,105)	-0,186 (0,103)
Retrieval of Explicitly Stated Information (Mean = 100; SD = 15)				
Min - Max	63 -150	64 - 135	67 - 133	51 - 132
Skewness (S.E.)	-0,159 (0.045)	-0,081 (0,06)	-0,038 (0,083)	-0,269 (0,052)
Kurtosis (S.E.)	-0,477 (0.09)	-0,734 (0,12)	-0,717 (0,165)	-0,539(0,103)
Making Inferences (Mean = 100; SD = 15)				
Min - Max	61 - 140	57 - 137	55 - 144	62 - 135
Skewness (S.E.)	-0,023 (0.045)	-0,18 (0,06)	-0,178 (0,083)	-0,117(0,052)
Kurtosis (S.E.)	-0,375 (0.09)	-0,503 (0,12)	-0,222 (0,165)	- 0,589(0,103)
Analysis (Mean = 100; SD = 15)				
Min - Max	56 - 150	67 - 129	59 - 140	64 - 145
Skewness (S.E.)	0,014 (0.045)	-0,403 (0,06)	0,144 (0,083)	0,055 (0,052)
Kurtosis (S.E.)	-0,593 (0.09)	-0,534 (0,12)	-0,615 (0,165)	-0,628 (0,103)
Interpretation and Evaluation (Mean = 100; SD = 15)				
Min - Max	64 - 147	72 - 149	78 - 147	73 - 141
Skewness (S.E.)	-0,275 (0.045)	0,268 (0,06)	0,438 (0,083)	0,130 (0,052)
Kurtosis (S.E.)	-0,496 (0.09)	-0,609 (0,12)	-0,425 (0,165)	-0,807 (0,103)

Table 1.16. Results of Measurement Invariance Analysis For Different Forms of Reading Achievement Assessment

Model Tested (model compared with)	Model Fit Statistics							Model Comparison				
	χ2	df	npar	p	CFI	RMSEA [90% CI]	SRMR	Δχ2	Δdf	P	ΔCFI	ΔRMSEA
The year 2012 (6 different forms of the test)												
Configural	21.476	12	72	.044	.997	.040 [.007 .067]	.011					
Weak (vs configural)	58.353	27	57	<.001	.991	.048 [.031 .065]	.084	37.623	15	.001	-.006	.008
The year 2014 (4 different forms of the test)												
Configural	11.754	8	48	.163	.999	.024 [.000 .051]	.007					
Weak (vs configural)	93.484	17	39	<.001	.984	.073 [.059 .088]	.117	85.951	9	<.001	-.015	.049
The year 2015 (2 different forms of the test)												
Configural	23.383	4	24	<.001	.987	.105 [.067 .149]	.019					
Weak (vs configural)	33.439	7	21	<.001	.982	.093 [.063 .126]	.085	10.096	3	.018	-.005	-.012
The year 2016 (5 different forms)												
Configural												
Weak (vs configural)												

- Note: CFI - Comparative Fit Index; RMSEA – Root Mean Square Error of Approximation; SRMR – Standardized Root Mean Square Residual; CI – Confidence Interval. n_{par} – number of free parameters in the model.
- *** $p < .001$; ** $p < .01$; * $p < .05$.

2. ASESSING STUDENT BACKGROUND: SOCIAL-ECONOMIC-CULTURAL INDEX

2.1 Theoretical Conceptualization of the Construct

Socio-economic status[5] is a relative position of a family or individual defined by their access to or control over valuable resources in a society, including wealth, power and status (Mueller & Parcel, 1981). Socio-economic status is related to such key aspects of human functioning as health, subjective well-being, academic achievement, or career (Diemer et al., 2013). The conceptualization and measurement of socio-economic status varies in scholarly literature and depends on the approach taken by the researchers. The American Psychological Association (APA, 2007) outlines three main approaches towards SES:

Materialist, which focuses on the role of material and structural factors and considers such quantifiable characteristics as income and wealth (Avvisati, 2020) or composite indicators constructed from a person's income, education, and occupation (APA, 2007), although the latter approach received substantial criticism (Sirin, 2005; Marks & Pokropek, 2019).

Gradient approach, which focuses on the effects of relative status and inequality. In this approach, socio-economic status is constructed as a relative position, which reflects an individual's situation in relation to others. Traditional indicators – occupation (occupational prestige), education, income (wealth), as well as subjective judgments of one's social status, are used to construct gradient conceptualizations (APA, 2007; Avvisati, 2020).

Class-based model, which focuses on a person's position within the hierarchical capitalist economy (possession of property, position in labour market and access to other resources). It is usually conceptualized and measured as an (ordered) categorical construct wherein classes are defined as reflecting certain types of economic activity and status (APA, 2007; Avvisati, 2020).

Some conceptualizations of SES stress that not only material resources (i.e., financial capital) determine the actual social status of a person or a family in a society, but also cultural and social resources (i.e, social, cultural or human capital) (Tramonte & Willms, 2010). For example, in educational research, including PISA surveys, an index of social-economic-cultural (SEC) status is used, which is defined as "a measure of students' access to family resources (financial capital, social capital, cultural capital and human capital) which determine the social position of the student's family/household" (Avvisati, 2020, p. 3). Some studies demonstrate that material and cultural aspects have different implications for individual outcomes, such as educational attainment (e.g., Yang, 2003).

Measurement of SES among school-aged children and adolescents often relies on traditional indicators of parental education, occupation, and/or income (Diemer et al., 2013). It has been shown, however, that the use of these traditional indicators for SEC assessment among children and adolescents has a number of limitations (Currie et al., 2008; Sirin, 2005), including large proportions of missing data and a lack of reliability (Aaro et al., 2009; Currie et al., 2008).

[5] In this text, we use concepts of socio-economic status, social-economic-cultural status, social status, and social class interchangeably, except, in cases where the distinction is explicitly mentioned and described.

An alternative way to assess SEC among children and adolescents is using a composite measure consisting of multiple items specifying home possessions of the child's family (Currie et al., 2008; OECD, 2014; Sirin, 2005; Yang, 2003), including items indicating family wealth (e.g., a number of cars owned by a family), cultural possessions (e.g., musical instruments at home), and home educational resources (e.g., availability of a computer for educational purposes) (OECD, 2017). The advantage of such measures is the high response rate in child and adolescent samples (Currie et al., 1997). Large cross-national studies on adolescent educational achievement and health include similar measures of SEC background (e.g., Currie et al., 2008; OECD, 2014).

2.2 Operationalization of the Construct in NSSA Data

Multiple items measuring different aspects of SEC were included in the NSSA data. These items encompass both traditional SES indicators (such as parental education, parental employment and supervisory status, pocket-money per week, eligibility for free meals at school, consultation by a private tutor) and indicators based on the child's family's home possessions (such as the number of books at home, ownership of encyclopedias, possession of musical instruments and art-related objects, possession of three or more computers and a dishwasher).

For the construction of the index items measuring parental education, parental employment and supervisory status were dropped as they either have low variability or have a lot of missing cases (see Table 2.1.) However, these items were employed for the assessment of external validity of the scales. Item measuring students' pocket-money per week was dropped due to low association with other items as revealed by the confirmatory factor analysis (see Section on validity of the scales). However, it was also used for the assessment of external validity of the resultant indexes.

The final set of items that were used for constructing SEC indexes included:

- ***Number of books at home*** (measured on a 5-point ordinal scale, see Table 2.2).
- ***Possession of 6 types of things***: own books, encyclopedia, musical instrument, works of art/albums, three or more computers and a dishwasher at home (measured on a binary scale (yes/no), see Table 2.2).
- ***Eligibility for free meals at school*** (measured on a binary scale (yes/no), see Table 2.2).
- ***Frequency of consultation by a private tutor*** (measured on a binary scale (never or almost never/sometimes vs. at last once a month), see Table 2.2).

Notably, the answer scale for the last question differed between the survey conducted in 2012 and the surveys conducted in other years. However, this fact did not appear to have a substantial effect on the construction of the index (see Section on validity of the scales).

We used two procedures to construct the SEC index: confirmatory factor analysis (CFA) and multiple correspondence analysis (MCA). We labeled the index based on CFA procedure as SEC_I, and the index based on MCA approach as SEC_D1. The following indexes and the procedures used to obtain them are presented below.

2.2.1 Development of SEC Index Based on CFA Procedure

CFA is a common method for scale construction when items measuring a construct or its dimensions are well-known in advance and have a good theoretical background. Importantly, this technique can accommodate both continuous and categorical variables, which was important in our case as all of our items were measured on either nominal or ordinal scale. However, it is less well-suited for dimensional, exploratory analysis. Notwithstanding, we used it for constructing our unidimensional SEC_I index, as we expected the unidimensional nature of the SEC construct to emerge. In particular, we employed weighted least squares mean and variance adjusted (WLSMV) estimation implemented in the Mplus 8.6 software in order to account for the categorical (in most cases binary) nature of the data and non-normality of the not-binary item[6]. All items were declared as categorical, and Delta parametrization used with probit link function. In order to improve the fit of the estimated model, two correlated errors were included into the model: 1) At home: musical instruments vs. At home: works of art/albums; 2) At home: three or more computers vs. At home: dishwasher. The analysis was performed on all the groups (years) separately, as measurement invariance (metric, in particular) did not hold for the joint dataset (see Section on validity of the scales). Factor scores resulting from the performed CFAs were saved and comprise the estimates of the index. Higher scores indicate higher SEC.

The structure of SEC index was analysed for each year and group of students separately, and the results of CFA for a single-factor model supported it (see Tables 2.3a – 2.3d). The overall fit to the data was observed at all NSSA assessment times; however, not all indicators proved equally stable and robust across different datasets. The highest and most robust loadings were observed for the following indicators: free meals at school, number of books, own books, encyclopedia, musical instruments, and works of art at home. Lower and less stable/robust loadings were observed for the rest of the indicators: three or more computers and a dishwasher at home and access to a private tutor. The latter had a particularly weak loading in the data collected from the 6th-grade students. Despite some variations in the strength of the indicators for the single-factor SEC indicator, the same structure was retained across different datasets.

2.2.2 Development of SEC Index Based on MCA Approach

MCA is a statistical method for the dimensional analysis of categorical data consisting of more than two variables (Greenacre, 2017). It is a descriptive method that allows the visual portrayal of interrelations among categories of multiple categorical variables. MCA has several implementations (based on indicator matrix, based on the Burt table, with or without adjustment of inertias, joint correspondence analysis, see Greenacre, 2017), and the indicator matrix approach is the most commonly used[7]. This approach is based on the recoding of original categorical data into indicator matrix where each category has its column, and the values are 1 (if a case belongs to that category) and 0 (if a case does not belong to that category). Then, MCA is a statistical technique for visualizing data of this "two-way table" by calculating coordinates representing both its rows and columns[8]. These coordinates are analogous to factor loadings in a principal components analysis, factor analysis, or multidimensional scaling, except that they partition the Chi-square value (usually called inertia) instead of the total variance.

[6] Additionally, this estimation method treats missing values on a case-by-case basis, which allows for the elimination of missing values in the scores.

[7] It is important to note that the solutions resulting from all the different methods employed are almost identical.

[8] For comprehensive introductions to MCA, please refer to Le Roux and Rouanet (2004), Le Roux and Rouanet (2009), Greenacre (2017), Husson, Le and Pagès (2017).

Although dimensions onto which coordinates are transferred invite interpretation, their interpretation in MCA differs from that in factor analysis (Greenacre, 2017). This difference mainly arises from the separate analysis of categories of categorical variables (columns) and cases (rows), followed by their joint plotting using a biplot, where the positions of categories and cases might be arbitrary[9]. Since two spaces (constructed separately for categories of categorical variables (columns) and cases (rows)) are portrayed on the plot[10], it is challenging to provide a singular interpretation (or "naming") of axes (dimensions). Typically, in MCA one begins by examining the "solution of categories" and identifying opposing categories on the first and second dimensions[11] for each variable separately. Then, one tries to discern any structure in the distribution of points. Importantly, distances between the points of categories represent Chi-square (and not Euclidean) differences and, therefore, are relatively abstract quantities.

The spatial locations of variable categories provide a visual representation of the relationship pattern between the analyzed variables. For separate variable categories, the angle between the origin and the two points (categories) is crucial. If the angle is small (close to 0 degrees), the two categories are not related at all. If the angle is 90 degrees, the two categories are not related at all. And if the angle is 180 degrees (they are opposite each other), the two categories are negatively related. Furthermore, the more distant the points are from the origin, the more distinctive they are from the average profile. Therefore, points close to the origin of the plot are not very interesting for the interpretation of MCA results. Finally, it is important to note that all the results of MCA are relative, meaning they have to be interpreted taking into consideration all the categories of variables, not just a few selected ones.

First, we estimated the optimal number of dimensions of the MCA solution for each group using the function ***estim_ncpMCA()*** included into the ***missMDA*** package of the ***R*** software environment for statistical computing and graphics (Josse & Husson, 2016). We employed ***Kfold*** (cross-validation) algorithm with ***pNA*** parameter (indicating the percentage of missing values inserted and predicted with MCA using ***ncp.min***=0 to ***ncp.max***=5 dimensions) set to 0.05, and ***nbsim*** parameter (the number of times the process is repeated) set to 100. The resulting analysis showed that a 2-dimensional solution produced the lowest value of the mean square error of prediction (MSEP) for all the groups (years), which is the criterion used to evaluate the optimal dimensionality of MCA solutions (Josse & Husson, 2016) (Table 2.4).

The second step consisted of performing the (regularized[12]) iterative MCA algorithm with the number of dimensions selected in the previous step (2 in our case). We used the function ***imputeMCA()*** from the ***R*** package ***missMDA*** to impute missing values for subsequent MCA analysis. Finally, in the third step (indicator matrix) MCA was performed on the imputed dataset, and standard coordinates of the two dimensions of the MCA solutions were saved. The standard coordinates, which are similar in interpretation to factor scores of the CFA solution, of the first of these dimensions constitute the values of the SEC_D1 index. To simplify interpretation, values of the index were reversed so that higher index scores indicate higher SEC. Standard coordinates of the second dimension were also saved for further analysis of their substantive meaning.

[9] Coordinate scores are variously transformed in order to allow for different types of interpretation.

[10] Simultaneous portrayal is made possible because the origins of the two spaces, one for categories of categorical variables and the other for cases, coincide, and the variation, both total and for each separate dimension, is the same.

[11] Or any other combination of dimensions if more than two are retained in the final solution.

[12] The regularized version is more appropriate in order to avoid overfitting issues (Josse & Husson, 2016).

The graphical representations of MCA solutions in Fig. 2.1a – 2.1d show that the categories of separate variables are dispersed along the first dimension (horizontal) following the logic of higher vs. lower SEC. On the positive side of the first dimension, we find categories indicating a lack of home possessions, eligibility for free meals at school, and no tutoring. The "opposite" categories are clustered on the negative side of the first dimension.

Relative contributions are usually calculated for each dimension to provide quantitative estimates of the contribution of each category (or case) to the inertia (total variance) of the dimension (Husson, Le & Pagès, 2017: 82-83)[13]. The higher the value of the relative contribution, the more the particular category contributes to the construction (identification) of the dimension under consideration[14]. If we look at the relative contributions of categories to the first dimension, we see that the three categories of low SEC (not having an encyclopedia at home, having only 1-10 books at home in general, and being eligible for free meals at school) score highest. This means that these three separate categories are most important for identifying (constructing) the first dimension. A more usual statistic, eta-squared, also shows that the same three variables (not separate categories) and having a musical instrument at home best explain the variance of the first dimension (Tables 2.5a – 2.5d).

The graphical representations of MCA solutions in Fig. 2.1a – 2.1d show that the categories of separate variables are also dispersed along the second dimension (vertical) following the logic of higher versus lower typicality of answers. The scores toward the higher end of this dimension indicate increasingly less typical, more contradictory patterns of available resources in the family, while the scores toward the lower end indicate very similar, consistent answers on items assessing SEC background of the students. Since this dimension does not provide a direct measure of SEC, the second dimension (SEC_D2) is not given an in-depth consideration in this report. However, it is notable that the results of MCA suggest that this second dimension (SEC_D2) should be controlled for in the models that assess the links between SEC_D1 and other variables. This is to account for the "noise", or more precisely, the (un)typicality of answers, when assessing SEC among students. Controlling for SEC_D2 should help assess the true links between SEC_D1 (i.e., the students' social-economic-cultural status) and other variables.

Finally, in order to have a categorical variable for the assessment of student achievement social inequalities we divided SEC_D1 values into quintiles using ***quantile ()*** function available in the ***R*** software. For this calculation, we applied the algorithm called "Type 8" as recommended by Hyndman and Fan (1996). This algorithm calculates continuous sample quantiles, ensuring that the resulting quantile estimates are approximately median-unbiased, regardless of the distribution of values in the transformed variable.

[13] Their substantive interpretation is similar to factor loadings in EFA or CFA.

[14] Additional measures, such as cosine-squared for the angle separating vectors of a category (case) and a dimension as well as v.test statistics (see Greenacre, 2017; Husson, Le & Pagès, 2017), help evaluate how well categories are represented by a dimension under consideration or how different the values of dimension coordinate estimates are for a particular category compared to all the values (substantively similar to communalities in EFA). However, estimates of relative contributions are better suited for dimension interpretation.

2.3 Descriptive Statistics

Descriptive statistics for the three interval-level SEC indexes are provided in Tables 2.6a and 2.6b, while histograms are displayed in Table 2.7. The scores for the simple aggregate index, SEC_I, exhibit a relatively symmetrical distribution around the mean. In 2015 and 2016 datasets, the scores display a slightly negative skew, indicating a slightly higher prevalence of individuals with a relatively larger number of belongings compared to those who have a relatively smaller number of belongings.

The scores for the first dimension SEC_D1 of the two-dimensional index are distributed relatively symmetrically around the mean in 2012 dataset. However, the distribution becomes increasingly negatively skewed in more recent datasets. This indicates that, more recently, the participants tend to have greater access to the material, cultural, and educational family resources listed in the questionnaire. The proportion of those with relatively few resources is decreasing, while the proportion of those with relatively many resources is increasing. Additionally, individuals towards the higher end of the dimension become more similar in their possession of resources. The maximum value is getting closer to the mean in later assessments. This suggests a diminishing ability of the questionnaire items to differentiate between socio-economic-cultural situations of the participants, particularly among those at the higher end of the continuum.

The scores for the second dimension, SEC_D2, of the two-dimensional index have a unique interpretation considering the construct assessed by this dimension. Scores toward the right end of the dimension indicate increasingly less typical, more contradictory patterns of available resources in the family, while the scores towards the left end indicate very similar, consistent answers. Thus, the overall positive skew of SEC_D2 distribution suggests that most of the participants provide rather consistent and similar answers about the resources available at home. However, there is a portion of the sample who answer in a more contradictory fashion regarding the items available in the family compared to the rest of the participants. This tendency is slightly stronger in earlier datasets.

Descriptives for the categorical SEC_C index are presented in Table 2.6c. This index can be used to divide the sample into five equal subgroups (quintiles), based on the socio-economic-cultural context. The first, third, and fifth quintiles have been previously used as proxies for low, medium, and high socio-economic classes with international student achievement data (Zabulionis, 2020). Consistently with observations from the descriptives of SEC_D1, the range of values for the highest quintile is decreasing over time, while the range of values for the lowest quintile is increasing. This suggests that those with the most favorable socio-economic situation are becoming slightly more similar to each other, while those with the least favorable socio-economic situation are becoming slightly more differentiated from each other.

As suggested by the intraclass correlation coefficient (ICC) estimates, for SEC_I, SEC_D1, and the categorical SEC_C indexes, the differences between schools account for 17,9% to 23,7% of the variance. In case of SEC_D2, the differences between schools are smaller, accounting for 3,9% to 6,5% of the variance (see ICC scores in Tables 2.6 a, b, c).

2.4 Scale Validity in NSSA Data

We explored the validity and reliability aspects of SEC_I and SEC_D1 indexes separately, since different analytical approaches were used in their construction.

2.4.1 Validity and reliability of SEC_I Index

We checked measurement invariance of the SEC index across different years and groups of students investigated in the NSSA. We were able to confirm configural and metric invariance of the index (fit statistics for a CFA model[15] with loadings fixed across groups (i.e., year of assessment): $X^2 = 578.760$ (df=124, p<0.001; CFI = 0.963; RMSEA = 0.032 (90% CI: 0.029-0.035, p=1; SRMR = 0.050). However, we were able to confirm only partial scalar invariance of the SEC index. This result indicates that scale means are different across years and groups of students investigated in the NSSA. Since the groups are defined as temporal objects, the outcome is rather expected. However, it also means that the groups should not be analyzed together, at least, if temporal (group) dimension is not included into the model explicitly.

We also assessed criterion validity of the SEC_I index constructed by means of CFA (Table 2.8a). As it was mentioned, for the final construction of the index items measuring parental education, parental employment status and item measuring students' pocket-money per week were not used, but we used them for the assessment of external validity of the scales. The findings indicated from week to moderate positive correlations between these items and SEC_I index. Moderate correlations (.35-.43) were observed between SEC_I index and parents' education and specific parental employment (job in the field of management) (.21-.26). Correlation between SEC_I index and students' pocket-money and between SEC_I index and parental employment status (item assessed on a three-point scale: ***3: work a paid full time job, 2: work part-time paid job, 1: do not work***) is weak (.14-.19 and .11-.18 respectively). The patterns in different years were the same.

Acceptable composite reliability was observed for SEC_I index across all rounds of NSSA, with the estimated value of ρ ranging from 0.66 to 0.73.

2.4.2 Validity and reliability of SEC_D1 Index

In order to evaluate how reliable (internally consistent) are dimensions of the MCA solution we calculated estimates of internal consistency[16] for the solution including all the variables and solutions when one variable is removed. The results of the analysis showed that for all the samples (groups and years) the estimates of internal consistency for the solution including all the variables (ranging from 0.54 to 0.60) are higher than those when any of the variables are removed.

[15] CFA performed with Mplus 8.6: weighted least squares mean and variance adjusted (WLSMV) estimation was used in order to account for categorical (binary) nature of the data and non-normality of the not-binary item. All items declared as categorical, parametrization – Theta, link function – Probit. Inter-item correlations included into the model: At home: Musical instruments vs. At home: Works of art; At home: Three or more computers vs. At home: Dishwasher.

[16] For the calculation of the estimates of internal consistency, we used the formula and the logic presented in Greenacre (2017: 159-160). It is based on the values of principal inertias (of the indicator matrix based MCA) and is monotonically related to Cronbach's alpha measure of reliability (internal consistency). In general, the higher the principal inertia (explained variance), the higher the reliability (internal consistency).

We also assessed criterion validity of the SEC_D1 index constructed by means of MCA (Table 2.8b). The findings indicated from weak to moderate positive correlations between validation items and SEC_D1 index. Moderate correlations (.40-.44) were observed between SEC_D1 index and parents' education and specific parental employment (job in the field of management) (.23-.30). Correlation between SEC_D1 index and students' pocket-money and between SEC_D1 index and parental employment status (item assessed on a three-point scale: ***3: work a paid full time job, 2: work part-time paid job, 1: do not work***) is weak (.16-.22 and .11-.19 respectively). The patterns in different years were the same.

The internal consistency of SEC_D1 was assessed using Cronbach's alpha, which ranged from 0.54 to 0.60 across different rounds of NSSA.

Table 2.1. Items Measuring Parental Education, Parental Employment and Supervisory Status, that were Dropped and not Included in the SEC Index.

	2012		2014		2015		2016	
	N	%	N	%	N	%	N	%
What is your mother's occupation?								
Working a paid full time job	2485	55,5	2111	56,1	1901	54,6	1349	49,8
Working a paid part- time job	1060	23,7	850	22,6	897	25,8	742	27,4
Does not work	585	13,1	511	13,6	391	11,2	297	11,0
I do not know	298	6,7	246	6,5	212	6,1	262	9,7
Answer is not administered (missing)	1	,0	7	,2	5	,1	11	,4
No answer (missing)	50	1,1	38	1,0	76	2,2	49	1,8
Total	4479	100,0	3763	100,0	3482	100,0	2710	100,0
What is your father's occupation?								
Working a paid full time job	2768	61,8	2335	62,1	2171	62,3	1598	59,0
Working a paid part- time job	686	15,3	584	15,5	599	17,2	525	19,4
Does not work	309	6,9	244	6,5	161	4,6	127	4,7
I do not know	579	12,9	474	12,6	417	12,0	368	13,6
Answer is not administered (missing)	2	,0	6	,2	9	,3	8	,3
No answer (missing)	135	3,0	120	3,2	125	3,6	84	3,1
Total	4479	100,0	3763	100,0	3482	100,0	2710	100,0
Is your mother currently working abroad?								
Yes	142	3,2	137	3,6	115	3,3	90	3,3
No	4098	91,5	3460	91,9	3134	90,0	2462	90,8
Answer is not administered (missing)	-	-	3	,1	1	,0	1	,0
No answer (missing)	239	5,3	163	4,3	232	6,7	157	5,8
Total	4479	100,0	3763	100,0	3482	100,0	2710	100,0
Is your father currently working abroad?								
Yes	596	13,3	484	12,9	477	13,7	463	17,1
No	3731	83,3	3126	83,1	2876	82,6	2165	79,9
Answer is not administered (missing)	2	,0	4	,1	-	-	2	,1
No answer (missing)	150	3,3	149	4,0	129	3,7	80	3,0
Total	4479	100,0	3763	100,0	3482	100,0	2710	100,0

	2012		2014		2015		2016	
	N	%	N	%	N	%	N	%
What is your mother's/guardian's education?								
University/higher education	1754	39,2	1440	38,3	1447	41,6	1057	39,0
Post Secondary (not higher) education	773	17,3	580	15,4	487	14,0	292	10,8
Vocational education	589	13,2	625	16,6	492	14,1	295	10,9
Secondary education	363	8,1	276	7,3	226	6,5	151	5,6
Basic education	62	1,4	87	2,3	72	2,1	74	2,7
No basic education	5	,1	9	,2	6	,2	6	,2
I do not know	836	18,7	653	17,4	621	17,8	715	26,4
Answer is not administered (missing)	51	1,1	56	1,5	55	1,6	93	3,4
No answer (missing)	46	1,0	37	1,0	76	2,2	27	1,0
Total	4479	100,0	3763	100,0	3482	100,0	2710	100,0
What is your father's/guardian's education?								
University/higher education	1114	24,9	825	21,9	907	26,0	706	26,1
Post Secondary (not higher) education	962	21,5	804	21,4	666	19,1	385	14,2
Vocational education	671	15,0	714	19,0	590	16,9	316	11,7
Secondary education	307	6,9	246	6,5	217	6,2	126	4,6
Basic education	77	1,7	82	2,2	79	2,3	99	3,7
No basic education	15	,3	8	,2	12	,3	8	,3
I do not know	1171	26,1	931	24,7	867	24,9	938	34,6
Answer is not administered (missing)	45	1,0	48	1,3	42	1,2	82	3,0
No answer (missing)	117	2,6	105	2,8	102	2,9	50	1,8
Total	4479	100,0	3763	100,0	3482	100,0	2710	100,0

Table 2.2. SEC Index: Structure and Syntax

Items			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
B5/How many books are there at Your home, approximately?	B5/How many books are there at Your home, approximately?	B5/How many books are there at Your home, approximately?	B4/How many books are there at Your home, approximately?
Response Scale:	Response Scale:	Response Scale:	Response Scale:
1 1-10 books	1 1-10 books	1 1-10 books	1 1-10 books
2 11-25 books	2 11-25 books	2 11-25 books	2 11-25 books
3 26-100 books	3 26-100 books	3 26-100 books	3 26-100 books
4 101-200 books	4 101-200 books	4 101-200 books	4 101-200 books
5 More than 200 books	5 More than 200 books	5 More than 200 books	5 More than 200 books
Intro: Do you have at your home:			
B6a/Your own books (do not include textbooks)	B6a/Your own books (do not include textbooks)	B6a/Your own books (do not include textbooks)	B5a/Your own books (do not include textbooks)
B6b/ an encyclopedia	B6b/ an encyclopedia	B6b/ an encyclopedia	B5b/ an encyclopedia
B6g/ a musical instrument (e.g., piano, guitar, etc.)	B6g/ a musical instrument (e.g., piano, guitar, etc.)	B6h/ a musical instrument (e.g., piano, guitar, etc.)	B5h/ a musical instrument (e.g., piano, guitar, etc.)
B6h/ works of art, artistic photography albums	B6h/ works of art, artistic photography albums	B6i/ works of art, artistic photography albums	B5i/ works of art, artistic photography albums
B6i/ a total number of computers is three or more	B6i/ a total number of computers is three or more	B6j/ a total number of computers is three or more	B5j/ a total number of computers is three or more
B6j/ a dishwasher	B6j/ a dishwasher	B6k/ a dishwasher	B5k/ a dishwasher
Response Scale:	Response Scale:	Response Scale:	Response Scale:
1 Yes	1 Yes	1 Yes	1 Yes
2 No	2 No	2 No	2 No

Items			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
B8/ Do you receive free meals at school: Response Scale: 1 Yes 2 No	B8/ Do you receive free meals at school: Response Scale: 1 Yes 2 No	B8/ Do you receive free meals at school: Response Scale: 1 Yes 2 No	B7/ Do you receive free meals at school: Response Scale: 1 Yes 2 No
Intro: Who helps you with extra studying besides regular class hours:			
B20a/ A tutor (paid teacher, who helps to study) or several tutors Response Scale: 1 Never 2 At least sometimes	B20a/ A tutor (paid teacher, who helps to study) or several tutors Response Scale: 1 Never or almost never 2 At least 1 time per month	B17a/ A tutor (paid teacher, who helps to study) or several tutors Response Scale: 1 Never or almost never 2 At least 1 time per month	B17a/ A tutor (paid teacher, who helps to study) or several tutors Response Scale: 1 Never or almost never 2 At least 1 time per month
Missings:		98, 99	
Indexes			
Aggregate Index			
One-Dimensional Index: SEC_I = factors scores from CFA[17] on 9 items: B5 + B6a + B6b + B6g + B6h + B6i + B6j + B8 + B20a Before CFA: Values of items B6 were recoded into 0-No and 1-Yes. Values of item B8 were recoded into 0-Yes and 1-No. Values of item B20a were recoded into 0-Never and 1-At least sometimes.	One-Dimensional Index: SEC_I = factors scores from CFA on 9 items: B5 + B6a + B6b + B6g + B6h + B6i + B6j + B8 + B20a Before CFA: Values of items B6 were recoded into 0-No and 1-Yes. Values of item B8 were recoded into 0-Yes and 1-No. Values of item B20a were recoded into 0-Never or almost never and 1-At least 1 time per month.	One-Dimensional Index: SEC_I = factors scores from CFA on 9 items: B5 + B6a + B6b + B6h + B6i + B6j + B6k + B8 + B17a Before CFA: Values of items B6 were recoded into 0-No and 1-Yes. Values of item B8 were recoded into 0-Yes and 1-No. Values of item B17a were recoded into 0-Never or almost never and 1-At least 1 time per month.	One-Dimensional Index: SEC_I = factors scores from CFA on 9 items: B4 + B5a + B5b + B5h + B5i + B5j + B5k + B7 + B17a Before CFA: Values of items B5 were recoded into 0-No and 1-Yes. Values of item B7 were recoded into 0-Yes and 1-No. Values of item B17a were recoded into 0-Never or almost never and 1-At least 1 time per month.
Two-Dimensional Index: SEC_D1 = reversed standard coordinates of Dim1 of indicator matrix MCA on 9 items: B5 + B6a + B6b + B6g + B6h + B6i + B6j + B8 + B20a	Two-Dimensional Index: SEC_D1 = reversed standard coordinates of Dim1 of indicator matrix MCA on 9 items: B5 + B6a + B6b + B6g + B6h + B6i + B6j + B8 + B20a	Two-Dimensional Index: SEC_D1 = reversed standard coordinates of Dim1 of indicator matrix MCA on 9 items: B5 + B6a + B6b + B6h + B6i + B6j + B6k + B8 + B17a	Two-Dimensional Index: SEC_D1 = reversed standard coordinates of Dim1 of indicator matrix MCA on 9 items: B4 + B5a + B5b + B5h + B5i + B5j + B5k + B7 + B17a
Two-Dimensional Index: SEC_D2 = standard coordinates of Dim2 of indicator matrix MCA on 9 items: B5 + B6a + B6b + B6g + B6h + B6i + B6j + B8 + B20a	Two-Dmensional Index: SEC_D2 = standard coordinates of Dim2 of indicator matrix MCA on 9 items: B5 + B6a + B6b + B6g + B6h + B6i + B6j + B8 + B20a	Two-Dimensional Index: SEC_D2 = standard coordinates of Dim2 of indicator matrix MCA on 9 items: B5 + B6a + B6b + B6h + B6i + B6j + B6k + B8 + B17a	Two-Dimensional Index: SEC_D2 = standard coordinates of Dim2 of indicator matrix MCA on 9 items: B4 + B5a + B5b + B5h + B5i + B5j + B5k + B7 + B17a
Categorical Index: SEC_C = quintiles constructed from SEC_D1 using R function quantile() (calculation algorithm = "Type 8")	Categorical Index: SEC_C = quintiles constructed from SEC_D1 using R function quantile() (calculation algorithm = "Type 8")	Categorical Index: SEC_C = quintiles constructed from SEC_D1 using R function quantile() (calculation algorithm = "Type 8")	Categorical Index: SEC_C = quintiles constructed from SEC_D1 using R function quantile() (calculation algorithm = "Type 8")

[17] Estimation technique is described on page 5.

Table 2.3a. Weighted Least Squares Mean and Variance Adjusted Estimates and Fit Statistics for Single-Factor Models of the Social-Economic-Cultural Index (SEC_I) Items: 8th-grade, 2012.

Items	8th grade, 2012					
	Estimate	S.E.	p-value	Resid. Variance	Std. Estimate	R^2
Number of Books at Home	1.000	--	--	0.556	0.666	0.444
At Home: Own Books	0.696	0.049	0.000	0.785	0.463	0.215
At Home: Encyclopedia	1.120	0.046	0.000	0.444	0.746	0.556
At Home: Musical Instruments	0.697	0.038	0.000	0.785	0.464	0.215
At Home: Works of Art	0.502	0.038	0.000	0.888	0.334	0.112
At Home: Three or More Computers	0.472	0.039	0.000	0.901	0.314	0.099
At Home: Dishwasher	0.464	0.039	0.000	0.904	0.309	0.096
Free Meal at School	0.706	0.039	0.000	0.779	0.470	0.221
Private Tutor	0.476	0.040	0.000	0.899	0.317	0.101
Model Characteristics						
X^2			221.131 (df=25, p<0.001)			
Comparative Fit Index			0.946			
Tucker-Lewis Index			0.922			
Root Mean Square Error of Approximation			0.042 (90% CI: 0.037-0.047, p (probability RMSEA <= .05) = 0.996			
Standardized Root Mean Square Residual			0.050			
N			4479			

- Notes: S.E. – standard error; CI – confidence interval.
- Analysis was performed using Mplus 8.6 with weighted least squares mean and variance adjusted (WLSMV) estimation. WLSMV was used in order to account for categorical (binary) nature of the data and non-normality of the not-binary item. All items declared as categorical, with Delta parametrization link function and a Probit link function. Inter-item correlations included in the model: At home: Musical instruments vs. At home: Works of art = 0.163, At home: Three or more computers vs. At home: Dishwasher = 0.275.

Table 2.3b. Weighted Least Squares Mean and Variance Adjusted Estimates and Fit Statistics for Single-Factor Models of the Social-Economic-Cultural Index Items: 8th grade, 2014.

Items	8th grade, 2014					
	Estimate	S.E.	p-value	Resid. Variance	Std. Estimate	R^2
Number of Books at Home	1.000	--	--	0.437	0.750	0.563
At Home: Own Books	0.769	0.043	0.000	0.667	0.577	0.333
At Home: Encyclopedia	0.995	0.039	0.000	0.442	0.747	0.558
At Home: Musical Instruments	0.642	0.034	0.000	0.768	0.482	0.232
At Home: Works of Art	0.528	0.036	0.000	0.843	0.397	0.157
At Home: Three or More Computers	0.321	0.034	0.000	0.942	0.241	0.058
At Home: Dishwasher	0.385	0.035	0.000	0.916	0.289	0.084
Free Meal at School	0.639	0.035	0.000	0.77	0.479	0.23
Private Tutor	0.349	0.040	0.000	0.931	0.262	0.069
Model Characteristics						
X^2			167.245 (df=25, p<0.001)			
Comparative Fit Index			0.962			
Tucker-Lewis Index			0.945			
Root Mean Square Error of Approximation			0.039 (90% CI: 0.033-0.045, p (probability RMSEA <= .05) = 0.999			

Items	8th grade, 2014					
	Estimate	S.E.	p-value	Resid. Variance	Std. Estimate	R^2
Standardized Root Mean Square Residual			0.049			
N			3763			

- Notes: S.E. – Standard Error; CI – Confidence Interval.
- The analysis was performed using Mplus 8.6. Weighted least squares mean and variance-adjusted (WLSMV) estimation were used to account for categorical (binary) nature of the data and non-normality of the not-binary items. All items were declared as categorical, with parametrization set to Delta and the link function set to Probit. Inter-item correlations included in the model were as follows: At home: Musical instruments vs. At home: Works of art = 0.100, At home: Three or more computers vs. At home: Dishwasher = 0.209.

Table 2.3c. Weighted Least Squares Mean and Variance Adjusted Estimates and Fit Statistics for Single-Factor Models of the Social-Economic-Cultural Index Items: 8th-grade, 2015.

Items	8th grade, 2015					
	Estimate	S.E.	p-value	Resid. Variance	Std. Estimate	R^2
Number of Books at Home	1.000	--	--	0.433	0.753	0.567
At Home: Own Books	0.819	0.045	0.000	0.619	0.617	0.381
At Home: Encyclopedia	0.979	0.043	0.000	0.456	0.737	0.544
At Home: Musical Instruments	0.681	0.038	0.000	0.737	0.513	0.263
At Home: Works of Art	0.484	0.037	0.000	0.867	0.365	0.133
At Home: Three or More Computers	0.304	0.035	0.000	0.947	0.229	0.053
At Home: Dishwasher	0.361	0.036	0.000	0.926	0.272	0.074
Free Meal at School	0.656	0.038	0.000	0.756	0.494	0.244
Private Tutor	0.291	0.039	0.000	0.952	0.219	0.048
Model Characteristics						
X^2			107.231 (df=25, p<0.001)			
Comparative Fit Index			0.975			
Tucker-Lewis Index			0.964			
Root Mean Square Error of Approximation			0.031 (90% CI: 0.025-0.037, p (probability RMSEA <= .05) = 1.000			
Standardized Root Mean Square Residual			0.041			
N			3482			

- Notes: S.E. – Standard Error; CI – Confidence Interval.
- The analysis was performed using Mplus 8.6. Weighted least squares mean and variance-adjusted (WLSMV) estimation were used to account for categorical (binary) nature of the data and non-normality of the not-binary items. All items were declared as categorical, with parametrization set to Delta and the link function set to Probit. Inter-item correlations included in the model were as follows: At home: Musical instruments vs. At home: Works of art = 0.086, At home: Three or more computers vs. At home: Dishwasher = 0.180.

Table 2.3d. Weighted Least Squares Mean and Variance-Adjusted Estimates and Fit Statistics for Single-Factor Models of the Social-Economic-Cultural Index Items: 6th-grade, 2016.

Items	6th grade, 2016					
	Estimate	S.E.	p-value	Resid. Variance	Std. Estimate	R^2
Number of Books at Home	1.000	--	--	0.528	0.687	0.472
At Home: Own Books	0.755	0.067	0.000	0.73	0.519	0.27
At Home: Encyclopedia	1.122	0.065	0.000	0.405	0.771	0.595
At Home: Musical Instruments	0.562	0.049	0.000	0.851	0.386	0.149
At Home: Works of Art	0.473	0.050	0.000	0.894	0.325	0.106

Items	6th grade, 2016					
	Estimate	S.E.	p-value	Resid. Variance	Std. Estimate	R^2
At Home: Three or More Computers	0.302	0.046	0.000	0.957	0.208	0.043
At Home: Dishwasher	0.315	0.046	0.000	0.953	0.216	0.047
Free Meal at School	0.728	0.052	0.000	0.75	0.5	0.25
Private Tutor	0.108	0.055	0.047	0.994	0.075	0.006
Model Characteristics						
X^2			70.331 (df=25, p<0.001)			
Comparative Fit Index			0.974			
Tucker-Lewis Index			0.963			
Root Mean Square Error of Approximation			0.026 (90% CI: 0.019-0.033, p (probability RMSEA <= .05) = 1.000			
Standardized Root Mean Square Residual			0.040			
N			2710			

- Notes: S.E. – Standard Error; CI – Confidence Interval.
- The analysis was performed using Mplus 8.6. Weighted least squares mean and variance-adjusted (WLSMV) estimation were used to account for categorical (binary) nature of the data and non-normality of the not-binary item. All items were declared as categorical, with parametrization set to Delta and the link function set to Probit. Inter-item correlations included in the mode were as follows: At home: Musical instruments vs. At home: Works of art = 0.029, At home: Three or more computers vs. At home: Dishwasher = 0.203

Table 2.4. MSEP Values for Different Numbers of Dimensions Across Four Datasets.

Dataset Year	Number of Dimensions					
	0	1	2	3	4	5
2012	3.863278	3.859874	3.858670	3.858678	3.858906	3.859101
2014	3.839623	3.836934	3.836340	3.836623	3.837070	3.837131
2015	3.849389	3.846234	3.845809	3.845903	3.846251	3.846403
2016	3.853725	3.851673	3.851164	3.851340	3.851512	3.851868

Table 2.5a. Coordinates, Relative Contributions, Squared Cosines, V.Test, and Eta-Squared Estimates from the Two-Dimensional MCA Solution for the 2012 NSSA Data.

Category	Dimension 1					Dimension 2				
	Coord.	Ctrb.	Cos^2	V.test	Eta^2	Coord.	Ctrb.	Cos^2	V.test	Eta^2
Books:1-10	1.151	9.146	0.220	31.324		1.191	15.949	0.235	32.408	
Books:11-25	0.471	3.028	0.087	19.687		-0.237	1.252	0.022	-9.918	
Books:26-100	-0.253	1.030	0.032	-11.908	0.461	-0.474	5.889	0.112	-22.308	0.345
Books:101-200	-0.709	3.438	0.083	-19.193		-0.134	0.201	0.003	-3.631	
Books:>200	-1.062	5.786	0.134	-24.402		0.696	4.050	0.057	15.995	
Home:book:No	1.244	4.840	0.109	21.823	0.106	1.987	20.113	0.278	34.853	0.271
Home:book:Yes	-0.086	0.333	0.109	-21.823		-0.137	1.383	0.278	-34.853	
Home_ency:No	1.097	14.493	0.403	42.107	0.396	0.413	3.340	0.057	15.837	0.056
Home_ency:Yes	-0.361	4.765	0.403	-42.107		-0.136	1.098	0.057	-15.837	
Home_musi:No	0.470	5.864	0.272	34.513	0.266	-0.025	0.026	0.001	-1.815	0.001
Home_musi:Yes	-0.566	7.074	0.272	-34.513		0.030	0.032	0.001	1.815	

Category	Dimension 1					Dimension 2				
	Coord.	Ctrb.	Cos^2	V.test	Eta^2	Coord.	Ctrb.	Cos^2	V.test	Eta^2
Home_arta:No	0.579	5.285	0.164	26.819	0.161	0.205	1.079	0.021	9.493	0.020
Home_arta:Yes	-0.277	2.528	0.164	-26.819		-0.098	0.516	0.021	-9.493	
Home_3com:No	0.271	2.419	0.158	26.259	0.154	-0.338	6.135	0.246	-32.768	0.240
Home_3com:Yes	-0.568	5.071	0.158	-26.259		0.709	12.865	0.246	32.768	
Home_dish:No	0.275	2.465	0.158	26.307	0.155	-0.317	5.359	0.211	-30.392	0.206
Home_dish:Yes	-0.563	5.052	0.158	-26.307		0.650	10.986	0.211	30.392	
FreeMeal:Yes	0.731	7.998	0.238	32.616	0.238	-0.025	0.015	0.000	-1.106	0.000
FreeMeal:No	-0.325	3.557	0.238	-32.616		0.011	0.007	0.000	1.106	
Tutor:No	0.200	1.460	0.120	23.165	0.120	-0.202	2.431	0.122	-23.418	0.122
Tutor:Yes	-0.599	4.368	0.120	-23.165		0.605	7.273	0.122	23.418	

Table 2.5b. Coordinates, Relative Contributions, Squared Cosines, V.Test, and Eta-Squared Estimates from the Two-Dimensional MCA Solution for the 2014 NSSA Data.

Category	Dimension 1					Dimension 2				
	Coord.	Ctrb.	Cos^2	V.test	Eta^2	Coord.	Ctrb.	Cos^2	V.test	Eta^2
Books:1-10	1.327	12.874	0.330	35.162	0.539	1.102	14.859	0.228	29.212	0.396
Books:11-25	0.337	1.528	0.046	13.188		-0.559	7.020	0.127	-21.857	
Books:26-100	-0.274	1.081	0.034	-11.251		-0.389	3.632	0.068	-15.946	
Books:101-200	-0.774	3.825	0.096	-18.941		0.187	0.373	0.006	4.576	
Books:>200	-1.069	5.726	0.138	-22.789		0.766	4.915	0.071	16.326	
Home:book:No	1.573	8.178	0.192	26.692	0.189	1.691	15.805	0.222	28.695	0.219
Home:book:Yes	-0.120	0.626	0.192	-26.692		-0.129	1.210	0.222	-28.695	
Home_ency:No	1.156	15.143	0.436	40.250	0.431	0.396	2.966	0.051	13.776	0.050
Home_ency:Yes	-0.372	4.877	0.436	-40.250		-0.127	0.955	0.051	-13.776	
Home_musi:No	0.476	5.687	0.268	31.586	0.265	-0.036	0.056	0.002	-2.415	0.002
Home_musi:Yes	-0.557	6.642	0.268	-31.586		0.043	0.065	0.002	2.415	
Home_arta:No	0.677	6.476	0.202	27.444	0.200	0.169	0.673	0.013	6.841	0.012
Home_arta:Yes	-0.296	2.832	0.202	-27.444		-0.074	0.294	0.013	-6.841	
Home_3com:No	0.320	2.323	0.098	19.133	0.097	-0.458	7.931	0.201	-27.340	0.199
Home_3com:Yes	-0.304	2.201	0.098	-19.133		0.434	7.515	0.201	27.340	
Home_dish:No	0.270	2.106	0.122	21.238	0.120	-0.365	6.451	0.223	-28.745	0.220
Home_dish:Yes	-0.444	3.468	0.122	-21.238		0.601	10.623	0.223	28.745	
FreeMeal:Yes	0.818	8.345	0.246	30.384	0.245	-0.256	1.363	0.024	-9.496	0.024
FreeMeal:No	-0.300	3.063	0.246	-30.384		0.094	0.500	0.024	9.496	
Tutor:No	0.121	0.555	0.065	15.578	0.065	-0.193	2.370	0.165	-24.882	0.165
Tutor:Yes	-0.533	2.443	0.065	-15.578		0.851	10.424	0.165	24.882	

Table 2.5c. Coordinates, Relative Contributions, Squared Cosines, V.Test, and Eta-Squared Estimates from the Two-Dimensional MCA Solution for the 2015 NSSA data.

Category	Dimension 1					Dimension 2				
	Coord.	Ctrb.	Cos^2	V.test	Eta^2	Coord.	Ctrb.	Cos^2	V.test	Eta^2
Books:1-10	1.464	14.753	0.373	35.868		0.999	11.883	0.174	24.475	
Books:11-25	0.315	1.316	0.040	11.692		-0.501	5.764	0.100	-18.601	
Books:26-100	-0.299	1.343	0.043	-12.126	0.550	-0.444	5.121	0.094	-18.004	0.366
Books:101-200	-0.743	3.386	0.084	-17.028		0.379	1.527	0.022	8.695	
Books:>200	-0.947	4.932	0.121	-20.387		0.749	5.326	0.075	16.109	
Home:book:No	1.698	9.348	0.218	27.334	0.215	1.667	15.583	0.210	26.832	0.207
Home:book:Yes	-0.126	0.696	0.218	-27.334		-0.124	1.160	0.210	-26.832	
Home_ency:No	1.235	15.685	0.435	38.669	0.430	0.315	1.763	0.028	9.856	0.028
Home_ency:Yes	-0.348	4.418	0.435	-38.669		-0.089	0.496	0.028	-9.856	
Home_musi:No	0.483	5.968	0.286	31.302	0.281	-0.088	0.341	0.009	-5.692	0.009
Home_musi:Yes	-0.583	7.204	0.286	-31.302		0.106	0.412	0.009	5.692	
Home_arta:No	0.615	5.474	0.172	24.274	0.169	0.117	0.341	0.006	4.608	0.006
Home_arta:Yes	-0.275	2.447	0.172	-24.274		-0.052	0.153	0.006	-4.608	
Home_3com:No	0.265	1.773	0.084	16.934	0.082	-0.410	7.349	0.201	-26.214	0.197
Home_3com:Yes	-0.311	2.082	0.084	-16.934		0.482	8.632	0.201	26.214	
Home_dish:No	0.267	1.965	0.104	18.879	0.102	-0.402	7.707	0.236	-28.425	0.232
Home_dish:Yes	-0.384	2.826	0.104	-18.879		0.578	11.083	0.236	28.425	
FreeMeal:Yes	0.965	9.312	0.256	29.682	0.253	-0.041	0.030	0.000	-1.271	0.000
FreeMeal:No	-0.262	2.532	0.256	-29.682		0.011	0.008	0.000	1.271	
Tutor:No	0.137	0.654	0.054	13.746	0.054	-0.256	3.943	0.189	-25.668	0.189
Tutor:Yes	-0.396	1.887	0.054	-13.746		0.739	11.379	0.189	25.668	

Table 2.5d. Coordinates, Relative Contributions, Squared Cosines, V.Test, and Eta-Squared Estimates from the Two-Dimensional MCA Solution for the 2016 NSSA Data.

Category	Dimension 1					Dimension 2				
	Coord.	Ctrb.	Cos^2	V.test	Eta^2	Coord.	Ctrb.	Cos^2	V.test	Eta^2
Books:1-10	1.455	15.125	0.341	30.336		0.527	3.253	0.045	10.984	
Books:11-25	0.320	1.746	0.051	11.687		-0.294	2.421	0.043	-10.744	
Books:26-100	-0.431	3.180	0.092	-15.781	0.523	-0.213	1.273	0.023	-7.797	0.167
Books:101-200	-0.755	3.721	0.083	-14.944		0.126	0.169	0.002	2.486	
Books:>200	-0.917	3.259	0.069	-13.591		1.051	7.019	0.090	15.572	
Home:book:No	1.807	8.740	0.181	21.983	0.178	1.658	12.067	0.153	20.167	0.150
Home:book:Yes	-0.099	0.477	0.181	-21.983		-0.091	0.659	0.153	-20.167	
Home_ency:No	1.246	18.505	0.470	35.508	0.465	0.161	0.510	0.008	4.600	0.008
Home_ency:Yes	-0.373	5.544	0.470	-35.508		-0.048	0.153	0.008	-4.600	
Home_musi:No	0.420	4.694	0.189	22.522	0.187	-0.089	0.344	0.008	-4.764	0.008
Home_musi:Yes	-0.446	4.982	0.189	-22.522		0.094	0.366	0.008	4.764	
Home_arta:No	0.602	5.254	0.143	19.569	0.141	0.381	3.456	0.057	12.391	0.057
Home_arta:Yes	-0.235	2.050	0.143	-19.569		-0.149	1.348	0.057	-12.391	

Category	Dimension 1					Dimension 2				
	Coord.	Ctrb.	Cos^2	V.test	Eta^2	Coord.	Ctrb.	Cos^2	V.test	Eta^2
Home_3com:No	0.283	2.084	0.082	14.815	0.081	-0.504	10.819	0.260	-26.354	0.256
Home_3com:Yes	-0.286	2.102	0.082	-14.815		0.508	10.912	0.260	26.354	
Home_dish:No	0.269	1.946	0.080	14.579	0.078	-0.559	13.767	0.344	-30.279	0.338
Home_dish:Yes	-0.292	2.109	0.080	-14.579		0.606	14.920	0.344	30.279	
FreeMeal:Yes	0.996	11.083	0.275	27.231	0.274	0.172	0.540	0.008	4.695	0.008
FreeMeal:No	-0.275	3.061	0.275	-27.231		-0.047	0.149	0.008	-4.695	
Tutor:No	0.038	0.062	0.007	4.216	0.007	-0.204	2.890	0.187	-22.511	0.187
Tutor:Yes	-0.172	0.277	0.007	-4.216		0.916	12.966	0.187	22.511	

Table 2.6a. Aggregate SEC_I Index: Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	4479	3763	3482	2710
Missing	0	0	0	0
Min - Max	-1.41 – 1.23	-1.61 – 1.33	-1.66 – 1.28	-1.54 – 1.15
Mean (SD)	-0.01(0.52)	-0.01(0.06)	-0.01(0.60)	-0.02(0.53)
Median	0.03	0.00	0.02	0.01
Skewness (st.error)	-0.08(0.04)	-0.09(0.04)	-0.17(0.04)	-0.22(0.05)
Kurtosis (st.error)	-0.42(0.07)	-0.42(0.08)	-0.37(0.08)	-0.33(0.09)
ICC (school)	0.23	0.2	0.24	0.2

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating the portion of variance in the SEC_I Index accounted for by school-level differences.

Table 2.6b. Two-Dimensional (SEC_D1 and SEC_D2) Index: Descriptives

	SEC_D1				SEC_D2			
	2012	2014	2015	2016[1]	2012	2014	2015	2016[1]
N	4479	3763	3482	2710	4479	3763	3482	2710
Missing	0	0	0	0	0	0	0	0
Min - Max	-1.40 – 1.02	-1.53 – 0.91	-1.63 – 0.83	-1.71 – 0.74	-0.52 – 1.63	-0.65 – 1.49	-0.59 – 1.38	-0.61 – 1.47
Mean (SD)	0.00(0.48)	0.00(0.49)	0.00(0.49)	0.00(0.46)	0.00(0.37)	0.00(0.38)	0.00(0.37)	0.00(0.36)
Median	0.02	0.05	0.07	0.09	-0.07	-0,03	0.00	-0.02
Skewness (st.error)	-0.24(0.04)	-0.52(0.04)	-0.73(0.04)	-0.85(0.05)	0.84(0.04)	0,55(0,04)	0.52(0.04)	0.43(0.05)
Kurtosis (st.error)	-0.43(0.07)	-0.17(0.08)	0.15(0.08)	0.42(0.09)	0.68(0.07)	-0.06(0.08)	-0.07(0.08)	-0.03(0.09)
ICC (school)	0.23	0.19	0.23	0.19	0.07	0.04	0.04	0.04

- Notes: 1Dataset (2016) contains responses of the 6th-grade students, while the other databases contain responses from the 8th-graders.
- ICC (School) – Intra-Class Correlation Coefficient, indicating the portion of variance in SEC_D1 and SEC_D2 Indexes accounted for by school-level differences.

Table 2.6c. Categorical SEC_C Index: Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	4479	3763	3482	2710
Missing	0	0	0	0

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
1st quintile (n)	-1.40 / -0.42 (896)	-1.53 /-0.43 (756)	-1.63 / -0.39 (696)	-1.71 / -0.38 (548)
2nd quintile (n)	-0.42 / -0.12 (899)	-0.43 / -0.07 (756)	-0.39 / -0.06 (698)	-0.39 / -0.03 (538)
3rd quintile (n)	-0.12 / 0.16 (895)	-0.07 / 0.18 (752)	-0.06 / 0.18 (713)	-0.03 / 0.19 (546)
4th quintile (n)	0.16 / 0.42 (893)	0.18 / 0.42 (750)	0.18 / 0.42 (693)	0.19 / 0.41 (536)
5th quintile (n)	0.42 / 1.02 (896)	0.42 / 0.91 (749)	0.42 / 0.83 (682)	0.41 / 0.74 (542)
ICC (school)	0.2	0.19	0.22	0.18

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating a proportion of variance in the SEC_C Index accounted for by school-level differences.

Table 2.7. Histograms for SEC_I and SEC_D1, SEC_D2 Indexes.

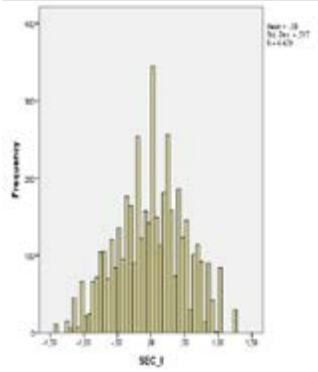
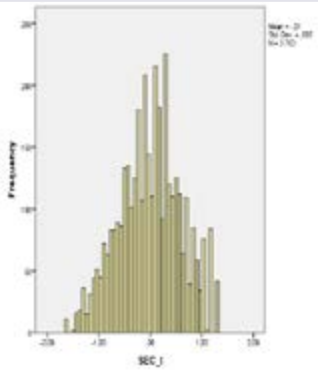
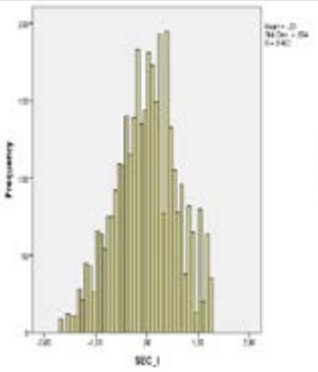
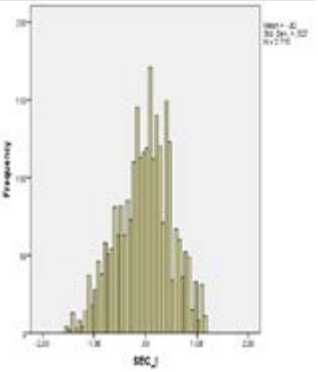
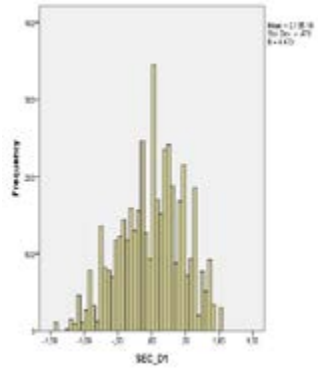
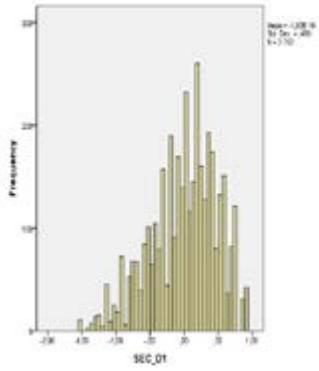
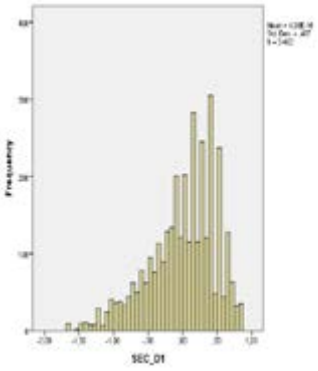
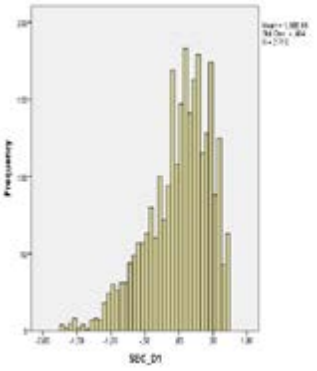
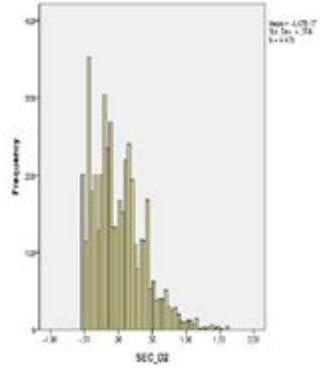
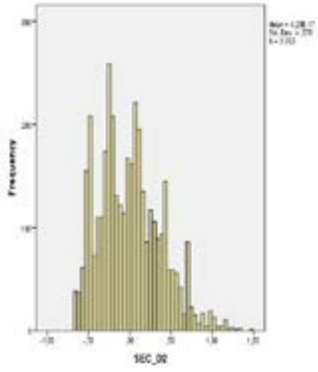
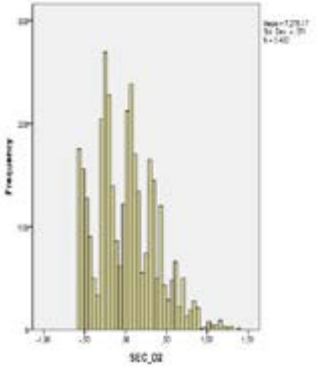
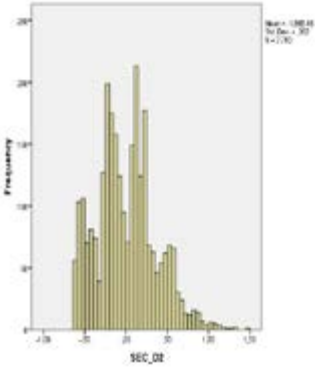
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
SEC_I			
			
SEC_D1			
			
SEC_D2			
			

Table 2.8a. SEC_I Index: Discriminant Validity and Internal Consistency

Correlates	SEC_I			
	2012	2014	2015	2016
Students' Pocket-Money	.18	.19	.14	.14
Mother's Job	.14	.16	.18	.12
Father's Job	.11	.12	.13	.11
Mother's Job (in the field of management)	.21	.25	-	-
Father's Job (in a field of management)	.25	.26	-	-
Mother's Education	.43	.42	.35	.37
Father's Education	.39	.38	.35	.35
Composite Reliability Estimate	.69	.73	.70	.66

• Note: Pearson's correlation coefficients (r) are presented in the table. All correlations are statistically significant at the .001 level.

Table 2.8b. SEC_D1 Index: Discriminant Validity and Internal Consistency

Correlates	SEC_D1			
	2012	2014	2015	2016
Students' Pocket-Money	.21	.22	.17	.16
Mother's Job	.15	.17	.19	.13
Father's Job	.12	.13	.14	.11
Mother's Job (in the field of management)	.23	.30	-	-
Father's Job (in a field of management)	.27	.28	-	-
Mother's Education	.44	.42	.36	.37
Father's Education	.40	.37	.35	.34
Estimate of Internal Consistency of Items	.58	.60	.60	.54

• Note: Pearson's correlation coefficients (r) are presented in the table. All correlations are statistically significant at the .001 level.

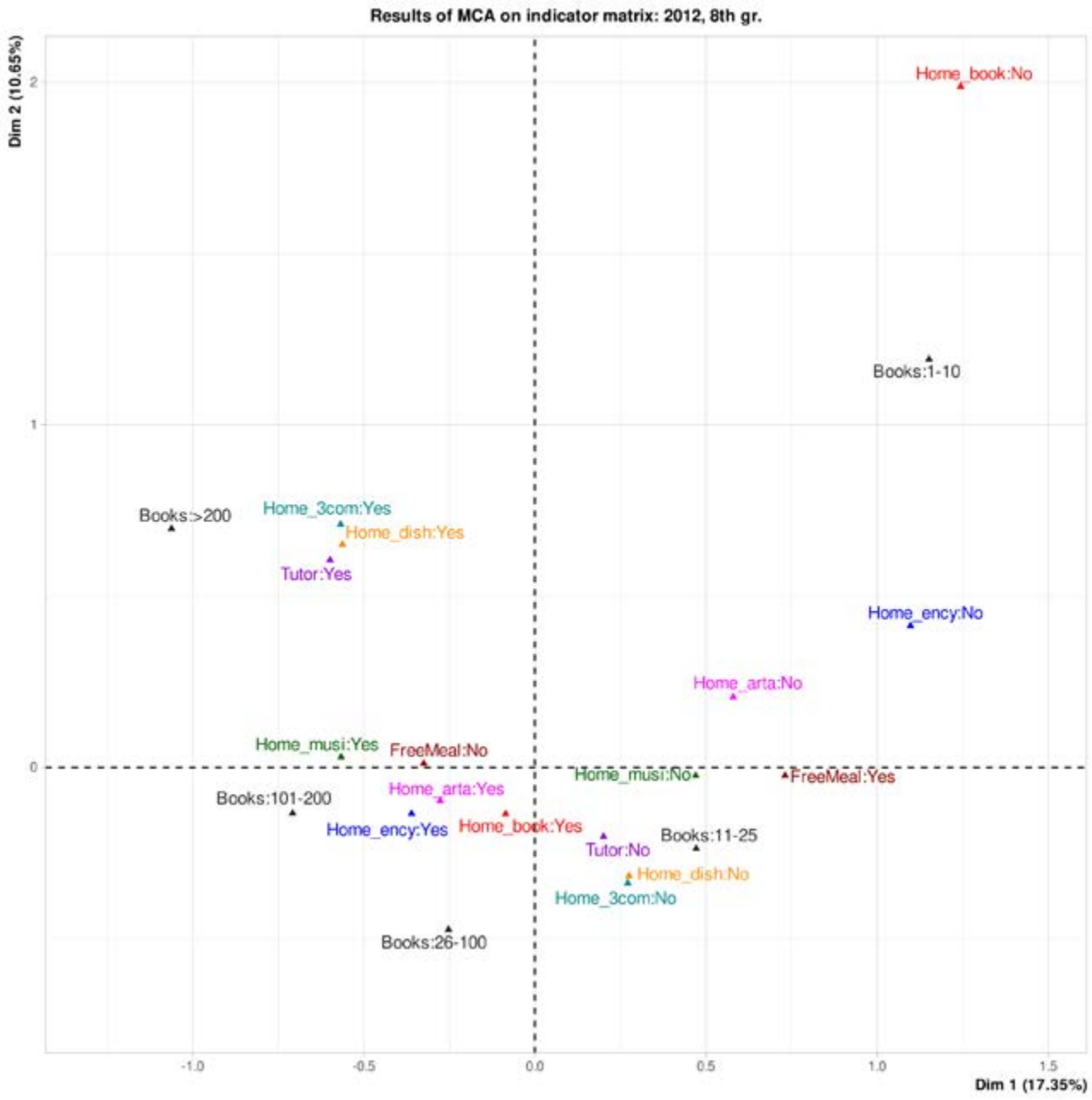


Figure 2.1a. MCA Solution for 2012 (8th Grade) Items Measuring SEC.

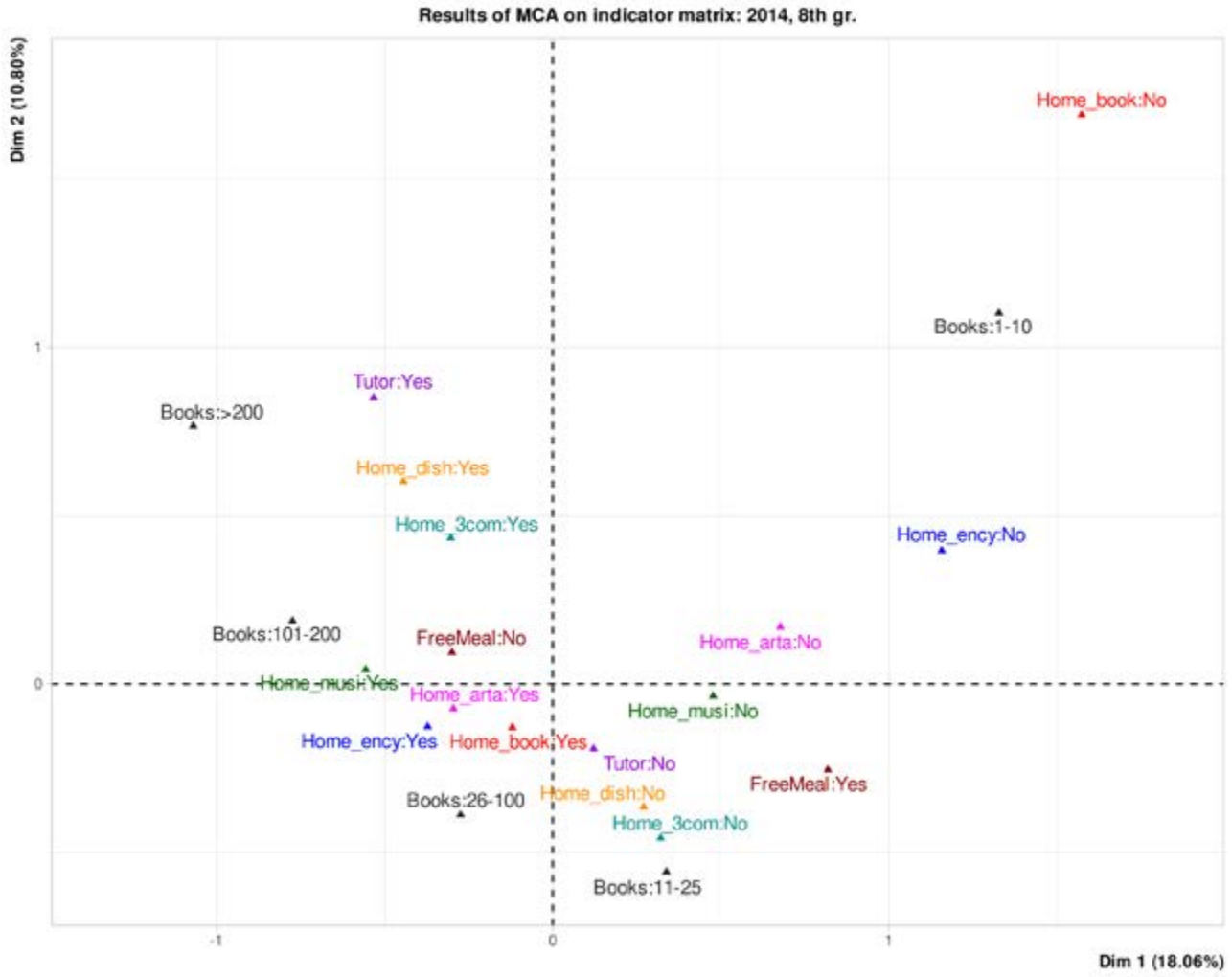


Figure 2.1b. MCA Solution for 2014 (8th Grade) Items Measuring SEC.

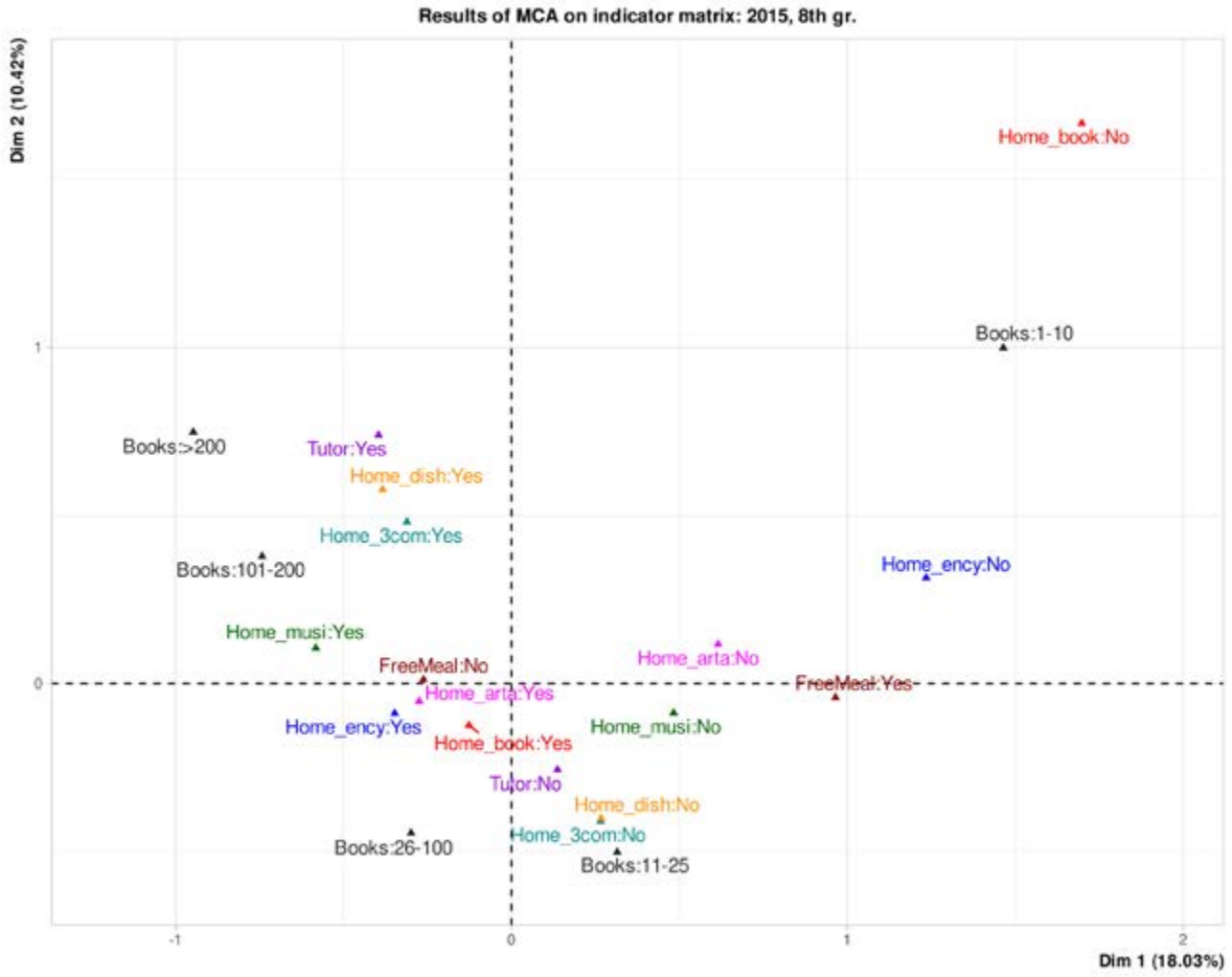


Figure 2.1c. MCA Solution for 2015 (8th Grade) Items Measuring SEC.

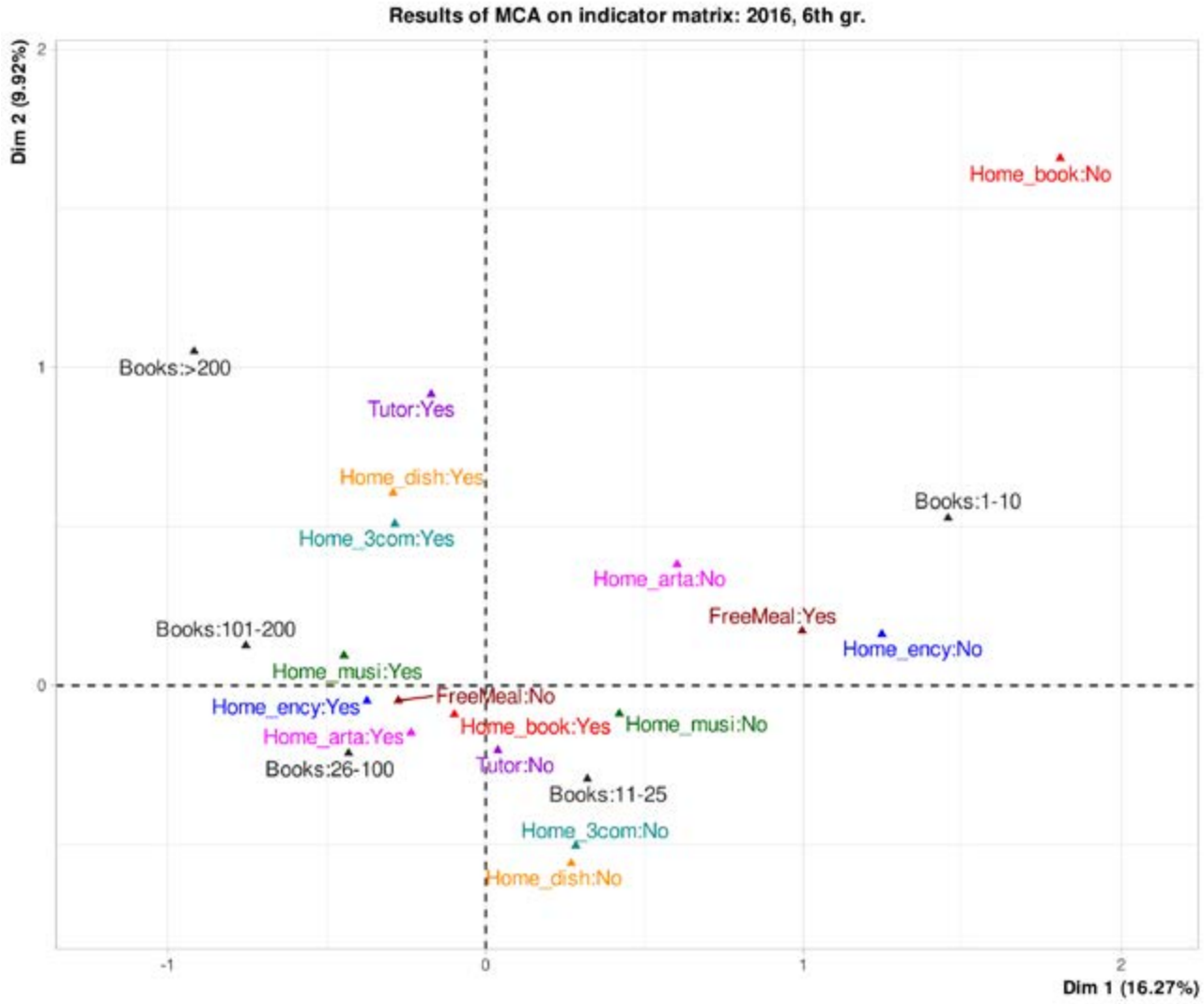


Figure 2.1d. MCA Solution for 2016 (6th Grade) Items Measuring SEC.

3. ASSESSING STUDENTS' MOTIVATIONAL, EMOTIONAL, AND SOCIAL FUNCTIONING AT SCHOOL

3.1 Academic Self-Concept

3.1.1 Theoretical Conceptualization of the Construct

Academic self-concept is one component of a multidimensional, hierarchical model of self-concept, consisting of academic, social, emotional, and physical self-concepts (Marsh & Craven, 2006; Marsh&Martin, 2011; Shelveson, 1976). This model makes an important distinction between general self-concept and its different components. Research shows that the most significant relations of self-concept are between specific components of self-concept and specific outcomes that are most logically related. For example, academic achievement is correlated with academic self-concept but is nearly unrelated with non-academic components of self-concept or the more global self-concept construct (Marsh & Craven, 2006; Marsh&Martin 2011).

A key component of academic self-concept is perceived academic competence. In its broadest sense, academic self-concept encompasses individuals' knowledge and perceptions about themselves in the context of achievement (Bong & Skaalvik, 2003) or school subjects in general (Brunner, Keller, Hornung, Reichert, & Martin, 2009; Marsh, Trautwein, Ludtke, Koller, & Baumert, 2005). Specific operationalizations of academic self-concept vary across studies; however the construct generally refers to subjective answers to the question "Can I succeed in this task (learning at school)?" (Eccles et al., 1993).

Students' self-perceptions play an important role in their achievement and adjustment during childhood and adolescence. Academic self-concept is related to a range of academic outcomes. Students with high self-concept tend to show higher academic results (Arens et al., 2017; Valentine et al., 2004), express greater interest in the subject (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005), are more engaged in extracurricular activities (Nagengast et al., 2011), more often express specific, occupational aspirations and intentions to study or work in a particular subject-related field (Ireson & Hallam, 2009; Nagengast et al., 2011). Research also shows that a positive self-concept is particularly beneficial in cases of anxiety, impaired motivation, and is important for facilitating subsequent performance following failure (Marsh & Craven, 2006).

An important question that is raised in contemporary research is "What comes first – academic self-concept or academic achievement?" A number of studies have found that the relationship between academic self-concept and academic achievement is often is reciprocal: higher academic achievement enhances academic self-concept and vice versa - higher academic self-concept enhances academic achievement (Marsh & Craven, 2006; Marsh & Martin, 2011; Marsh et al., 2005, Vu et al., 2021).

Such findings, which indicate that academic self-concept and academic achievement are reciprocally related and mutually reinforcing, have important implications for educators. Teachers should strive to improve both academic self-concept and achievement simultaneously because if teachers focus on only one of these constructs, then both are likely to suffer (Marsh & Martin, 2011).

3.1.2 Operationalization of the Construct in NSSA Data

The operationalization of academic self-concept in NSSA data aligns with the conceptualization of the phenomenon as a unidimensional construct, encompassing aspects of self-concept such as self-confidence, a focus on learning, and the use of different approaches to complete tasks. Respondents were asked to express their agreement with statements like:

- You are not afraid of difficulties during learning.
- You trust in your own strengths while learning.
- You know different ways to complete not only the tasks you enjoy but also those that are difficult or boring.
- You are good at maintaining your focus on learning.

Each item was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree***, 3 - ***agree,*** 4 - ***completely agree***. The total score for the scale is calculated by averaging the responses to the four items. The mean score represents the level of student's academic self-concept. Higher scores indicate a higher level of academic self-concept. The same items and identical response scale were used to assess academic self-concept across different rounds of NSSA (2012-2016) (see Table 3.1.1).

3.1.3 Descriptive Statistics

Descriptives for the scale are presented in Tables 3.1.2 and 3.1.3. Mean scores range from 2.8 to 3.0, with the maximum possible value being 4. Median scores are 2.8, except in 2016, where the median score is 3.0. This indicates that half of the participants reported their academic self-concept higher than a value of 2.8.

The values of skewness range between -0.33 and 0.16 across different rounds of NSSA, indicating that the data are slightly skewed to the left side in 2016 and to the right side in 2012 and 2015. However, with values of skewness between -0.5 and 0.5 the distributions of the academic self-concept scale appear fairly symmetric across all rounds. The values of kurtosis range between 0.13 to 0.80. Thus, it can be assumed that the data for this scale approximately follow a normal distribution.

Individual differences are the primary source of variance in academic self-concept. Differences between schools account for 2.8% to 4.4% of variance in academic self-concept from 2012 to 2015. Differences between schools were not observed in the year 2016 (see ICC scores in table 3.1.2).

3.1.4 Scale Validity in NSSA Data

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) conducted on the four academic self-concept items (see Table 3.1.4). In all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor ranged from 46.69% to 57.39%. All item loadings were above the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. The findings indicated moderate to strong positive correlations between academic self-concept and teaching characteristics such as: autonomy support, competence support, and relatedness support (ranging from 0.23 to 0.58). Strong positive correlations were observed between academic self-concept and academic task value (ranging from 0.67 to 0.78), moderate positive corelations - between academic self-concept and emotional school engagement (ranging from 0.23 to 0.37) and relationships with parents (ranging from 0.26 to 0.34). Correlations between academic self-concept and victimization in bullying were negative and ranged from weak to moderate (ranging from -0.23 to -0.09). Correlations between academic self-concept and academic achievement were weak to moderately positive, ranging between 0.10 to 0.25 (see Table 3.1.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha ranging from 0.71 to 0.81.

Table 3.1.1. Academic Self-Concept: Scale Structure and Syntax

Intro: Do you agree with these statements:			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
A1d/You are not afraid of difficulties during learning/ Nebijai mokymosi sunkumų	A1d/You are not afraid of difficulties during learning/ Nebijai mokymosi sunkumų	A1d/You are not afraid of difficulties during learning/ Nebijai mokymosi sunkumų	A1d/You are not afraid of difficulties during learning/ Nebijai mokymosi sunkumų
A1e/You trust in your own strengths while learning/ Mokydamasis pasitiki savo jėgomis	A1e/You trust in your own strengths while learning/ Mokydamasis pasitiki savo jėgomis	A1e/You trust in your own strengths while learning/ Mokydamasis pasitiki savo jėgomis	A1e/You trust in your own strengths while learning/ Mokydamasis pasitiki savo jėgomis
A5b/You know different ways to complete not only the tasks you like but also the ones that are difficult or boring/ Žinai įvairių būdų, padedančių atlikti ne tik tas užduotis, kurios Tau patinka, bet ir tas, kurios sunkios ar nuobodžios	A5b/You know different ways to complete not only the tasks you like but also the ones that are difficult or boring/ Žinai įvairių būdų, padedančių atlikti ne tik tas užduotis, kurios Tau patinka, bet ir tas, kurios sunkios ar nuobodžios	A5b/You know different ways to complete not only the tasks you like but also the ones that are difficult or boring/ Žinai įvairių būdų, padedančių atlikti ne tik tas užduotis, kurios Tau patinka, bet ir tas, kurios sunkios ar nuobodžios	A5b/You know different ways to complete not only the tasks you like but also the ones that are difficult or boring/ Žinai įvairių būdų, padedančių atlikti ne tik tas užduotis, kurios Tau patinka, bet ir tas, kurios sunkios ar nuobodžios
A5a/You are good at focusing on learning/ Tau gerai sekasi sutelkti dėmesį mokantis	A5a/You are good at focusing on learning/ Tau gerai sekasi sutelkti dėmesį mokantis	A5a/You are good at focusing on learning/ Tau gerai sekasi sutelkti dėmesį mokantis	A5a/You are good at focusing on learning/ Tau gerai sekasi sutelkti dėmesį mokantis
Response Scale:		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
AcSELF=MEAN(A1d, A1e, A5b, A5a)	AcSELF=MEAN(A1d, A1e, A5b, A5a)	AcSELF=MEAN(A1d, A1e, A5b, A5a)	AcSELF=MEAN(A1d, A1e, A5b, A5a)

Table 3.1.2. Academic Self-Concept: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	991	830	431	430
Missing	3488	2933	3051	2380
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	2.84 (0.47)	2.82 (0.51)	2.87 (0.53)	2.99 (0.55)
Median	2.8	2.8	2.8	3.0
Skewness (st.error)	-0.001 (0.08)	0.093 (0.09)	0.157 (0.12)	-0.33 (0.12)

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
Kurtosis (st.error)	0.64 (0.16)	0.57 (0.17)	0.13 (0.24)	0.80 (0.24)
ICC (school)	0.028	0.044	0.028	-*

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating the proportion of variance in academic self-concept accounted for by school-level differences.
- *no differences between schools were observed.

Table 3.1.3. Academic Self-Concept: Histograms

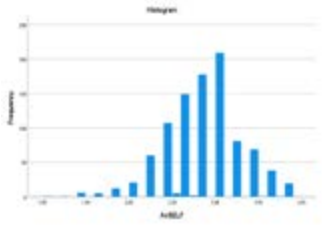
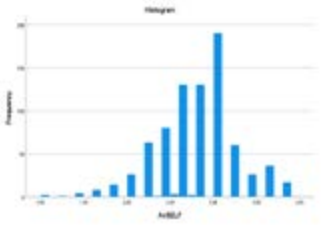
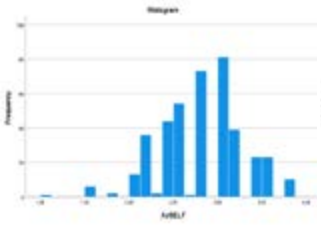
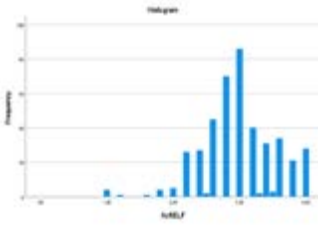
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
			

Table 3.1.4. Academic Self-Soncept: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 1, %	46.69	52.50	52.23	57.39
No of items for factor 1	5	5	5	5
Mix – Max factor loadings	0.50 - 0.61	0.50 - 0.76	0.43 - 0.76	0.61- 0.79

- Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 3.1.5. Academic Self-Concept: Discriminant Validity and Internal Consistency

Correlates	Academic Self-Concept			
	2012	2014	2015	2016
Mathematics Achievement	0.203**	0.194**	0.135**	0.246**
Reading Achievement	0.104**	0.158**	0.141**	0.108*
Academic Value	0.674**	0.711**	0.683**	0.776**
Positive School-Related Affect	0.229**	0.371**	0.329**	0.359**
Victimization in Bullying	-0.092**	-0.198**	-0.106*	-0.225**
Autonomy Support	0.307**	0.455**	0.423**	0.568**
Competence Support	0.296**	0.417**	0.464**	0.509**
Relatedness Support	0.296**	0.430**	0.405**	0.583**
Parents Academic Support	0.261**	0.366**	-	-
Communication with Parents	0.273**	0.337**	0.286**	0.288**
Cronbach's Alpha	0.71	0.77	0.77	0.81

- Note: Pearson's correlation coefficients (r) are presented in the table. **Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level.

3.2 Positive School-Related Affect

3.2.1 Theoretical Conceptualization of the Construct

School-related affect is one component of motivational functioning and engagement at school, with other aspects being behavioural, cognitive, and social (Wang et al., 2017; Li and Lerner, 2013). While the emotional, behavioural, cognitive, and social components of school functioning are often explored separately, they mutually influence each other over time. It has been suggested that school-related affect plays a significant and distinctive role in the how students engage in academic activities as their school career progresses (Li and Lerner, 2013).

Positive school-related affect encompasses the overall positive affective reactions and the enjoyment of, and value attributed to school activities (Finn, 1989). Positive school-related affect is thought to play a central role in adolescents' academic achievement and adjustment. Studies show that positive affect towards school can be a protective asset that decreases the chance of negative behaviours and increases the likelihood of academic success. Students who are not experiencing positive affectivity at school may be able to earn good grades, but they are at risk for poor mental health outcomes, which can affect various measures of adolescents' academic success (Wang et al., 2015).

It has been suggested that positive school-related affect in school activities is a substantial prerequisite for students' effort, achievement, and persistence in their studies. Students who regard school as essential and valuable, and who consider themselves to be integral members of the school community, have been shown to earn higher grades and to graduate school successfully. Furthermore, a strong sense of belonging at school is associated with positive future orientations in adolescence and overall positive development in adolescence (Ulmanen et al., 2016).

The quality of interaction with teachers and other students plays an important yet distinct role in the development of positive school-related affect. The significance of receiving informational support from peers is crucial in the context of developing a more engaging pedagogy that utilises peer interaction as a resource for learning, not just for improving the school climate or satisfaction (Ulmanen et al., 2016).

A lack of positive affectivity at school may lead adolescents to associate with delinquent friends, devalue academics, and feel alienated from peers and teachers, which in turn, increases their disengagement from school (Morrison, Robertson, Laurie, & Kelly, 2002).

3.2.2 Operationalization of the Construct in NSSA Data

The operationalization of positive school-related affect in NSSA data aligns with the conceptualization of the phenomenon as a unidimensional construct encompassing emotional aspects such as safety at school and positive feelings towards school, class, and learning. Respondents were asked to express their agreement with statements such as:

- I feel safe at school.
- I love being in school.
- I enjoy studying in school.
- I feel good in class.

Each item was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree***, 3 - ***agree,*** 4 - ***completely agree***. The total score for the scale is calculated by averaging the responses to the four items. The mean score represents the level of student's positive school-related affect. Higher scores indicate higher level of positive school-related affect. The same items and identical response scale were used to assess positive school-related affect across different rounds of NSSA (2012-2016) (see Table 3.2.1).

3.2.3 Descriptive Statistics

Descriptives for the scale are presented in Tables 3.2.2 and 3.2.3. Mean scores range from 2.8 to 2.97, with the maximum possible value being 4. Median scores are 3, indicating that half of the participants reported positive school-related affect higher than the value of 3.

Values of skewness are negative, ranging from -0.58 to -0.33, across different rounds of NSSA, indicating that the data are a little skewed to the left side. Values of kurtosis range from 0.39 to 0.81. Thus, a normal distribution of this scale data could be assumed.

Individual differences are the primary source of variance in positive school-related affect. Differences between schools account for 6.7% to 10.4% of variance in positive school-related affect (see ICC scores in Table 3.2.2).

3.2.4 Scale Validity in NSSA Data

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) conducted on the four positive school-related affect items (refer to Table 3.2.4). In all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor ranged from 39.74% to 47.49%. All item loadings exceeded the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. The findings revealed moderate positive correlations between positive school-related affect and teaching characteristics, specifically autonomy support, competence support, and relatedness support, with coefficients rangingfrom 0.29 to 0.41. Additionally, weak to moderately positive correlations were observed between positive school-related affect and students' functioning at school, including academic self-concept and academic task value, with coefficients ranging from 0.17 to 0.37. Correlations between positive school-related affect and victimization in bullying were moderately negative, with coefficients from -0.33 to -0.30. Moderate positive correlations were identified between positive school-related affect and relationships with parents, with coefficients from 0.28 to 0.32. Weak positive correlations were found between positive school-related affect and academic achievement, with coefficients from 0.04 to 0.13. All correlations are significant, except for the correlations between positive school-related affect and mathematics achievement in the year 2014 (see Table 3.2.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha values ranging from 0.72 to 0.78.

Table 3.2.1. Positive School-Related Affect: Scale Structure and Syntax

Intro: What do you think:			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
B23a/ At school, you feel safe [Mokykloje Tu jautiesi saugus]	B24a/ At school, you feel safe [Mokykloje Tu jautiesi saugus]	B21a/ At school, you feel safe [Mokykloje Tu jautiesi saugus]	B21a/ At school, you feel safe [Mokykloje Tu jautiesi saugus]
B23b/ You love being in school / guardians [Tau patinka būti mokykloje]	B24b/ You love being in school / guardians [Tau patinka būti mokykloje]	B21b/ You love being in school / guardians [Tau patinka būti mokykloje]	B21b/ You love being in school / guardians [Tau patinka būti mokykloje]
B23c/ You enjoy studying in your school [Tau patinka mokytis savo mokykloje]	B24c/ You enjoy studying in your school [Tau patinka mokytis savo mokykloje]	B21c/ You enjoy studying in your school [Tau patinka mokytis savo mokykloje]	B21c/ You enjoy studying in your school [Tau patinka mokytis savo mokykloje]
B24c/ You feel good in class [Klasėje jautiesi gerai]	B25c/ You feel good in class [Klasėje jautiesi gerai]	B22c/ You feel good in class [Klasėje jautiesi gerai]	B22c/ You feel good in class [Klasėje jautiesi gerai]
Response Scale:		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
EmoENG = MEAN(B23a, B23b, B23c, B24c)	EmoENG = MEAN(B24a, B24b, B24c, B25c)	EmoENG = MEAN(B21a, B21b, B21c, B22c)	EmoENG = MEAN(B21a, B21b, B21c, B22c)

Table 3.2.2. Positive School-Related Affect: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	4463	3750	3445	2695
Missing	16	13	37	15
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	2.8 (0.54)	2.81 (0.61)	2.85 (0.58)	2.97 (0.58)
Median	3.0	3.0	3.0	3.0
Skewness (st.error)	-0.45 (0.04)	-0.33 (0.04)	-0.43 (0.04)	-0.58 (0.05)
Kurtosis (st.error)	0.81 (0.07)	0.39 (0.08)	0.59 (0.08)	0.7 (0.09)
ICC (school)	0.085	0.104	0.093	0.067

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating the proportion of variance in positive school-related affect accounted for by school-level differences.

Table 3.2.3. Positive School-Related Affect: Histograms

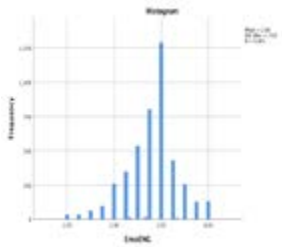
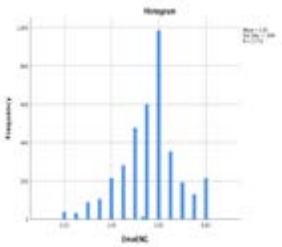
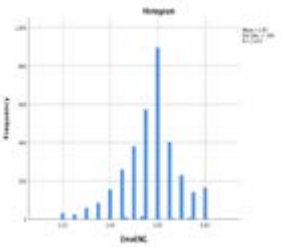
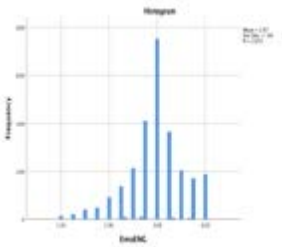
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
			

Table 3.2.4. Positive School-Related Affect: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 1, %	39.74	47.49	44.67	46.38
No of items for factor 1	4	4	4	4
Mix – Max factor loadings	0.51 - 0.73	0.52 - 0.78	0.51 - 0.73	0.60 - 0.74

- Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 3.2.5. Positive School-Related Affect: Discriminant Validity and Internal Consistency

Correlates	Positive School-Related Affect			
	2012	2014	2015	2016
Mathematics Achievement	0.083**	0.044	0.117**	0.091**
Reading Achievement	0.096**	0.111**	0.132**	0.089**
Academic Value	0.174**	0.314**	0.360**	0.223**
Academic Self-Concept	0.229**	0.371**	0.329**	0.359**
Victimization in Bullying	-0.303**	-0.326**	-0.312**	-0.310**
Autonomy Support	0.293**	0.410**	0.406**	0.351**
Competence Support	0.301**	0.395**	0.408**	0.329**
Relatedness Support	0.328**	0.394**	0.418**	0.368**
Parents academic Support	0.276**	0.291**	-	-
Communication with Parents	0.302**	0.303**	0.311**	0.324**
Cronbach's Alpha	0.72	0.78	0.76	0.77

- Note. Pearson's correlation coefficients (r) are presented in the table. **Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level.

3.3 Academic Task Value

3.3.1 Theoretical Conceptualization of the Construct

Academic task value comes from expectancy-value theory (Eccles et al., 1983; Wigfield &Eccles, 2000), which posits that students' decisions and behaviors relatd to achievement can be explained by their perception of the value of academic tasks and their beliefs about expectations for success. Academic task value is a motivational construct, and when combined with other aspects of academic motivational processes, such as academic self-concept and positive school-related affect, it can be considered among the most immediate psychological determinants of engagement in academic activities as well as academic performance (e.g., Eccles & Wigfield, 2020; Fredricks, Blumenfeld, & Paris, 2004; Vu et al., 2021; Wang & Eccles, 2011).

The value that a student sees in academic tasks or learning in general reflects a subjective answer to the question "Do I want to succeed in this task (learning at school)?" (Eccles, Wigfield, Midgley, Reuman, Iver, & Feldlaufer, 1993). The overall value attributed to academic activities depends on various characteristics of these activities, as well as on the broader needs, values, goals, and past experiences of a student (Eccles & Wigfield, 1995).

Task value is conceptualized as a motivational construct, which is composed of four characteristics: instinct value (how much the individual is interested in and enjoys doing the task), attainment value (the importance of doing well on a task or activity), utility value (the usefulness of the task for achieving future goals), and cost value (the negative aspects of engaging in a task, such as performance anxiety, fear of failure, and time consumption) (Eccles et al., 1983; Eccles& Wigfield, 2020).

Students with high academic task value see academic activities as interesting, satisfying, important, instrumental for achieving their longer-term goals, and requiring relatively low investment or sacrifice to succeed. Subjective task value is a very strong predictor of persistence, indicating a determination not to give up on learning (Eccles & Wigfield, 2020; Wigfield & Eccles, 2002; Wigfield & Eccles, 2000).

As children develop and mature, their perceptions of task value become more conscious and sophisticated. Research indicates that task value perceptions can change over time, with most common pattern of decline across school years and different subjects (for example, the expected value for math and reading domains declines, but not for sports). (see Wigfield, Eccles, 2000; Eccles, Wigfield, 2020; Liem, 2008).

In order to enhance students' positive perception of task value, numerous of intervention research studies have been conducted. From an intervention perspective, special attention could be placed on the utility value component. This component captures some intinsic reasons for task engagement; for example students participate in activities not because they enjoy them, but also to be with friends, due to parental pressure, or other interests. Therefore, it could be considered as most malleable of the task value components and is most likely to change through interventions. Utility-value interventions have a positive impact on students' interest and performance, as well as other value components. They strengthen students' willingness to take longer courses, improve retention, and even can lead to reduction in the social-class achievement gap (Harackiewicz, et al., 2014, 2016).

3.3.2 Operationalization of the Construct in NSSA Data

The operationalization of academic value in NSSA data aligns with the conceptualization of the phenomenon as a unidimensional construct covering various value aspects, such as importance, willingness, responsibility for learning, and the utility of learning in general. Respondents were asked to express their agreement with statements related to these value aspects:

- It is important for you to study well.
- You study willingly.
- You feel responsible for your own learning.
- You know what is important for you to learn.
- It is important for you to understand the learning objectives of the subject.

Each item was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree***, 3 - ***agree,*** 4 - ***completely agree***. The total score for the scale is calculated by averaging the responses to five items. The mean score represents the level of students' academic value. Higher scores indicate a higher academic value. The same items and an identical response scale were used to assess academic value across different rounds of NSSA (2012-2016) (see Table 3.3.1).

3.3.3 Descriptive Statistics

Descriptives for the scale are presented in Tables 3.3.2 and 3.3.3. Mean scores range from 3.0 to 3.3, with the maximum value being 4. Median scores are generally 3 (except in 2016, where the median score is 3.2), indicating that half of the participants reported that their academic value is higher than a value of 3.

Values of skewness are negative (ranging from -0.87 to -0.16) across different rounds of NSSA, indicating that the data are slightly skewed to the left. Values of kurtosis range from 1.50 to 2.73.

Individual differences are the primary source of variance in academic value. Differences between schools account for only 2.4% to 4.3% of the variance in school-related affect from 2012 to 2015. Differences between schools were not observed in the year 2016 (see ICC scores in Table 3.3.2).

3.3.4 Scale Validity in NSSA Data

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) for the five academic value items (see Table 3.3.4). Across all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor ranged from 52.32% to 62.79%. All item loadings were above the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. The findings indicated moderate to strong positive correlations between academic task value and teaching characteristics: autonomy support, competence support and relatedness support (ranging from 0.22 to 0.57). Strong positive correlations were observed between academic task value and academic self-concept

(ranging from 0.67 to 0.78), while correlations with emotional school engagement ranged from weak to moderate positivity (from 0.17 to 0.36). Correlations between academic task value and victimization in bullying were close to zero to weakly negative (ranging from -0.14 to -0.032). Moderate positive correlations were observed between academic task value and relationships with parents (ranging from 0.22 to 0.38). Correlations between academic task value and academic achievements ranged from weak to moderate positivity (from 0.17 to 0.23) (refer to Table 3.3.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha values ranging from 0.77 to 0.85.

Table 3.3.1. Academic Task Value: Scale Structure and Syntax

Intro: Do you agree with these statements:			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
A1a/It is important for you to study well/ Tau yra svarbu gerai mokytis	A1a/It is important for you to study well/ Tau yra svarbu gerai mokytis	A1a/It is important for you to study well/ Tau yra svarbu gerai mokytis	A1a/It is important for you to study well/ Tau yra svarbu gerai mokytis
A1b/You study willingly/ Mokaisi noriai	A1b/You study willingly/ Mokaisi noriai	A1b/You study willingly/ Mokaisi noriai	A1b/You study willingly/ Mokaisi noriai
A1c/You feel responsible for your own learning/ Jautiesi atsakingas už savo mokymąsi	A1c/You feel responsible for your own learning/ Jautiesi atsakingas už savo mokymąsi	A1c/You feel responsible for your own learning/ Jautiesi atsakingas už savo mokymąsi	A1c/You feel responsible for your own learning/ Jautiesi atsakingas už savo mokymąsi
A3a/You know what is important for you to learn/ Žinai, ko Tau svarbu išmokti	A3a/You know what is important for you to learn/ Žinai, ko Tau svarbu išmokti	A3a/You know what is important for you to learn/ Žinai, ko Tau svarbu išmokti	A3a/You know what is important for you to learn/ Žinai, ko Tau svarbu išmokti
A3b/It is important for you to understand the learning objectives of the subject/ Tau svarbu suprasti dalyko mokymosi tikslus	A3b/It is important for you to understand the learning objectives of the subject/ Tau svarbu suprasti dalyko mokymosi tikslus	A3b/It is important for you to understand the learning objectives of the subject/ Tau svarbu suprasti dalyko mokymosi tikslus	A3b/It is important for you to understand the learning objectives of the subject/ Tau svarbu suprasti dalyko mokymosi tikslus
Response Scale:		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
AcVAL=MEAN(A1a, A1b, A1c, A3a, A3b).	AcVAL=MEAN(A1a, A1b, A1c, A3a, A3b).	AcVAL=MEAN(A1a, A1b, A1c, A3a, A3b).	AcVAL=MEAN(A1a, A1b, A1c, A3a, A3b).

Table 3.3.2. Academic Task Value: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	992	830	431	430
Missing	3487	2933	3051	2280
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	3.14 (0.45)	3.01 (0.49)	3.15 (0.49)	3.26 (0.52)
Median	3.0	3.0	3.0	3.2
Skewness (st.error)	-0.16 (0.08)	-0.30 (0.09)	-0.37 (0.12)	-0.87 (0.12)
Kurtosis (st.error)	1.19 (0.16)	1.35 (0.17)	1.50 (0.24)	2.73 (0.24)
ICC (school)	0.024	0.037	0.043	-*

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating the proportion of variance in academic value accounted for by school-level differences.
- *No differences between schools are observed.

Table 3.3.3. Academic Task Value: Histograms

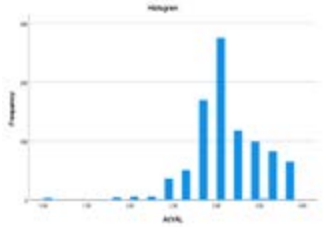
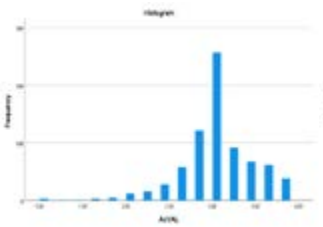
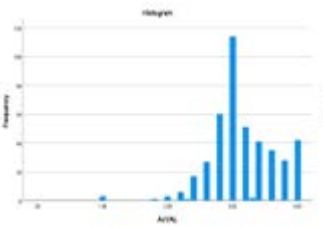
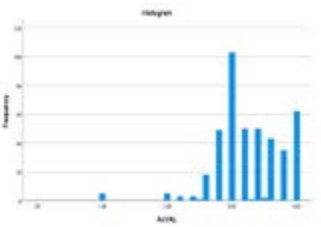
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
			

Table 3.3.4. Academic Task Value: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 1, %	52.32	57.92	54.97	62.79
No of items for factor 1	5	5	5	5
Mix – Max factor loadings	0.54 - 0.71	0.63 - 0.73	0.59 - 0.74	0.60 - 0.79

- Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 3.3.5. Academic Task Value: Discriminant Validity and Internal Consistency

Correlates	Academic Task Value			
	2012	2014	2015	2016
Mathematics Achievement	0.187**	0.219**	0.165**	0.199**
Reading Achievement	0.181**	0.214**	0.229**	0.114*
Academic Self-Concept	0.674**	0.711**	0.683**	0.776**
Positive School Rrelated Affect	0.174**	0.314**	0.360**	0.223**
Victimization in Bullying	-0.032	-0,144**	-0.092	-0.067
Autonomy Support	0.307**	0.422**	0.341**	0.543**
Competence Support	0.292**	0.382**	0.385**	0.510**
Relatedness Support	0.280**	0.375**	0.334**	0.570**
Parents academic Support	0.223**	0.378**	-	-
Communication with Parents	0.234**	0.377**	0.301**	0.265**
Cronbach's Alpha	0.77	0.82	0.79	0.85

- Note: Pearson's correlation coefficients (r) are presented in the table. **Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level.

3.4 Victimization in Bullying

3.4.1 Theoretical Conceptualization of the Construct

In developmental research on children and adolescents bullying is discussed in a broader context of peer victimization (Hong & Espelage, 2012). Based on a classical definition by Olweus (1993), victimization in bullying is being exposed to repeated acts over time that are intended to cause physical or psychological discomfort or injury. These acts are carried out by a person or group in a position of more power. Victimization in bullying can occur directly (e.g., experiencing pushing, shoving, hitting, kicking, or restraint by peers) or indirectly (e.g., being teased, taunted, threatened, called names, or smeared) (Olweus, 1993).

Poverty is considered a risk factor for bullying victimization (Hong & Espelage, 2012). Youth from low-income families are more likely to be exposed to peer violence in school (Carlson, 2006). Regarding academic achievement, both children with highest levels of school achievement and those with learning difficulties are at risk of experiencing bullying from peers at school (Hong & Espelage, 2012). Bullying victimization can have long-term negative consequences for victims and is associated with severe levels of intra- and interpersonal difficulties. These difficulties include anxiety, withdrawal, depressive tendencies, poor self-esteem, somatization, low social competence, and impaired school functioning (Goldbaum, Craig, Pepler, & Connolly, 2003; Hawker, & Boulton, 2000; Olweus, 1994).

Different forms of victimization in traditional school bullying are commonly included in bullying assessment: verbal (name calling), threatening (intimidation), physical (including physical harm, property damage, or theft), relational (e.g., exclusion form friendships), and social (lies, rumors, etc.) (Shaw et al., 2013). Some authors discuss the need to include electronic forms of bullying, known as cyberbullying victimization, since a substantial share of bullying among children and adolescents happens in cyber spaces or by the means of digital devices (Ybarra, Diener-West, & Leaf, 2007). However, others argue that it is not necessary to distinguish between traditional and electronic forms of bullying since it may be difficult for young people to report these behaviors separately (Shaw et al., 2013).

Different forms of victimization in bullying are considered to constitute one broader construct of victimization in bullying (Shaw et al., 2013). Therefore, a multi-item scale measuring victimization in bullying is commonly used, with composite scores, such as mean scores, indicating the level of bullying victimization. Using a multi-item scale for bullying victimization is believed to offer greater sensitivity and variability than a binary outcome, reflecting the continuous nature of the latent victimization variable (Shaw et al., 2013).

3.4.2 Operationalization of the Construct in NSSA Data

The operationalization of victimization in bullying in NSSA data aligns with the conceptualization of the phenomenon as a unidimensional construct encompassing several forms of peer victimization, including verbal, threatening, physical, relational, and social victimization. The scale used to assess the level of victimization asks respondents whether they experience five forms of behaviors from other students in their school They are asked „***Do other students in your school***":

- Call you names, mock you.
- Make you feel uncomfortable.
- Send you offensive messages (by phone or other means), insult you, threaten you, etc.
- Try to prevent your friends from getting along with you.
- Take your things or money.

Each item was assessed on a four-point ratio scale: 1 - ***never/ very rarely***, 2 -***sometimes***, 3 -***often***, 4 -***very often***. Notably, this measure does not specify a reference period for reporting victimization, as is commonly done in other instruments assessing bullying rates (e.g., Shaw et al., 2013). In addition, the scale's categories refer to respondents' subjective understanding of the frequency of their encounters with bullying behaviors, rather than more standardized responses based on specific frequencies (e.g., once a week, several times a week, etc., Shaw et al., 2013).

The total score for the scale is calculated by averaging the responses for all five items, as in Shaw et al. (2013). The mean score represents the sum of the frequency and the number of different ways in which a student was bullied. Higher scores indicate greater exposure to bullying. The same items and identical response scale was used to assess victimization in bullying across different rounds of NSSA (2012-2016) (see Table 3.4.1).

3.4.3 Descriptive Statistics

Descriptives for the scale are presented in Tables 3.4.2 and 3.4.3. The distribution of scores is skewed towards the lower end of the scale and has a peak at the lowest point on the scale, i.e., either no or very rare instances of victimization in bullying.The observed pattern is consistent across all rounds of NSSA and is similar to the patterns reported in previous studies (e.g., Erentaitė, Žukauskienė, & Bergman, 2012; Shaw et al., 2013). Mean scores are close to the minimum value of 1. In all rounds of the study, around half of the students have mean scores of 1, indicating that they experience no or very rare victimization.

Generally, the distribution of the scale, with inflated scores at the lowest point of the scale, indicates potential relevance of a categorical scale instead of an interval scale to assess the level of bullying victimization. The functionality of the cutoff points is discussed in the literature on bullying (e.g., Solberg & Olweus, 2003), however, the differences in the response scales have to be taken into account (pre-specified vs subjective judgements) when considering recommended cutoffs. A more data-driven approach would be to use cluster analyses with the five victimization items to identify the actual patterns of intensity and forms of bullying victimization, as suggested in the previous studies by Erentaitė et al. (2012) or Gradinger, Strohmeier, & Spiel (2009).

Individual differences are the main source of variance in bullying victimization. Differences between schools account for 3.1% to 7.0% of variance in bullying victimization (see ICC scores in Table 3.4.2).

3.4.4 Scale Validity in NSSA Data

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) for the five victimization items (refer to Table 3.4.4). Across all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor ranged from 55.5% to 60%. All item loadings were above the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. We assessed the patterns of convergence and divergence of scores on bullying victimization with other measures of emotional and relational functioning. Specifically, we expected a negative correlation between victimization in bullying and emotional school engagement, relatedness support from teachers, as well as communication with parents. The findings indicated weak to moderate associations in the expected direction (see Table 3.4.5) supporting the construct validity of the victimization in bullying scale.

Internal Consistency. High internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha ranging from 0.79 to 0.82.

Table 3.4.1. Victimization in Bullying: Scale Structure and Syntax

Intro: Do other students in your school:			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
B25a/ Call you names, mock you	B26a/ Call you names, mock you	B23a/ Call you names, mock you	B23a/ Call you names, mock you
B25b/ Make you feel uncomfortable	B26b/ Make you feel uncomfortable	B23b/ Make you feel uncomfortable	B23b/ Make you feel uncomfortable
B25c/ Send you offensive messages (by phone or otherwise), insult, threaten you, and so on	B26c/ Send you offensive messages (by phone or otherwise), insult, threaten you, and so on	B23c/ Send you offensive messages (by phone or otherwise), insult, threaten you, and so on	B23c/ Send you offensive messages (by phone or otherwise), insult, threaten you, and so on
B25d/ Try to prevent your friends from getting along with you	B26d/ Try to prevent your friends from getting along with you	B23d/ Try to prevent your friends from getting along with you	B23d/ Try to prevent your friends from getting along with you
B25e/ Take your things or money	B26e/ Take your things or money	B23e/ Take your things or money	B23e/ Take your things or money
Response Scale:		Never/ very rarely Sometimes Often Very often	
Missings:		98, 99	
Scale Total			
BULL = MEAN(B25a, B25b, B25c, B25d, B25e)	BULL = MEAN(B26a, B26b, B26c, B26d, B26e)	BULL = MEAN(B23a, B23b, B23c, B23d, B23e)	BULL = MEAN(B23a, B23b, B23c, B23d, B23e)

Table 3.4.2. Victimization in Bullying: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	4451	3735	3435	2687
Missing	28	28	47	23
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	1.28 (0.44)	1.29 (0.47)	1.26 (0.43)	1.31 (0.46)
Median	1.20	1.00	1.00	1.20
Skewness (st.error)	2.70 (0.04)	2.58 (0.04)	2.96 (0.04)	2.22 (0.05)
Kurtosis (st.error)	9.65 (0.07)	8.34 (0.08)	11.59 (0.08)	6.14 (0.09)
% of no or very rare victimization (score = 1)	48.6	51.7	51.1	46.6
ICC (school)	0.046	0.048	0.031	0.07

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating the proportion of variance in bullying victimization accounted for by school-level differences.

Table 3.4.3. Victimization in Bullying: Histograms

2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)

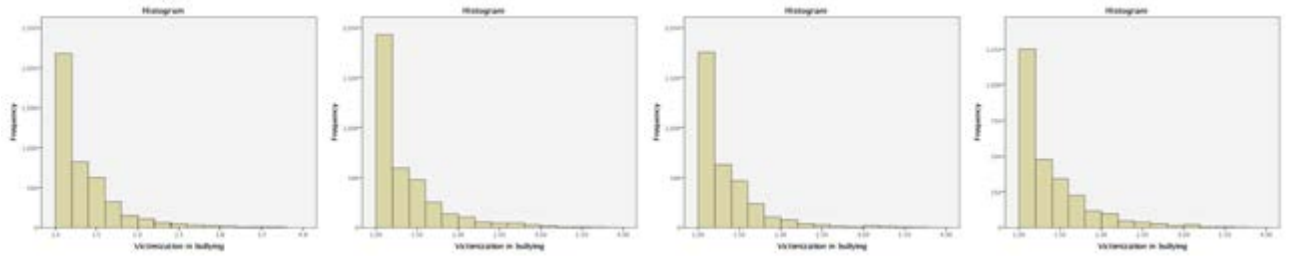


Table 3.4.4. Victimization in Bullying: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 1, %	58.17	59.84	56.91	55.50
No of items for factor 1	5	5	5	5
Mix – max factor loadings	0.54 - 0.79	0.56 - 0.79	0.48 - 0.75	0.49 - 0.81

- Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 3.4.5. Victimization in Bullying: Discriminant Validity and Internal Consistency

Correlates	Victimization in Bullying			
	2012	2014	2015	2016
Positive School-Related Affect	-0.303**	-0.326**	-0.312**	-0.310**
Relatedness Support	-0.081*	-0.134**	-0.109*	-0.204**
Communication with Parents	-0.138**	-0.182**	-0.182**	-0.165**
Cronbach's Alpha	0.81	0.82	0.80	0.79

- Note: Pearson's correlation coefficients (r) are presented in the table. All correlations are significant at the .001 level.

4. ASSESSING PERCEIVED TEACHING CHARACTERISTICS: SUPPORT FOR AUTONOMY, COMPETENCE, AND RELATEDNESS

4.1 Theoretical Conceptualization of the Constructs

Self-determination theory postulates that autonomy, competence, and relatedness are psychological needs relevant to all humans (Ryan & Deci, 2000). The study by Ryan and Powelson (1991) revealed that these three psychological needs - autonomy, competence, and relatedness - synergistically and interactively promote development and behavior. It also explored how the educational context influences the motivation driven by these needs. While there are many desires, needs and purposes that influence the intrinsic direction of psychological development, autonomy, competence, and relatedness are considered the most important (Ryan & Powelson, 1991).

The term ***autonomy*** refers to the regulation of a person's experience and behavior, including the initiation of action and direction. When acting autonomously, individuals perceive themselves as agents of their behaviour (Ryan & Powelson, 1991). The need for autonomy is the experience of behavior as volitional and reflectively self-endorsed (Niemiec & Ryan, 2009).

Competence is linked to the sense of achievement and outcomes that result from utilizing one's abilities in an optimally challenging environment. The important thing is that competency needs to operate without external factors, that is, they are reinforced in contexts that provide autonomy (Ryan and Powelson, 1991).

The need for competence signifies the experience of effective behavior. Importantly, in order to sustain intrinsic motivation, it is imperative to fulfill the needs for autonomy and competence. Students who feel competent but lack autonomy will struggle to maintain intrinsic motivation for learning. To date, many of experimental studies have affirmed the postulate of self-determination theory that autonomy and competence are prerequisites for sustaining intrinsic motivation (Niemiec and Ryan, 2009).

Self-determination theory posits that perceived competence will not lead to greater well-being unless the behavior is perceived as self-initiated, stemming from a personal decision, which is autonomous (Levesque, Zuehlke, Stanek, & Ryan, 2004). The pursuit of personal competence is most often manifested in conditions that support autonomy (Niemiec & Ryan, 2009). The individual must feel competent to experience greater well-being and at the same time feel autonomous in choosing actions (Fisher, 1978; Ryan1982).

Relatedness is about emotional and personal connections between individuals, reflecting a person's desire to connect, support, and interact with others. Relatedness means more than just a connection. Relatedness refers to the experience of connecting with others in a way that promotes well-being and mutual self-cohesion among all involved. Relatedness needs are not opposed to either competence or autonomy (Ryan, 1991), and in fact, individuals often feel most connected to those who respond to their autonomous expressions (Ryan and Powelson, 1991).

Under favorable conditions for to autonomy, competence, and relatedness to flourish, people are likely to express their innate drive to learn, improve and develop. People are motivated and engaged in areas where their basic psychological needs may be periodically met. This fundamental assumption of the organismic approach is crucial in translating it into the school context and applying it in the teaching process (Vansteenkiste, Niemiec, Soenens, 2010;

Niemiec & Ryan, 2009; Deci & Ryan, 2000; Reeve, Bolt, & Cai, 1999; Reeve, 1998). The needs expressed by students, which can lead to their involvement in schooling, are largely interpersonal in nature. In educational settings and tasks where students experience support for their autonomy, feel connected to, and are supported by significant others, they are likely to be highly motivated. Conversely, in controlling contexts where students feel disconnected and unrelated to significant others, they are likely to feel alienation and disengagement. The needs for autonomy and relatedness affect the educational process and the motivation of students to engage in school activities (Levesque, Zuehlke, Stanek, & Ryan, 2004; Ryan and Powelson, 1991).

An autonomy-supportive environment allows for self-determination and choice, when there are almost no goals, demands, judgments, and pressures imposed. Autonomy-supportive context provides positive, non-judgmental, informative feedback and is sensitive to the perspectives of others (Deci and Ryan, 1985, 2000; Reeve, 1998: Reeve, Bolt, & Cai, 1999; Ryan and Deci, 2000). Research has found that teachers who support autonomy enhance their students' self-motivation and desire for challenges (Deci & Ryan, 2000; Reeve, 1998: Reeve, Bolt, & Cai, 1999; Ryan & Deci, 2000).

Teachers differ in their propensity to control students or maintain their independence; their' operating styles range from highly controlled to highly autonomy supportive. Relatively controlling teachers set an agenda for students to follow, and these teachers use instructions and external motivators to encourage students to follow that agenda. This approach is controlling because the teacher makes an effort to control the goals and behaviors of the students to achieve the set goal. Relatively autonomy-supportive teachers encourage students to set and pursue their own agendas. Such teachers encourage, support students' initiatives and intrinsic motivation. This approach supports autonomy because the goal of the teacher is to strengthen students' autonomous self-regulation (Levesque, Zuehlke, Stanek, & Ryan, 2004).

Academic achievement is higher among students whose teachers support and promote autonomy compared to students whose teachers are controlling. Research has revealed that students of teachers who support autonomy also possess a better understanding of concepts and a lower dropout rate (Vansteenkiste, Niemiec, Soenens, 2010; Oliver et al., 2008; Reeve, Bolt, & Cai, 1999). Research has found that teachers who support autonomy increase their students' autonomous motivation and desire for challenges (Levesque, Zuehlke, Stanek, & Ryan, 2004). The researchers found that teachers who claimed to support autonomy actually taught in ways that nurtured, encouraged, and supported student autonomy. These teachers listened more, gave fewer instructions, verbalized fewer directives, asked more about what the student wanted or intended to do, answered more of the questions generated by the students, and offered more possible alternatives (Reeve, Bolt, & Cai, 1999; Reeve, 1998).

Strategies to increase autonomy include encouraging and teaching students to choose learning activities, listening to why such choices have been made, acknowledging students' feelings about the topics they are studying, and avoiding pressure and control (Niemiec & Ryan, 2009). Students' competence can be developed applying learning activities that are optimally complex. This allows students to expand and grow their academic abilities. Competence development strategies or support include teacher and student discussions on how to complete the task, advice on how to make it easier to learn a difficult topic, an explanation of what difficulties we may face in completing the task, and what to do next. Competence development strategies also include timely, comprehensive feedback on the tasks they perform. Students will be involved in and value only those activities that they understand and can master. Therefore, targeted and timely feedback would show students their appropriate outcomes, provide rein-

forcement, and provide guidelines for improvement as a task to perform better (Niemiec & Ryan, 2009; Reeve, Bolt, & Cai, 1999; Reeve, 1998; Ryan & Powelson, 1991). Competence development strategies include the provision of impact-based rather than norm-based assessment, feedback, and optimally challenging tasks. Strategies for strengthening or supporting relatedness include conveying warmth, care, and respect to students, encouraging students to be self-confident, focused and caring about learning, and advising on how to organize learning to achieve better results (Niemiec & Ryan, 2009; Reeve, Bolt, & Cai, 1999; Reeve, 1998). Autonomy and relatedness have been shown to be essential for learning. Therefore, facilitative environments are those that create and sustain interpersonal engagement and self-reliance (Ryan & Powelson, 1991). Numerous studies confirm the Self-determination theory postulate that meeting students' basic psychological needs for autonomy, competence, and relatedness is critical to mastering academic motivation. Research has confirmed that meeting all three basic, psychological needs was associated with greater learning experiences and greater academic achievement. An environment that maintains satisfaction with autonomy, competence, and relatedness, makes students more motivated and more likely to perform less interesting tasks and appreciate academic performance. With a greater desire, learners demonstrate higher-quality learning outcomes, better well-being, and greater value in the services provided by the school. Recognizing the importance of an interpersonal atmosphere between teachers and students in fostering intrinsic motivation to learn can help reorient educators' goals and practices to focus less on cognitive standards and more on increasing student interest and engagement in learning (Vansteenkiste, Niemiec, Soenens, 2010; Ryan & Powelson, 1991).

4.2 Operationalization, Descriptives and Validity of the Constructs in NSSA Data

Similar to previous studies (e.g. Van den Berghe, Cardon, Tallir, Kirk & Haerens, 2016; Abós, Javier, Martín-Albo, Julián, & García-González, 2018) and in alignnment with a developmental motivational perspective (Connell & Wellborn, 1991; Deci & Ryan, 1985, Roeser, Eccles, & Sameroff, 1998), the three dimensions of teaching behavior (autonomy support, competence support, and relatedness support) are presented in the measure.

4.2.1 Autonomy Support

Autonomy support was measured by three items reflecting students' perspective on teachers' provision of rationales and instruction variability that stimulate students' feeling that they are the causal agents of their learning (Deci, Ryan, 2000). Respondents were asked to express their agreement to such support aspects as:

- Teachers make sure we are interested in learning.
- Teachers help you to understand what you are learning and why.
- Teachers teach us to learn in a variety of ways.

Each item was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree,*** 3 - ***agree,*** 4 - ***completely agree***. The total score for the scale is calculated by averaging the responses for three items. The mean score represents the level of students' autonomy support. Higher scores indicate higher autonomy support. The same items and identical response scale were used to assess the autonomy support concept across different rounds of NSSA (2012-2016) (see Table 4.2.1.1).

Descriptive Statistics. Descriptives for the scale are presented in Tables 4.2.1.2 and 4.2.1.3. Mean scores are from 2.8 to 3.0 with the maximum values of 4. Median scores are 3.0, indicating that half of the participants indicated that their autonomy support is higher then a value of 3.0.

Values of skewness are negative, from -0.70 to -0.30, across different rounds of NSSA, indicating that data are slightly skewed to the left side. Values of kurtosis are between 0.26 and 1.29. Overall, a normal distribution of this scale data could be assumed.

Individual differences are the main source of variance in autonomy support. Differences between schools account for 4.1% to 12.8% of variance in autonomy support (see ICC scores in Table 4.2.1.2).

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) for the three autonomy support items (see Table 4.2.1.4). Across all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor ranged from 69.76% to 71.15%. All item loadings were above the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. The findings indicated strong positive correlations between autonomy support and another teaching characteristics: competence support and relatedness support, which ranged between 0.77 and 0.84. Moderate to strong positive correlation were observed between autonomy support and such students characteristics as academic self-concept, emotional school engagement, and academic task value, which ranged between 0.29 and 0.54. Correlations between autonomy support and victimization in bullying were zero to weak negative, which ranged between 0.15 and -0.03. Weak to moderately positive correlations were observed between autonomy support and relationships with parents, which ranged from 0.17 to 0.29. Correlations between autonomy support and academic achievements, in most cases, were zero to weak negative, which ranged between -0.11 and -0.02 (see Table 4.2.1.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha ranging from 0.76 to 0.79.

Table 4.2.1.1. Autonomy Support: Scale Structure and Syntax

Intro: Do you agree with these statements:			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
K1a/Teachers make sure we are interested in learning/ Mokytojai pasirūpina, kad mums būtų įdomu mokytis	K1a/Teachers make sure we are interested in learning/ Mokytojai pasirūpina, kad mums būtų įdomu mokytis	K1a/Teachers make sure we are interested in learning/ Mokytojai pasirūpina, kad mums būtų įdomu mokytis	K1a/Teachers make sure we are interested in learning/ Mokytojai pasirūpina, kad mums būtų įdomu mokytis
K3a/Teachers help you understand what you are learning and why/ Mokytojai Tau padeda suprasti, ko ir kodėl mokaisi	K3a/Teachers help you understand what you are learning and why/ Mokytojai Tau padeda suprasti, ko ir kodėl mokaisi	K3a/Teachers help you understand what you are learning and why/ Mokytojai Tau padeda suprasti, ko ir kodėl mokaisi	K3a/Teachers help you understand what you are learning and why/ Mokytojai Tau padeda suprasti, ko ir kodėl mokaisi
K5a/Teachers teach us to learn in a variety of ways/ Mokytojai mus moko mokytis įvairiais būdais	K5a/Teachers teach us to learn in a variety of ways/ Mokytojai mus moko mokytis įvairiais būdais	K5a/Teachers teach us to learn in a variety of ways/ Mokytojai mus moko mokytis įvairiais būdais	K5a/Teachers teach us to learn in a variety of ways/ Mokytojai mus moko mokytis įvairiais būdais
Response Scale:		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
AuSUPP=MEAN(K1a, K3a, K5a)	AuSUPP=MEAN(K1a, K3a, K5a)	AuSUPP=MEAN(K1a, K3a, K5a)	AuSUPP=MEAN(K1a, K3a, K5a)

Table 4.2.1.2. Autonomy Support: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	988	827	428	430
Missing	3491	2936	3054	2280
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	2.85 (0.60)	2.75 (0.61)	2.92 (0.63)	3.00 (0.63)
Median	3.0	3.0	3.0	3.0
Skewness (st.error)	-0.35 (0.08)	-0.47 (0.09)	-0.30 (0.19)	-0.70 (0.12)
Kurtosis (st.error)	0.66 (0.16)	0.77 (0.17)	0.26 (0.24)	1.29 (0.24)
ICC (school)	0.104	0.054	0.128	0.041

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating a proportion of variance in autonomy support accounted for by school-level differences.

Table 4.2.1.3. Autonomy Support: Histograms

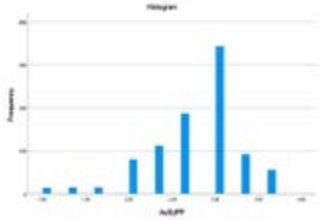
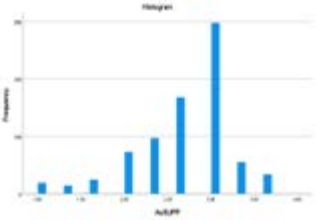
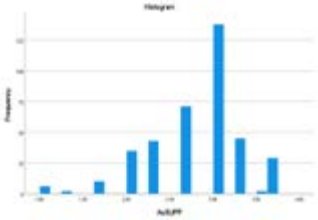
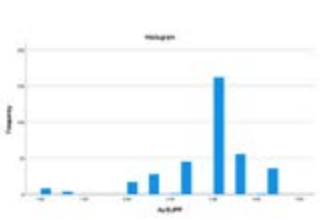
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
			

Table 4.2.1.4. Autonomy Support: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 10. %	67.97	69.25	71.15	69.76
No of items for factor 1	3	3	3	3
Mix – Max factor loadings	0.71 – 0.73	0.70 – 0.76	0.72 – 0.81	0.69 – 0.81

- Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 4.2.1.5. Autonomy Support: Discriminant Validity and Internal Consistency

Correlates	Autonomy Support			
	2012	2014	2015	2016
Mathematics Achievement	-0.051	-0.016	-0.105*	0.037
Reading Achievement	-0.099**	-0.072	-0.086	-0.082
Academic Value	0.307**	0.422**	0.341**	0.543**
Academic Self-Concept	0.307**	0.455**	0.423**	0.568**
Positive School-Related Affect	0.293**	0.410**	0.406**	0.351**
Victimization in Bullying	-0.025	-0.146**	-0.076	-0.153**
Competence Support	0.776**	0.789**	0.799**	0.815**
Relatedness Support	0.771**	0.801**	0.806**	0.835**
Parental Academic Support	0.202**	0.290**	-	-
Communication with Parents	0.170**	0.243**	0.323**	0.214**
Cronbach's Alpha	0.76	0.78	0.79	0.78

- Note: Pearson's correlation coefficients (r) are presented in the table. **Correlation is significant at the 0.01 level0. *Correlation is significant at the 0.05 level.

4.2.2 Competence Support

Competence support was assessed by seven items capturing different teaching practices that allow the creation of a well-structured studying environment. ***Competence support*** strengths the students' feeling that they could effectively achieve learning goals (Skinner, Belmont, 1993). Respondents were asked to express their agreement to such support aspects as:

- We discuss with teachers how we will complete one task or another, how long it will take, etc.
- Teachers advise us on how to make it easier to learn one thing or another.
- Teachers explain what difficulties we may face in completing the task and what should be done then.
- Together with teachers, we try out different ways that help us track our learning progress.
- Teachers advise and monitor that we get the job done on time.
- In difficult lessons, teachers offer a few minutes of rest (rest breaks).
- Teachers give us the help we need to keep learning time from being in vain.

Each item was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree***, 3 - ***agree,*** 4 - ***completely agree***. The total score for the scale is calculated by averaging the responses for the seven items. The mean score represents the level of students' competence support. Higher scores indicate higher competence support. The same items and identical response scale were used to assess competence support concept across different rounds of NSSA (2012-2016) (see Table 4.2.2.1).

Descriptive Statistics. Descriptives for the scale are presented in Tables 4.2.2.2 and 4.2.2.3. Mean scores are between 2.8 and 3.1, when the maximum values are 4. Median scores are 2.9, except in 2016 when the median score is 3.0, indicating that half of participants indicated that their competence support is higher that value of 3.0.

Values of skewness are negative, ranging between -0.53 and -0.17, across different rounds of NSSA, indicating that data are slightly skewed to the left side. Values of kurtosis are between 1.02 and 1.78.

Individual differences are the main source of variance in competence support. Differences between schools account for 5.5% to 11.2% of the variance in competence support (see ICC scores in Table 4.2.2.2).

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) for the seven competence support items (see Table 4.2.2.4). Across all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor ranged from 48.48% to 58.90%. All item loadings were above the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. The findings indicated strong positive correlations between competence support and other teaching characteristics: autonomy support and relatedness support ranging between 0.78 and 0.87. Moderate to strong positive correlations were observed between competence support and such students characteristics as: academics self-concept, emotional school engagement, and academic task value, which were between 0.29 and 0.51. Correlations between competence support and victimization in bullying were weakly negative, between -0.13 and

-0.1. From weak to moderate positive correlations were observed between competence support and relationships with parents, which were between 0.19 and 0.32. Correlations between competence support and academic achievements were zero to weakly negative, ranging between -0.09 and 0.05 (see Table 4.2.2.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha ranging from 0.82 to 0.88.

Table 4.2.2.1. Competence Support: Scale Structure and Syntax

Intro: Do you agree with these statements:			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
K3b/We discuss with teachers how we will complete one task or another, how long it will take, etc./ Su mokytojais aptariame, kaip atliksime vieną ar kitą užduotį, kiek tam reikės laiko ir pan.	K3b/We discuss with teachers how we will complete one task or another, how long it will take, etc./ Su mokytojais aptariame, kaip atliksime vieną ar kitą užduotį, kiek tam reikės laiko ir pan.	K3b/We discuss with teachers how we will complete one task or another, how long it will take, etc./ Su mokytojais aptariame, kaip atliksime vieną ar kitą užduotį, kiek tam reikės laiko ir pan.	K3b/We discuss with teachers how we will complete one task or another, how long it will take, etc./ Su mokytojais aptariame, kaip atliksime vieną ar kitą užduotį, kiek tam reikės laiko ir pan.
K5b/Teachers advise us on how to make it easier to learn one thing or another/ Mokytojai mums pataria, kaip lengviau būtų išmokti vieną ar kitą dalyką	K5b/Teachers advise us on how to make it easier to learn one thing or another/ Mokytojai mums pataria, kaip lengviau būtų išmokti vieną ar kitą dalyką	K5b/Teachers advise us on how to make it easier to learn one thing or another/ Mokytojai mums pataria, kaip lengviau būtų išmokti vieną ar kitą dalyką	K5b/Teachers advise us on how to make it easier to learn one thing or another/ Mokytojai mums pataria, kaip lengviau būtų išmokti vieną ar kitą dalyką
K3d/Teachers explain what difficulties we may face in completing the task and what should be done then/ Mokytojai paaiškina, su kokiais sunkumais galime susidurti atlikdami užduotį ir ką reikėtų tada daryti	K3d/Teachers explain what difficulties we may face in completing the task and what should be done then/ Mokytojai paaiškina, su kokiais sunkumais galime susidurti atlikdami užduotį ir ką reikėtų tada daryti	K3d/Teachers explain what difficulties we may face in completing the task and what should be done then/ Mokytojai paaiškina, su kokiais sunkumais galime susidurti atlikdami užduotį ir ką reikėtų tada daryti	K3d/Teachers explain what difficulties we may face in completing the task and what should be done then/ Mokytojai paaiškina, su kokiais sunkumais galime susidurti atlikdami užduotį ir ką reikėtų tada daryti
K6a/Together with teachers, we try out different ways that help us track our learning progress/ Kartu su mokytojais išbandome įvairius būdus, kurie padeda mums stebėti savo mokymosi pažangą	K6a/Together with teachers, we try out different ways that help us track our learning progress/ Kartu su mokytojais išbandome įvairius būdus, kurie padeda mums stebėti savo mokymosi pažangą	K6a/Together with teachers, we try out different ways that help us track our learning progress/ Kartu su mokytojais išbandome įvairius būdus, kurie padeda mums stebėti savo mokymosi pažangą	K6a/Together with teachers, we try out different ways that help us track our learning progress/ Kartu su mokytojais išbandome įvairius būdus, kurie padeda mums stebėti savo mokymosi pažangą
K4a/Teachers advise and monitor that we get the job done on time/ Mokytojai pataria ir stebi, kad darbą atliktume laiku	K4a/Teachers advise and monitor that we get the job done on time/ Mokytojai pataria ir stebi, kad darbą atliktume laiku	K4a/Teachers advise and monitor that we get the job done on time/ Mokytojai pataria ir stebi, kad darbą atliktume laiku	K4a/Teachers advise and monitor that we get the job done on time/ Mokytojai pataria ir stebi, kad darbą atliktume laiku
K4b/In difficult lessons, teachers offer a few minutes of rest (rest breaks)/ Pamokose atliekant sunkias užduotis mokytojai pasiūlo keletą minučių pailsėti (poilsio pertraukėlių)	K4b/In difficult lessons, teachers offer a few minutes of rest (rest breaks)/ Pamokose atliekant sunkias užduotis mokytojai pasiūlo keletą minučių pailsėti (poilsio pertraukėlių)	K4b/In difficult lessons, teachers offer a few minutes of rest (rest breaks)/ Pamokose atliekant sunkias užduotis mokytojai pasiūlo keletą minučių pailsėti (poilsio pertraukėlių)	K4b/In difficult lessons, teachers offer a few minutes of rest (rest breaks)/ Pamokose atliekant sunkias užduotis mokytojai pasiūlo keletą minučių pailsėti (poilsio pertraukėlių)
K4d/Teachers give you the help you need to keep learning time from being in vain/ Mokytojai suteikia Tau reikalingą pagalbą, kad neleistum mokymosi laiko veltui	K4d/Teachers give you the help you need to keep learning time from being in vain/ Mokytojai suteikia Tau reikalingą pagalbą, kad neleistum mokymosi laiko veltui	K4d/Teachers give you the help you need to keep learning time from being in vain/ Mokytojai suteikia Tau reikalingą pagalbą, kad neleistum mokymosi laiko veltui	K4d/Teachers give you the help you need to keep learning time from being in vain/ Mokytojai suteikia Tau reikalingą pagalbą, kad neleistum mokymosi laiko veltui
Response Scale:		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
CoSUPP=MEAN(K3b, K5b, K3d, K6a, K4a, K4b, K4d)	CoSUPP=MEAN(K3b, K5b, K3d, K6a, K4a, K4b, K4d)	CoSUPP=MEAN(K3b, K5b, K3d, K6a, K4a, K4b, K4d)	CoSUPP=MEAN(K3b, K5b, K3d, K6a, K4a, K4b, K4d)

Table 4.2.2.2. Competence Support: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	987	824	427	429
Missing	3492	2939	3055	2281
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	2.84 (0.49)	2.79 (0.50)	2.89 (0.51)	3.08 (0.55)
Median	2.86	2.86	2.86	3.0
Skewness (st.error)	-0.17 (0.08)	-0.34 (0.09)	-0.45 (0.19)	-0.53 (0.12)
Kurtosis (st.error)	1.02 (0.16)	1.59 (0.17)	1.78 (024)	1.04 (0.24)
ICC (school)	0.061	0.055	0.112	0.061

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating a proportion of variance in competence support accounted for by school-level differences.

Table 4.2.2.3. Competence Support: Histograms

2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)

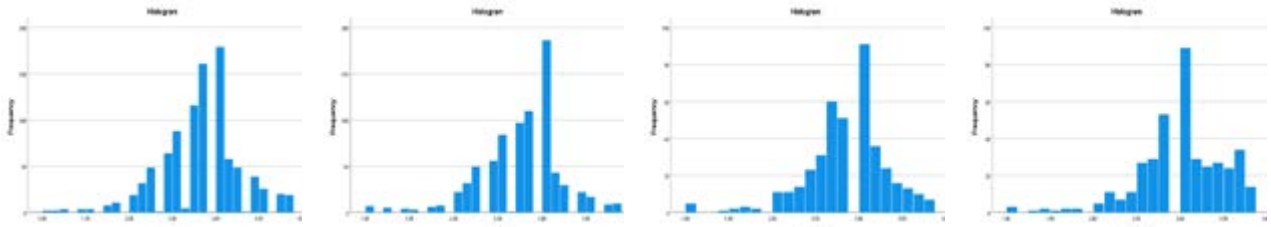


Table 4.2.2.4. Competence Support: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 10. %	48.48	50.10	53.70	58.90
No of items for factor 1	7	7	7	7
Mix – Max factor loadings	0.54 - 0.74	0.54 - 0.71	0.58 - 0.73	0.59 - 0.80

- Note: Principal axis factoring is applied to evaluate factor structure of a scale

Table 4.2.2.5. Competence Support: Discriminant Validity and Internal Consistency

	Competence Support			
Correlates	2012	2014	2015	2016
Mathematics Achievement	-0.056	-0.030	-0.062	0.045
Reading Achievement	-0.090**	-0.090	-0.058	-0.012
Academic Value	0.292**	0.382**	0.385**	0.510**
Academic Self-Concept	0.296**	0.417**	0.464**	0.509**
Positive School-Related Affect	0.301**	0.395**	0.408**	0.329**
Victimization in Bullying	-0.130**	-0.123**	-0.104*	-0.125*
Autonomy Support	0.776**	0.789**	0.799**	0.815**
Relatedness Support	0.817**	0.820**	0.835**	0.874**
Parental Academic Support	0.253**	0.320**	-	-
Communication with Parents	0.190**	0.304**	0.306**	0.221**
Cronbach's Alpha	0.82	0.83	0.85	0.88

- Note: Pearson's correlation coefficients (r) are presented in the table. **Correlation is significant at the 0.01 level. *Correlation is significant at the 0.05 level.

4.2.3 Relatedness Support

For assessing ***relatedness support***, we used four items reflecting students' perception about the emotional supportive interaction with teachers. When teachers are sensitive, take time for students and are available in case of need, they create an environment where students feel they are safe to explore and gain new experience (Skinner, Belmont, 1993). Respondents were asked to express their agreement to such support aspects as:

- Teachers support us, encourage us to trust in our own strengths.
- Teachers notice and encourage our efforts to learn.
- Teachers take the time to talk to you about how you are doing.
- Teachers tell you what you are doing well and advise you on how you can achieve better results.

Each item was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree***, 3 - ***agree,*** 4 - ***completely agree***. The total score for the scale is calculated by averaging the responses for four items. The mean score represents the level of students' relatedness support. Higher scores indicate higher relatedness support. The same items and identical response scale were used to assess relatedness support concept across different rounds of NSSA (2012-2016) (see Table 4.2.3.1).

Descriptive Statistics. Descriptives for the scale are presented in Tables 4.2.3.2 and 4.2.3.3. Mean scores are between 2.8 and 3.1, when the maximum values are 4. Median scores are 3.0, indicating that half of the participants indicated that their relatedness support is higher than a value of 3.0.

Values of skewness are negative, ranging between -0.59 and -0.30, across different rounds of NSSA, indicating that the data are slightly skewed to the left side. Values of kurtosis are between 0.74 and 1.23. Overall, a normal distribution of this scale data could be assumed.

Individual differences are the main source of variance in relatedness support. Differences between schools account for 7.2% to 11.0% of the variance in relatedness support (see ICC scores in Table 4.2.3.2).

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) for the four relatedness support items (see Table 4.2.3.4). Across all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor ranged from 63.11% to 69.93%. All item loadings were above the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. The findings indicated strong positive correlations between relatedness support and other teaching characteristics: competence support and autonomy support, which were between 0.78 and 0.87. Moderate to strong positive correlations were observed between relatedness support and student characteristics such as academic self-concept, emotional school engagement, and academic task value ranged between 0.28 and 0.58. Correlations between relatedness support and victimization in bullying were zero to weakly negative, ranged between -0.1 and -0.03. Moderate positive correlations were observed between relatedness support and relationships with parents, which were between 0.2 and 0.32. Correlations between relatedness support and academic achievement were zero to weak, which ranged from -0.10 to 0.10 (see Table 4.2.3.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha ranging from 0.80 to 0.86.

Table 4.2.3.1. Relatedness Support: Scale Structure and Syntax

Intro: Do you agree with these statements:			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
K1b/Teachers support us, encourage us to trust in our own strengths/ Mokytojai palaiko mus, skatina pasitikėti savo jėgomis	K1b/Teachers support us, encourage us to trust in our own strengths/ Mokytojai palaiko mus, skatina pasitikėti savo jėgomis	K1b/Teachers support us, encourage us to trust in our own strengths/ Mokytojai palaiko mus, skatina pasitikėti savo jėgomis	K1b/Teachers support us, encourage us to trust in our own strengths/ Mokytojai palaiko mus, skatina pasitikėti savo jėgomis
K1c/Teachers notice and encourage our efforts to learn/ Mokytojai pastebi ir paskatina mūsų pastangas mokytis	K1c/Teachers notice and encourage our efforts to learn/ Mokytojai pastebi ir paskatina mūsų pastangas mokytis	K1c/Teachers notice and encourage our efforts to learn/ Mokytojai pastebi ir paskatina mūsų pastangas mokytis	K1c/Teachers notice and encourage our efforts to learn/ Mokytojai pastebi ir paskatina mūsų pastangas mokytis
K6c/Teachers take the time to talk to you about how you are doing/ Mokytojai skiria laiko pasikalbėti su Tavimi apie tai, kaip Tau sekasi mokytis	K6c/Teachers take the time to talk to you about how you are doing/ Mokytojai skiria laiko pasikalbėti su Tavimi apie tai, kaip Tau sekasi mokytis	K6c/Teachers take the time to talk to you about how you are doing/ Mokytojai skiria laiko pasikalbėti su Tavimi apie tai, kaip Tau sekasi mokytis	K6c/Teachers take the time to talk to you about how you are doing/ Mokytojai skiria laiko pasikalbėti su Tavimi apie tai, kaip Tau sekasi mokytis
K6b/Teachers tell you what you are doing well and advise you on how you can achieve better results/ Mokytojai pasako Tau, ką atlieki gerai, ir pataria, kaip galėtum pasiekti geresnių rezultatų	K6b/Teachers tell you what you are doing well and advise you on how you can achieve better results/ Mokytojai pasako Tau, ką atlieki gerai, ir pataria, kaip galėtum pasiekti geresnių rezultatų	K6b/Teachers tell you what you are doing well and advise you on how you can achieve better results/ Mokytojai pasako Tau, ką atlieki gerai, ir pataria, kaip galėtum pasiekti geresnių rezultatų	K6b/Teachers tell you what you are doing well and advise you on how you can achieve better results/ Mokytojai pasako Tau, ką atlieki gerai, ir pataria, kaip galėtum pasiekti geresnių rezultatų
Response Scale:		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
ReSUPP=MEAN(K1b, K1c, K6a, K6b)	ReSUPP=MEAN(K1b, K1c, K6a, K6b)	ReSUPP=MEAN(K1b, K1c, K6a, K6b)	ReSUPP=MEAN(K1b, K1c, K6a, K6b)

Table 4.2.3.2. Relatedness Support: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	988	827	426	430
Missing	3491	2936	3056	2280
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	2.84 (0.57)	2.80 (0.57)	2.93 (0.57)	3.14 (0.59)
Median	3.0	3.0	3.0	3.0
Skewness (st.error)	-0.30 (0.08)	-0.42 (0.09)	-0.36 (0.19)	-0.59 (0.12)
Kurtosis (st.error)	0.74 (0.16)	1.15 (0.17)	1.04 (0.24)	1.23 (0.24)
ICC (school)	0.107	0.072*	0.110	0.078

- Note. ICC (School) – Intra-Class Correlation Coefficient, indicating a proportion of variance in relatedness support accounted for by school-level differences.

Table 4.2.3.3. Relatedness Support: Histograms

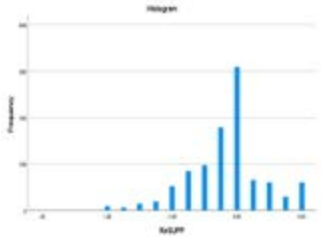
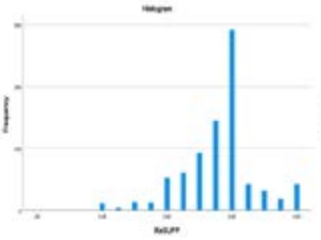
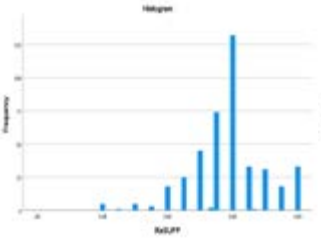
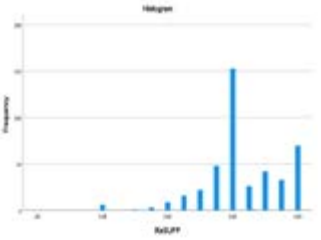
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
			

Table 4.2.3.4. Relatedness Support: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 10. %	63.11	63.78	62.94	69.93
No of items for factor 1	4	4	4	4
Mix – Max factor loadings	0.60 - 0.81	0.61 - 0.81	0.63 - 0.77	0.71 - 0.85

- Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 4.2.3.5. Relatedness Support: Discriminant Validity and Internal Consistency

Correlates	Relatedness Support			
	2012	2014	2015	2016
Mathematics Achievement	-0.059	-0.055	-0.031	0.098*
Reading Achievement	-0.091**	-0.100*	-0.041	0.015
Academic Value	0.280**	0.375**	0.334**	0.570**
Academic Self-Concept	0.296**	0.430**	0.405**	0.583**
Positive School-Related Affect	0.328**	0.394**	0.418**	0.368**
Victimization in Bullying	-0.081*	-0.134**	-0.109*	-0.204**
Autonomy Support	0.771**	0.801**	0.806**	0.835**
Competence Support	0.817**	0.820**	0.835**	0.874**
Parental Academic Support	0.235**	0.318**	-	-
Communication with Parents	0.200**	0.276**	0.324**	0.264**
Cronbach's Alpha	0.80	0.81	0.80	0.86

- Note: Pearson's correlation coefficients (r) are presented in the table. **Correlation is significant at the 0.01 level0. *Correlation is significant at the 0.05 level.

5. ASSESSING RELATIONSHIPS WITH PARENTS

5.1 Parental Academic Support

5.1.1 Theoretical Conceptualization of the Construct

Parental academic support is a complex construct associated with student success (Shukla et al., 2015; Rogers et al., 2018; McNeal, 1999). Parental academic support can be classified and defined in terms of ***home-based*** or ***school-based parental involvement*** (Jeynes, 2010; Bakker et al., 2007), ***direct behaviors*** (e.g. supervision of homework), and ***emotional tone*** or ***supportive and encouraging parental involvement*** (Rogers et al., 2018). Jeynes (2010) revealed that home-based parental involvement is more important for school success than parental school-based involvement.

Parental supportive and encouraging involvement, or ***autonomy support,*** has its basis in self-determination theory and has been defined as parental behaviors that promote choice versus parental controlling/pressuring behaviors (Shukla et al., 2015). Parental autonomy support (behaviors that promote choice), which manifests itself as parents' active interest in students' daily and long-term educational activities, can take different forms, such as family routines, parental aspirations, parental cognitive stimulation (Shukla et al., 2015), parent-child discussion, and educational support strategies (McNeal, 1999).

In adolescence, parental autonomy support is associated with better school outcomes in children (Simpkins et al., 2006) and positively impacts children's achievement by improving both skill development and the child's intrinsic motivation for learning, while controlling or punitive involvement can undermine an adolescent's sense of competence and autonomy and lead to decreased motivation to learn (Rogers et al., 2018).

Active parent-child communication, expression of parental expectations for education, fostering educational and occupational aspirations, and discussing learning strategies convey to children the importance of schooling and education, strengthen self-regulated learning. Conversations and questioning reveal problems early on, prevent non-normative behavior, school truancy, and dropping out (Shukla et al., 2015; McNeal, 1999; Jeynes, 2007).

Parent involvement is more effective for higher-SES students. In other words, while parent-child discussion is generally effective at reducing the likelihood of truancy and dropping out and occasionally at raising levels of science achievement, it tends to be much less effective for members of the lower socio-economic status. In many circumstances, once a student is one standard deviation below the mean on SES, the positive benefits of parent involvement disappear. This is explained by the fact that higher-SES parents are well acquainted with the jargon of education systems and have more positive personal experiences with schooling (McNeal, 1999).

5.1.2 Operationalization of the Construct in NSSA Data

The operationalization of parental academic support in NSSA data is in line with the conceptualization of the phenomenon as a unidimensional construct covering several forms of parental academic support, including parents' interest in how their child is doing in school, their active encouragement of a child using verbal and non-verbal rewards, and provision of assistance to their child during learning. The scale used to assess the level of parental

academic support for students asks about the frequency of the three activities and about the agreement with one statement:

- How often are parents interested in your learning?
- Ask how you fared at school.
- Praise, encourage, advise.
- Reward for good learning.
- Do you agree with these statements about your family, home?
- You have someone to turn to for help with learning when you need it.

Frequency of activities was assessed on a four-point ratio scale: 1 - ***never***, 2 - ***sometimes***, 3 -***often***, 4 -***very often***. Notably, the measure does not specify a period of reference for reporting parents' activities. Agreement for the statement was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree***, 3 - ***agree,*** 4 - ***completely agree***.

The total score for the scale is calculated by averaging the responses for all four items. The mean score represents the level of students' perceived parental academic support. Higher scores indicate perceived higher parental academic support. The same items and identical response scale were used to assess parental academic support across two rounds of NSSA (2012 and 2014) (see Table 5.1.1).

5.1.3 Descriptive Statistics

Descriptives for the scale are presented in Tables 5.1.2 and 5.1.3. Mean scores are close to value of 3, considering the maximum value is 4. Median scores are also close to value of 3, indicating that half of the participants reported that their perceived parental academic support is higher than the value of 3.

Values of skewness and kurtosis are negative indicating that data are slightly skewed to the left side. However, values of skewness and kurtosis are between -0.5 and 0.5 indicating that distributions of parental academic support scale are fairly symmetric and a normal distribution of data could be assumed.

Individual differences are the main source of variance in parental academic support. Differences between schools account for 2.9% (in the year 2012) and 4.4% (in the year 2014) of variance in parental academic support (see ICC scores in Table 5.1.2).

5.1.4 Scale Validity in NSSA Data

Structural Validity. The unidimensional nature of the scale was supported by the findings from exploratory factor analysis (principal axis factoring) for the four parental academic support items (see Table 5.1.4). Across two datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by the single factor is 37.67% in 2012 dataset and 41% in 2014 dataset. All item loadings were above the common cutoff point of 0.40 in both datasets (Henson & Roberts, 2006).

Discriminant Validity. Moderate positive correlations are observed between parental academic support and such students' characteristics such as academic self-concept, emotional school engagement, and academic task value, ranging between 0.22 and 0.38. The correlation between parental academic support and victimization in bullying was weakly negative, approximately -0.15. Strong positive correlations are observed between parental academic support and communication with parents, approximately 0.60. Weak positive correlations, ranging between 0.08 and 0.12, were observed between parental academic support and academic achievement (see Table 5.1.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across two rounds of NSSA, Cronbach's alpha was 0.69 for 2012 dataset and 0.71 for 2014 dataset.

Table 5.1.1. Parental Academic Support: Scale Structure and Syntax

Intro: How often are parents interested in your learning? (for B19a, B19b, B19c); Do you agree with these statements about your family, home? (for B18d)			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
B19a/ Ask how you fared at school [Paklausia, kaip Tau sekėsi mokykloje]	B19a/ Ask how you fared at school [Paklausia, kaip Tau sekėsi mokykloje]	-	-
B19b/ Praise, encourage, advise [Pagiria, padrąsina, pataria]	B19b/ Praise, encourage, advise [Pagiria, padrąsina, pataria]	-	-
B19c/ Reward for good learning [Kuo nors apdovanoja už gerą mokymąsi]	B19c/ Reward for good learning [Kuo nors apdovanoja už gerą mokymąsi]	-	-
B18d/ You have someone to turn to for help with learning when you need it[Tu turi į ką kreiptis pagalbos mokantis, kai jos reikia]	B18d/ You have someone to turn to for help with learning when you need it[Tu turi į ką kreiptis pagalbos mokantis, kai jos reikia]	-	-
Response Scale (for B19a, B19b, B19c):		Never Sometimes Often Very often	
Response Scale (for B18d):		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
P_ACSUP = MEAN(B19a, B19b, B19c, B18d)	P_ACSUP = MEAN(B19a, B19b, B19c, B18d)	-	-

Table 5.1.2. Parental Academic Support: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	4468	3756	-	-
Missing	11	7	-	-
Min - Max	1 - 4	1 - 4	-	-
Mean (SD)	2.92 (0.56)	2.95 (0.58)	-	-
Median	3.00	3.00	-	-
Skewness (st.error)	-0.26 (0.04)	-0.23 (0.04)	-	-
Kurtosis (st.error)	-0.12 (0.07)	-0.21 (0.08)	-	-
ICC (school)	0.029	0.044	-	-

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating a proportion of variance in parents' academic support accounted for by school-level differences.

Table 5.1.3. Parental Academic Support: Histograms

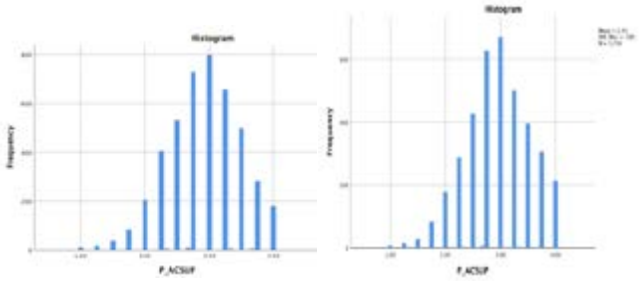
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
			

Table 5.1.4. Parental Academic Support: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	-	-
Total variance explained by factor 10. %	37.67	41.00	-	-
No of items for factor 1	4	4	-	-
Mix – Max factor loadings	0.45 - 0.84	0.47 - 0.84	-	-

• Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 5.1.5. Parental Academic Support: Discriminant Validity and Internal Consistency

Correlates	Parents' Academic Support			
	2012	2014	2015	2016
Mathematics Achievement	0.100**	0.082**	-	-
Reading Achievement	0.077**	0.124**	-	-
Academic Value	0.223**	0.378**	-	-
Academic Self-Concept	0.261**	0.366**	-	-
Positive School-Related Affect	0.276**	0.291**	-	-
Victimization in Bullying	-0.145**	-0.150**	-	-
Autonomy Support	0.202**	0.290**	-	-
Competence Support	0.253**	0.320**	-	-
Relatedness Support	0.235**	0.318**	-	-
Communication with Parents	0.559**	0.596**	-	-
Cronbach's Alpha	0.69	0.71	-	-

• Note: Pearson's correlation coefficients (r) are presented in the table. All correlations are significant at the .001 level

5.2 Communication with Parents

5.2.1 Theoretical Conceptualization of the Construct

The family communication patterns theory emphasizes the creation of a shared social reality as a fundamental principle of family functioning. Sharing social reality facilitates understanding and comprehension, which increases efficiency and coordination and reduces misunderstandings and conflicts. Research shows that parent-adolescent communication in the family, especially in socioeconomically disadvantaged families, plays an important role in developing the psychosocial adjustment of adolescents and young adults (Rueter & Koerner, 2008; Steinberg, 2001). Studies of parent-child communication have shown that parent-child interactions, characterized by open communication, warm and supportive behavior, and strong, consistent fulfillment of developmental expectations, have a positive effect on a child's adaptation (Rueter & Koerner, 2008).

In families where communication is open, with little conflict and relatively democratic control, teens are more likely to develop their own positive concepts that will help them better understand the world and address its challenges and problems (Lanz et al., 1999). Research has identified open parent–child communication as a protective factor, whereas problematic communication between parents and children as a risk factor for adolescent psychosocial adjustment. Some studies revealed that depressed adolescents report less communication, less exchange of thoughts and feelings with their parents, and less family cohesion than adolescents without depression. Open communication between parents and children was significantly and positively associated with the development of adolescents' moral reasoning, academic achievement, and self-esteem. Open communication can show better parent-child relationships, which can be a protective factor for children from the development of depression and anxiety and antisocial activities (Xiao et al., 2011).

5.2.2 Operationalization of the Construct in NSSA Data

The operationalization of communication with parents in NSSA data is in line with the conceptualization of the phenomenon as a unidimensional construct covering such aspects of communication as enjoyment, involvement and extent. Respondents were asked to express their agreement to these communication aspects:

- You like to spend time with your family.
- You are involved in decisions (e.g. where to vacation together, etc.).
- Communicate with you a lot.

Each item was assessed on a four-point ratio scale: 1 - ***completely disagree***, 2 - ***disagree***, 3 - ***agree,*** 4 - ***completely agree***. The total score for the scale is calculated by averaging the responses for three items. The mean score represents the level of students' communication with parents. Higher scores indicate better communication with parents. The same items and identical response scale were used to assess communication with parents' concept across different rounds of NSSA (2012-2016) (see Table 5.2.1).

5.2.3 Descriptive Statistics

Descriptive statistics for the scale are presented in Tables 5.2.2 and 5.2.3. Mean scores range from 3.1 to 3.3, with the maximum value being 4. Median scores fall between 3 and 3.3, indicating that half of the participants reported their communication with parents as being higher than a value of 3.

The skewness values are negative, ranging from -0.93 and -0.53 across different rounds of NSSA, indicating that the data are a skewed to the left. Kurtosis values range from 0.82 and 1.30. Overall, a normal distribution of this scale data could be assumed.

Individual differences are the primary source of variance in communication with parents, with differences between schools accounting for only 1.7% to 3.1% of the variance in communication with parents (see ICC scores in Table 5.2.2).

5.2.4 Scale Validity in NSSA Vata

Structural Validity. The unidimensional nature of the scale was confirmed by the findings from exploratory factor analysis (principal axis factoring) conducted on the three communication with parents' items (see Table 5.2.4). In all four datasets, a single factor with eigenvalue > 1 was identified. The total variance explained by this single factor ranged from 63.11% to 69.93%. All item loadings were above the common cutoff point of 0.40 in all datasets (Henson & Roberts, 2006).

Discriminant Validity. The findings revealed moderate positive correlations between communication with parents and certain student characteristics, including academic self-concept, emotional school engagement, and academic task value (ranging from 0.23 and 0.38). Conversely, correlations between communication with parents and victimization in bullying were weak and negative (ranging from -0.18 to -0.14). Strong positive correlations were found between communication with parents and parental academic support, approximately 0.60. Correlations between communication with parents and academic achievement are weakly positive, ranging from 0.06 and 0.16 (see Table 5.1.4 and Table 5.2.5).

Internal Consistency. Acceptable internal consistency was observed for the scale across all rounds of NSSA, with Cronbach's alpha ranging from 0.60 to 0.65.

Table 5.2.1. Relationship with Parents: Scale Structure and Syntax

Intro: Do you agree with these statements about your family, home? (for the 1st and 2nd); Your parents/guardians (for the 3rd)			
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
B18a/ You like to spend time with your family [Tau patinka leisti laiką kartu su namiškiais]	B18a/ You like to spend time with your family [Tau patinka leisti laiką kartu su namiškiais]	B16a/ You like to spend time with your family [Tau patinka leisti laiką kartu su namiškiais]	B15a/ You like to spend time with your family [Tau patinka leisti laiką kartu su namiškiais]
B18c/ You are involved in decisions (e.g. where to vacation together, etc.) [Tu dalyvauji priimant sprendimus (pvz., kur atostogauti kartu ar pan.)]	B18c/ You are involved in decisions (e.g. where to vacation together, etc.) [Tu dalyvauji priimant sprendimus (pvz., kur atostogauti kartu ar pan.)]	B16c/ You are involved in decisions (e.g. where to vacation together, etc.) [Tu dalyvauji priimant sprendimus (pvz., kur atostogauti kartu ar pan.)]	B15c/ You are involved in decisions (e.g. where to vacation together, etc.) [Tu dalyvauji priimant sprendimus (pvz., kur atostogauti kartu ar pan.)]
B16b/ Communicate with you a lot [su Tavimi daug bendrauja]	B16b/ Communicate with you a lot [su Tavimi daug bendrauja]	B13b/ Communicate with you a lot [su Tavimi daug bendrauja]	B12b/ Communicate with you a lot [su Tavimi daug bendrauja]
Response Scale:		Completely disagree Disagree Agree Completely agree	
Missings:		98, 99	
Scale Total			
P_REL = MEAN(B18a, B18c, B16b)	P_REL = MEAN(B18a, B18c, B16b)	P_REL = MEAN(B16a, B16c, B13b)	P_REL = MEAN(B15a, B15c, B12b)

Table 5.2.2. Relationship with Parents: Scale Descriptives

	2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
N	4463	3757	3452	2701
Missing	16	6	30	9
Min - Max	1 - 4	1 - 4	1 - 4	1 - 4
Mean (SD)	3.07 (0.54)	3.09 (0.56)	3.2 (0.55)	3.32 (0.56)
Median	3.0	3.0	3.33	3.33
Skewness (st.error)	-0.53 (0.04)	-0.60 (0.04)	-0.7 (0.04)	-0.93 (0.05)
Kurtosis (st.error)	0.82 (0.07)	1.08 (0.08)	0.91 (0.08)	1.3 (0.09)
ICC (school)	0.018	0.031	0.017	0.020

- Note: ICC (School) – Intra-Class Correlation Coefficient, indicating a proportion of variance in relationship with parents accounted for by school-level differences.

Table 5.2.3. Relationship with Parents: Histograms

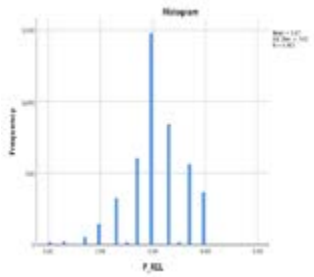
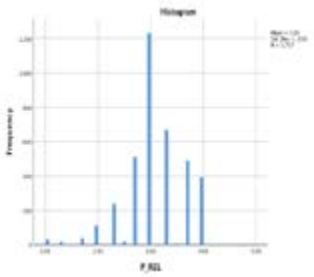
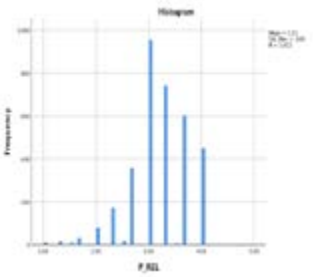
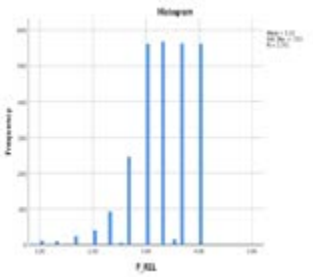
2012 (8th grade)	2014 (8th grade)	2015 (8th grade)	2016 (6th grade)
			

Table 5.2.4. Relationship with Parents: Factor Structure

	Results of Exploratory Factor Analysis			
	2012	2014	2015	2016
No of factors with eigenvalue >1	1	1	1	1
Total variance explained by factor 10. %	36.56	40.05	35.0	33.8
No of items for factor 1	3	3	3	3
Mix – Max factor loadings	0.49 - 0.69	0.53 - 0.74	0.51 - 0.71	0.53 - 0.62

• Note: Principal axis factoring is applied to evaluate factor structure of a scale.

Table 5.2.5. Relationship with Parents: Discriminant Validity and Internal Consistency

Correlates	Relationship with Parents			
	2012	2014	2015	2016
Mathematics Achievement	0.057**	0.093**	0.061	0.072**
Reading Achievement	0.101**	0.131**	0.163**	0.133**
Academic Value	0.234**	0.377**	0.301**	0.265**
Academic Self-Concept	0.273**	0.337**	0.286**	0.288**
Positive School-Related Affect	0.302**	0.303**	0.311**	0.324**
Victimization in Bullying	-0.138**	-0.182**	-0.182**	-0.165**
Autonomy Support	0.170**	0.243**	0.323**	0.214**
Competence Support	0.190**	0.304**	0.306**	0.221**
Relatedness Support	0.200**	0.276**	0.324**	0.264**
Parental Academic Support	0.559**	0.596**	-	-
Cronbach's Alpha	0.62	0.65	0.60	0.60

• Note: Pearson's correlation coefficients (r) are presented in the table. All correlations are significant at .001. **Correlation is significant at the 0.01 level.

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