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PSYCHOMETRIC PROPERTIES OF THE "STUDENT POST-TRANSITION ADJUSTMENT" SCALE IN STARTING COHORT 3

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Psychometric Properties of the "Student Post-Transition Adjustment" Scale in Starting Cohort 3

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Abstract

This paper presents information on the source, theoretical background, and psychometric properties of the "Student post-transition adjustment" scale used in Starting Cohort 3 to assess student experience of the transition from elementary to secondary school. We ran an item-level analysis, checked the scale's reliability, and internal structure. The items had good discriminatory power (> .5). The analyses confirmed the expected two-factor structure, but also revealed a residual correlation. The internal consistencies of the subscales equaled .74 for Learning Experience and .8 for Peer Relationships. Overall, the scale had acceptable psychometric properties.

Keywords

Acknowledgments

1. Introduction

The National Educational Panel Study, besides tracking the development of various competencies, aims at describing their patterns and better understanding how they unfold across the lifespan. To this end, information is gathered about various potential sources of influence, including the home environment, educational institutions, or the workplace. However, the main goal of the study cannot be achieved without extensive information about students, including their abilities, motivations, aspirations, self-perceptions as well as changes of these qualities over time.

This paper presents information on the source, theoretical background, and psychometric properties of the "Student post-transition adjustment" scale used in Starting Cohort 3 (SC3) to assess student experience of the transition from elementary to secondary school. Its goal is to document the scale and provide data users with basic information necessary to make an informed decision about use of the scale in analyses based on the NEPS data or in their own research.

2. Description of the Scale

The "Student post-transition adjustment" scale was designed to measure transition-related experience at the beginning of secondary school. It focuses on two areas that are key in adapting to a new school: learning and social contacts (Wild et al., 2006). Good experience in the two areas is considered an indicator of a successful transition (e.g., Evangelou et al., 2008). Moreover, the two areas are important predictors of later cognitive and non-cognitive outcomes. Good peer relationships after the transition are predictive for well-being and protective against later depression and anxiety (e.g., Evans et al., 2018; Lester & Cross, 2015; Rydell Altermatt, 2011; van Rens et al., 2018). Poor learning experience such as boredom in the classroom is associated with poorer academic outcomes (Tze et al., 2016). Meanwhile, it has been shown that positive achievement emotions decline whereas the negative ones increase after the transition (Meyer & Schlesier, 2021). Some students report being bored and frustrated at the beginning of secondary school because of studying content already covered in primary school (McGee et al., 2003).

The items come from the "Bildungsqualität von Schule (BIQUA)" research project (Wild et al., 2006). The scale includes two subscales, Learning Experience and Peer Relationships, consisting of 3 items each. Subjects are asked to indicate to what extent each item reflects their current school situation. The response options are labelled as follows: 1 = *does not apply at all*, 2 = *does rather not apply*, 3 = *applies partly*, 4 = *does rather apply*, 5= *applies completely*.

Table 1 presents the item wording and the corresponding variable names used in the Scientific Use Files. The original German-language wording is available on the project's website (www.neps-data.de). The variables can be found in NEPSplorer by selecting the following construct in the thematic search: "Learning environments –> Transitions –> Perceived barriers and problems in transition –> Comparison Elementary school - Secondary school".

3. Method

3.1 Data and Sample

We used data gathered during the National Educational Panel Study (NEPS) from Starting Cohort 3. The scale was administered at the beginning of Grade 5 (Wave 1, November 2010 - January 2011) as a part of a longer questionnaire. Information on the testing procedure is available in the data manual (Skopek et al., 2012) and interviewer manual.[1] A total of 4,627 Grade 5 students responded to at least one item of the scale. This number may be lower than the number of students who filled in at least one item in the whole questionnaire. Please note that the scale was not administered to students attending special schools.

Table 1

Items of the "Student Post-Transition Adjustment" Scale

Variable name	Subscale	To what extent do the following statements apply to you?
t292301	LE	Lessons are more fun than they were in elementary school.
t292302	RP	I feel much more comfortable in my class, than I did during elementary school.
t292303	RP	I like my new classmates more than the ones at the elementary school.
t292304	RP	I am more popular in my new class than I was in elementary school.
t292305	LE	The subjects are easier for me now than they were in elementary school.
t292306	LE	I like my new teachers more than those at the elementary school.

Note. LE = Learning Experience; RP = Peer Relationships.

3.2 Analytical Procedure

In the first step, we analyzed missing response rates per person and per item. Next, we inspected item distributions to identify potential problems with response scales, for instance, range restrictions. We also calculated items' discriminatory power (item-rest correlations).

The third step involved analyzing the internal structure of the scale using confirmatory factor analysis (CFA). The two last steps consisted of conducting reliability analyses and of inspecting factor score distributions.

The confirmatory factor analyses were performed with Mplus 8.2 (Muthén & Muthén, 1998-2017) using delta parameterization and the WLSMV estimator. This estimator is recommended for ordered categorical data, especially when item response distributions are

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[1] https://www.neps-data.de/Portals/0/NEPS/Datenzentrum/Forschungsdaten/SC3/1-0-0/NEPS_Interviewerhandbuch_SC3_W1.pdf (German only)

skewed and the number of response categories is small (e.g., Beauducel & Herzberg, 2006; Flora & Curran, 2004). The scales of CFA factors were set by fixing one factor loading to unity. All of the models accounted for the non-independence of students clustered within schools by adjusting to the standard errors using a sandwich estimator (the CLUSTER option).

The model fit was assessed with three commonly used (McDonald & Ho, 2002) fit indices, that is, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker–Lewis index (TLI). We assumed that CFI and TLI values not lower than .95, and RMSEA values not higher than .06 indicated a good fit (Hu & Bentler, 1999).

4. Results

4.1 Missing Responses

NEPS datasets include several codes for missing data. In this case, two types of missing value occurred: implausible values and unspecific missing values. Both types refer to nonresponse, with implausible values denoting invalid responses and unspecific missing values denoting nonresponse for which the cause is unknown.

Table 2

Rates of Implausible, Unspecific, and Total Missing Values per Person (Wave 1 of SC3)

Number of missing values	Implausible values		Unspecific missing values		Total missing values	
	Freq.	%	Freq.	%	Freq.	%
0	4566	98.68	4382	94.70	4331	93.60
1	47	1.02	168	3.63	201	4.34
2	8	0.17	24	0.52	34	0.73
3	2	0.04	14	0.30	17	0.37
4	4	0.09	13	0.28	15	0.32
5	0	0	26	0.56	29	0.63
Total	4627	100	4627	100	4627	100
>= 1	61	1.32	245	5.30	296	6.40

Table 2 contains information with the numbers and percentages of respondents with a given number of implausible values, unspecific missing values, and total missing values. The majority of missing values was unspecific. The number of implausible values per person was low. A total of 1.32% of respondents provided at least one implausible response.

The number of unspecific missing values per person was higher than the number of implausible values. The percentage of respondents with at least one unspecific missing value equaled 5.3%. The students most often omitted one item; 68.6% of all omissions were single-item omissions.

The total missing values per person and unspecific missing values per person hardly differed because of the low share of implausible values in the total missing values. Thus, the results for total missing values are not described.

Table 3 contains information about implausible, unspecific missing, and total missing values per item. All items featured some implausible values, but their rates were low and did not exceed 0.5%. The rates of unspecific missing values were higher, with item t292304 having a visibly higher rate (3.8%) than the other items.

The total missing values per item and the unspecific missing values per item hardly differed because of the low share of implausible values in the total missing values. As a consequence, the rates of total missing values are not described.

Table 3

Rates of Implausible, Unspecific Missing, and Total Missing Values per Item

Item	Implausible values		Unspecific missing values		Total missing values	
	Freq.	%	Freq.	%	Freq.	%
t292301	8	0.17	7	0.15	15	0.32
t292302	13	0.28	50	1.08	63	1.36
t292303	15	0.32	66	1.43	81	1.75
t292304	15	0.32	176	3.80	191	4.13
t292305	15	0.32	73	1.58	88	1.90
t292306	19	0.41	68	1.47	87	1.88

In summary, the implausible value rates per item were low. In conjunction with the low rates per person, this result suggests that respondents did not experience major difficulties with using the scale's response format. The rates of unspecific missing values per item and per person were also satisfactory. However, item t292304 showed increased rates of unspecific missing values. It is not clear why this happened. Possibly, a fraction of students might not have a clear sense of how popular they were in comparison to their situation in elementary school and omitted the item. This could happen especially among students surveyed in

November, at the beginning of the field phase of the study. However, other explanations cannot be excluded.

4.2 Item Distributions

Figure 1 presents the item response distributions. Their analysis showed that 5 out of 6 items had visibly skewed distributions However, respondents used all of the available response categories when filling in the scale.
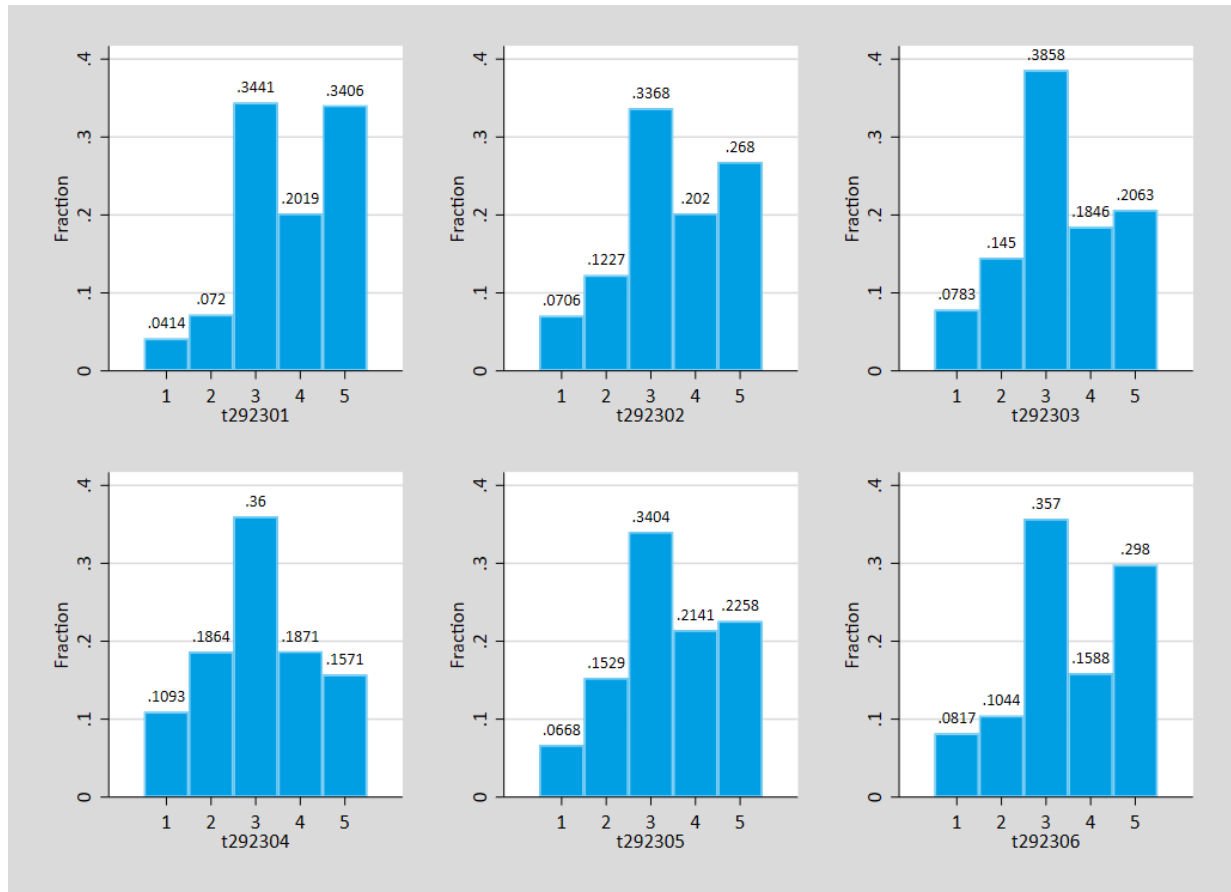

Figure 1. Item response distributions.

4.3 Discriminatory Power

The items' discriminatory power was assessed by calculating item-rest correlations within each subscale. Their values were satisfactory and ranged between .52 and .64. The results are presented in Table 4.

Table 4

Item-Rest Correlations (Pearson's r)

Item	n	r_{ir}
Learning Experience		
t292301	4612	.610
t292305	4539	.567
t292306	4540	.520
Peer Relationships		
t292302	4564	.646
t292303	4546	.683
t292304	4436	.587

Note. r_{ir} = item-rest correlation.

4.4 Internal Structure

Next, we tested the measure's internal structure. To increase the chances that the sample consisted of respondents who were committed to filling in the scale and provided valid responses, we excluded students who had three or more missing values (over 30%) in the scale.

In the first step, we ran a confirmatory factor analysis to test the expected two-factor structure. The model did not include any cross-loadings but factors were allowed to correlate. Although the values of CFI, TLI, and SRMR were satisfactory, RMSEA suggested poor fit to the data; detailed information is presented in Table 5.

Table 5

Fit of the Tested Models

Model	$N_{factors}$	N_{par}	χ^2	*df*	*p*	RMSEA	CFI	TLI	SRMR
CFA 1	2	31	351.69	8	< .001	.097	.981	.964	.020
CFA 2[a]	2	32	256.01	7	< .001	.088	.986	.970	.017

Note. N = 4566; N_{par} = number of free parameters.

[a] The model includes correlated residual errors between of items t292303 and t292304.

Second, due to poor fit indicated by RMSEA, we inspected the model and its modification indices. The inspection revealed that residual errors of items t292303 and t292304 might be correlated. The model fit significantly improved when the residual correlation was added (χ^2

(1) = 84.91, p < .001). Although RMSEA remained above the recommended level, the remaining fit indices were highly satisfactory. Please note that the residual correlation was allowed on an empirical (and not theoretical) basis.

The magnitude of the salient factor loadings in the final model (CFA 2), although varied, was satisfactory—the loadings ranged between .659 (t292304) and .883 (t292303). The factor loadings in the final two-factor CFA solution are available in Table 6.

Next, we inspected the items' thresholds (see Table 7). Thresholds indicate the levels of the latent variable at which individuals cross over to the next response category. Thus, they give some insight into the extent to which the items cover various levels of the measured characteristic. This aspect is particularly important for short scales because it is difficult to cover all trait levels with a small number of items. For 5 out of 6 items, the highest threshold had a value lower than 1 which suggested that the items did not fully cover high trait levels. A sole exception was item t292304 from the Peer Relationships subscale, whose fourth threshold equalled 1.

In summary, the internal structure of the scale was two-dimensional, however residual errors of two items correlated. It is not clear why the residual correlation appeared. Although in the original German-language version of the scale the two items with correlated errors start with words 'Im Vergleich…', their similar wording cannot explain the correlation. Item t292301 begins with the same expression but its residual error did not correlate with the two similarly worded items. This result provides an argument against the scale's construct validity. However, the residual correlation was small, and only one fit index of the model that did not include the residual correlation exceeded the recommended value.

Table 6

Factor Loadings of the Final CFA 2 Model

Item	Learning Experience	Peer Relationships
t292301	.789*	
t292302		.883*
t292303		.782*
t292304		.659*
t292305	.756*	
t292306	.703*	
Factor corr.	.759*	
Res. corr.	.095*	

Note. Res. corr. = residual correlation between items t292303 and t292304; * = statistically significant at p <= .001.

4.5 Reliability

In the next step we assessed the reliability of the scale using information on the items' explained variance and total information curves retrieved from the final CFA 2 model. Moreover, we calculated Cronbach's α coefficients based on raw scores. However, they should be treated with caution because the scale did not meet the assumption of essential tau-equivalence. Factor loadings differed between the items, which meant that the items did not measure the latent trait on the same scale. As a consequence, the scale's reliability is probably underestimated (Miller, 1995).

Table 7

Item Thresholds in the Final CFA 2 Model

Item $Threshold	LE	Item $Threshold	PR
t292301$1	-1.744	t292302$1	-1.473
t292301$2	-1.215	t292302$2	-0.865
t292301$3	-0.109	t292302$3	0.078
t292301$4	0.408	t292302$4	0.620
t292305$1	-1.499	t292303$1	-1.418
t292305$2	-0.775	t292303$2	-0.762
t292305$3	0.151	t292303$3	0.276
t292305$4	0.752	t292303$4	0.819
t292306$1	-1.392	t292304$1	-1.230
t292306$2	-0.892	t292304$2	-0.537
t292306$3	0.109	t292304$3	0.401
t292306$4	0.530	t292304$4	1.006

Note. LE = Learning Experience; RP = Peer Relationships.

Table 8 presents the items' explained variance in the final CFA 2 model. They were satisfactory, although varied, ranging from .43 to .78. A total of 4 out of 6 items had values of .5 or higher[2].

Figure 2 presents the total information curves of the two factors. The measurement precision of both subscales was the lowest at low and high ability levels, and close to uniform at the average ability level. However, the measurement precision of the Learning Experience subscale was shifted towards lower values.

The internal consistencies of the subscales were also satisfactory. The coefficients equaled .74 for Learning Experience and .8 for Peer Relationships.

Table 8

Items' Explained Variances (R^2) in the CFA 2 Model

Item	R^2
t292301	.623
t292302	.779
t292303	.612
t292304	.434
t292305	.571
t292306	.495

4.6 Factor Scores Distributions

Figure 3 presents the distributions of the factor scores derived from the final CFA 2 model. In case of both factors deviations form normality and strong ceiling effects were present. This result is consistent with the analysis of the items' thresholds, which suggested that the items might not fully cover higher trait levels. Descriptive statistics for the total sample and its subgroups with respect to gender, school track, and migration background are available in the Appendix (Table 1A).

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[2] Please note that all calculations were performed using the WLSMV estimator and therefore based on the polychoric correlation matrix. As a consequence, the explained variances refer to continuous underlying response variables instead of to categorical observed response variables.
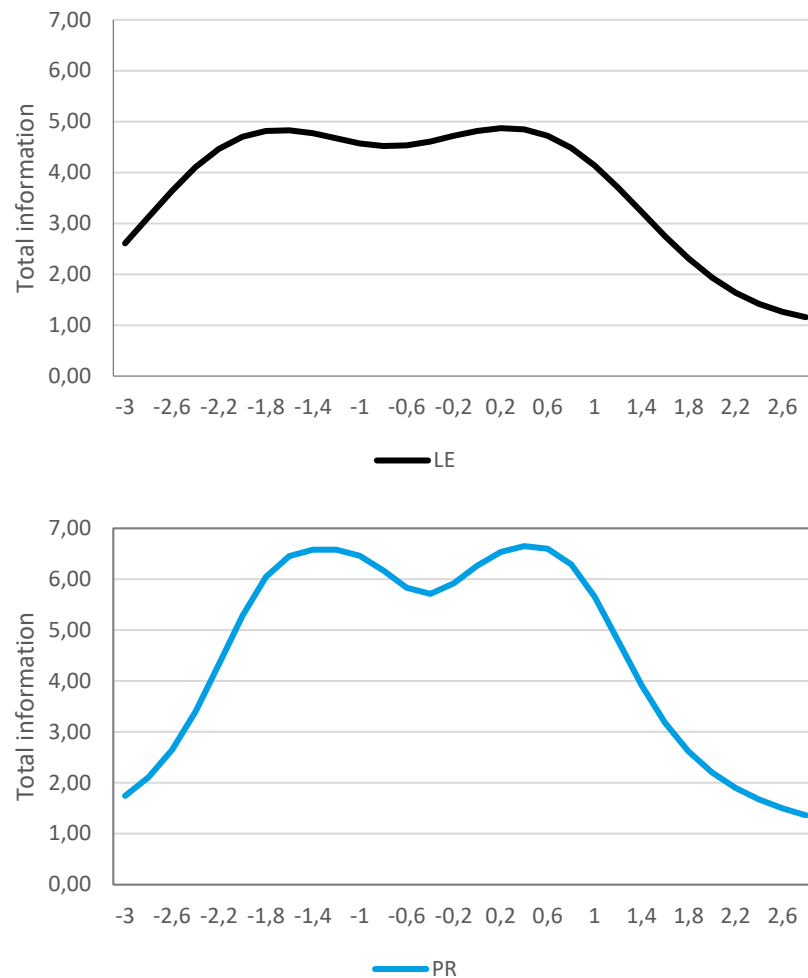
Figure 2. Total information curves of the CFA 2 factors. LE = Learning Experience, PR = Peer Relationships.

5. Summary

This paper documents the "Student post-transition adjustment" scale used in Wave 1 of Starting Cohort 3 to assess student transition-related experience. Besides providing information about the scale's source and theoretical background, the report provides information on its psychometric properties.

The scale was administered in Wave 1 of SC3 to 4,627 grade 5 students. The analyses revealed that the missing value rates per person and per item were acceptable. A total of 1.32% of students provided at least one implausible response and 5.3% omitted at least one item. In general, the rates of missing values per item did not exceed 0.5% in case of implausible responses and 1.6% in case of item omissions, although the rate of omissions of the item t292304 was increased (3.8%). Most of the items had skewed response distributions. The items' discriminatory power was high—it ranged from .52 to .68.

The analyses confirmed the expected internal structure of the scale. Although the two-factor CFA model did not show satisfactory fit, this was due to a residual correlation between a pair of items. The items' explained variances varied between .45 and .78. The measurement

precision of both subscales was the lowest at low and high ability levels, and close to uniform at the average level. However, the items did not cover all the trait levels which resulted in strong ceiling and weak floor effects in both subscales. However, this problem is common in very short scales. The reliabilities were satisfactory and equaled .74 for Learning Experience and .8 for Peer Relationships.
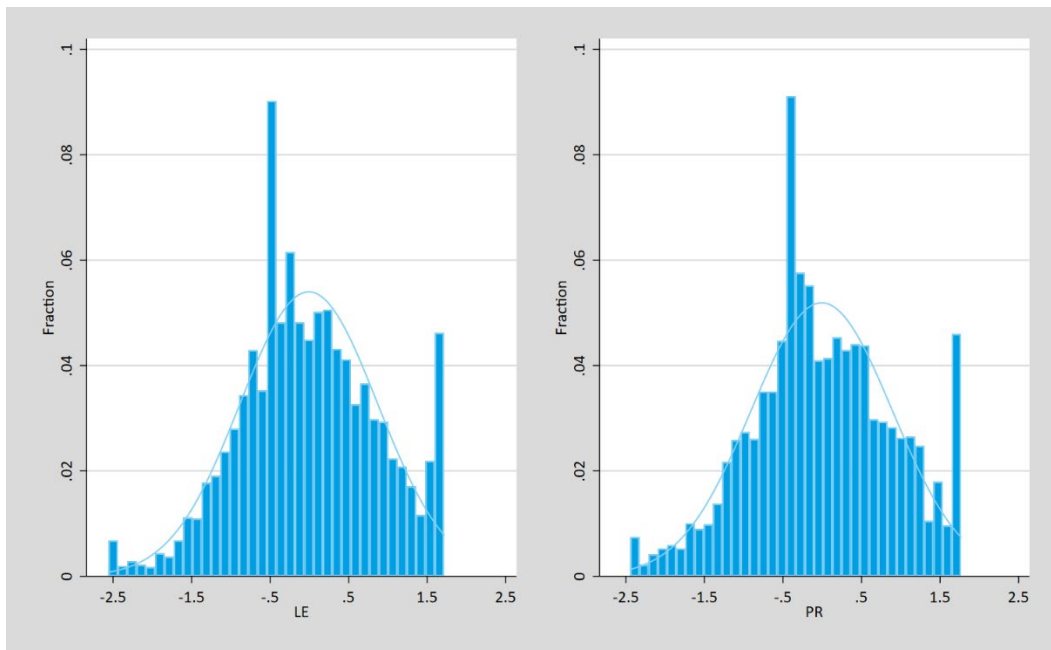
Figure 3. Distributions of the factor scores derived from the final CFA 2 model. LE = Learning Experience; PR = Peer Relationships.

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Appendix

Table 1A

Descriptive Statistics for Factor Scores Derived from the Final CFA 2 Model

Group	N	Mean	p50	SD	Var	Skew	Kurt	p25	p75	Min	Max
					Learning Experience						
Gender											
Girls	2234	-0.046	-0.123	0.846	0.716	0.044	-0.023	-0.550	0.499	-2.557	1.714
Boys	2330	0.032	0.012	0.902	0.814	-0.103	-0.279	-0.548	0.668	-2.557	1.714
Missing	2	-1.459	-1.459	1.553	2.411	0.000	-2.000	-2.557	-0.361	-2.557	-0.361
School track											
Academic	2200	-0.121	-0.199	0.807	0.651	0.118	0.076	-0.628	0.404	-2.557	1.714
Non-academic	2294	0.105	0.107	0.920	0.846	-0.185	-0.302	-0.480	0.770	-2.557	1.714
Migration background											
No	3353	-0.033	-0.112	0.860	0.740	0.003	-0.108	-0.563	0.539	-2.557	1.714
Yes	1135	0.070	0.050	0.914	0.836	-0.155	-0.246	-0.515	0.697	-2.557	1.714
Missing	78	-0.004	-0.030	0.952	0.906	0.027	-0.627	-0.601	0.553	-2.175	1.714
Total	4566	-0.007	-0.069	0.877	0.769	-0.032	-0.165	-0.548	0.584	-2.557	1.714

Group	N	Mean	p50	SD	Var	Skew	Kurt	p25	p75	Min	Max
					Peer Relationships						
Gender											
Girls	2234	-0.017	-0.106	0.869	0.756	-0.030	-0.135	-0.533	0.552	-2.444	1.766
Boys	2330	0.005	-0.060	0.925	0.855	-0.061	0.660	-0.575	0.620	-2.444	1.766
Missing	2	-2.070	-2.070	0.530	0.281	0.000	-2.000	-2.444	-1.695	-2.444	-1.695
School track											
Academic	2200	-0.061	-0.167	0.834	0.696	0.028	-0.094	-0.565	0.485	-2.444	1.766
Non-academic	2294	0.048	0.010	0.947	0.896	-0.113	-0.385	-0.536	0.699	-2.444	1.766
Migration background											
No	3353	-0.035	-0.125	0.885	0.783	-0.032	-0.164	-0.562	0.552	-2.444	1.766
Yes	1135	0.077	0.065	0.937	0.879	-0.128	-0.415	-0.547	0.746	-2.444	1.766
Missing	78	-0.019	-0.083	0.866	0.750	0.152	-0.236	-0.618	0.518	-2.102	1.766
Total	4566	-0.007	-0.089	0.899	0.808	-0.048	-0.240	-0.562	0.587	-2.444	1.766

Note. Migration background—Yes = at least one parent born abroad; Migration background—No = both parents born in Germany.