CENTRE FOR INTERNATIONAL STUDENT ASSESSMENT

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Subject-specific truancy: Dimensionality of the truancy scale and associations with subject-specific achievement

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Introduction

Most large-scale student assessments implicitly assume that the proficiency such as mathematics, science or reading is mainly acquired at school. Skipping classes means that students do not use this opportunity to learn. Intentionally skipped classes might be related to motivational student characteristics and achievement.

Student performance or academic achievement is a part of students' school biography that intuitively seems to be negatively related to truant behavior: the worse a student does at school, the more he or she will play truant (Vaughn et al., 2013). And yet, students who play truant achieve not necessarily lower than students who don't (Renzulli & Park, 2000).

This association has mostly been studied using school grades or exams as a measure for student achievement. However, using school exams may generate biased outcomes because they depend on curricula. In our study, we are using the PISA 2012 proficiency scales as a standardized, cross-curricular measure for student achievement. We take a closer look at subject-specific truancy and its relationship with achievement in the corresponding subject domain.

Research questions

1. Is truancy a multidimensional construct that can be captured by students selectively skipping certain school subjects?

2. How does subject-specific truancy relate to student achievement in the corresponding competence domains in the PISA 2012 test?

Methods

Sample

- PISA 2012 sample of 15-year-old students in Germany (N = 5,001)
- 51 % were female, 14 % had an immigrant background
- Students attended one of five lower secondary school types

Instruments

- **Students' proficiency** in the PISA competence domains (Reading, Mathematics, Science) was measured using the PISA 2012 competence test
- 5 Plausible Values (PVs) were assigned to each student (OECD, 2012)
- Student questionnaire contained **two truancy scales**:
  (1) A frequency index differentiating single-lesson skipping, skipping of first and last lessons of a school day, skipping half and whole school days as well as skipping two or more school days in a row
  (2) Subject-specific truancy was measured by a list of six subjects that correspond to the PISA assessment domains of Reading, Mathematics and Science

Analyses

Question 1 IRT-based pairwise comparative scaling approach with six subject-specific truancy items using the R package *pairwise* (Heine, 2014) for unbiased IRT measures under the condition of higher rates of missing data (Heine & Tarnai, in press)

One stepwise regression model per competence domain, predicting student proficiency by subject-specific truancy — Question 2

Results

Proportions of students who reported to have played truant

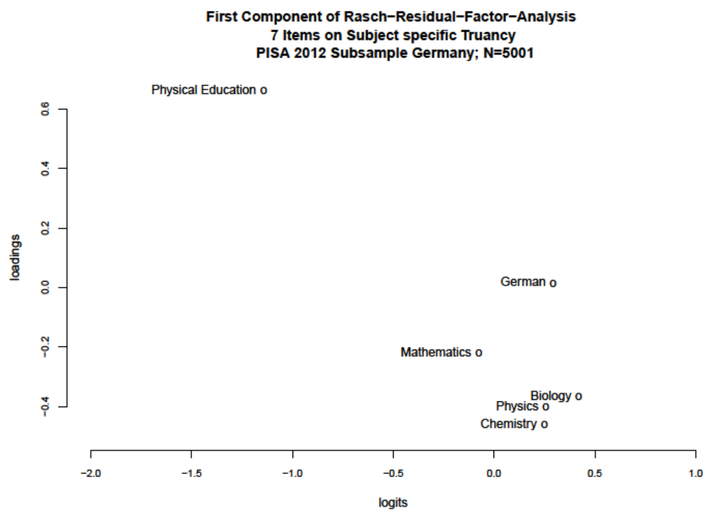
Apparently, most students who choose to not attend a class select PE lessons for skipping (n = 463).
The other subjects in our list are equally 'popular' with regard to student truancy (191 < n < 243).
The general frequency index that was administered in the Student Questionnaire yielded a proportion of students skipping classes of n = 375.

Table 1: Proportions of students who reported to have played truant (subject-specific and general frequency index), N = 5,001

	Missing	Score 0	Score 1	Score 2
Biology	1083	3630	209	79
Chemistry	1077	3593	243	88
Physics	1094	3617	192	98
Mathematics	1085	3572	214	130
Physical Education	1072	3203	463	263
German	1086	3632	191	92
Truancy Index	1130	3400	375	96

Overall, we see for all subject-specific items and for the frequency index that most of the students who indicate to play truant do so only once or twice.

Question 1



The factor analysis of the Rasch-residuals resulting from the pairwise scaling procedure revealed the assumed (sub-)dimensionality of the truancy construct.
The figure shows the item loadings on the first main component of the Rasch-residual-factor analysis (Linacre, 1998) plotted against the item difficulties obtained from the pairwise scaling approach of the six truancy items. With regard to their loadings, the items split into four groups suggesting a four-dimensional structure of the construct of 'subject-specific truancy'. PE is isolated from the other dimensions and the most popular among the subjects to be skipped. For most students who play truant, PE is the only subject they avoid. Both German and Mathematics in their role as core subjects form separate dimensions.

The fourth dimension is a conglomerate of the three science-related subjects that are taught in German secondary schools: Physics, Chemistry and Biology. This means that students who choose to skip one science subject tend to skip another science subject as well.

Question 2

Table 2: Regression Model: Covariates, truancy in mathematics and PE and predicting PISA Mathematics Competence (PV Math).

	Model 1: Individual characteristics		Model 2: Subject-specific truancy		Model 3: Subject-specific truancy and skipping PE	
	B	SE	B	SE	B	SE
Intercept	415.98***	5.76	436.65***	5.46	437.10***	5.53
Male	14.67***	2.43	16.68***	2.91	16.34***	2.85
Immigrant status	-23.16***	5.35	-26.99***	5.20	-27.13***	5.23
HISEI	1.81***	.09	1.61***	.08	1.60***	.08
Truancy Math			-22.35***	3.32	-21.51***	4.03
Truancy PE					-1.87	2.92
R^2	.18		.20		.20	

Notes: *PE = Physical Education; *** = p <.001; ** = p < .01; * = p < .05; HISEI values are z-standardized.

Table 3: Regression Model: Covariates, truancy in German and PE predicting PISA Reading Competence (PV Reading).

	Model 1: Individual characteristics		Model 2: Subject-specific truancy		Model 3: Subject-specific truancy and skipping PE	
	B	SE	B	SE	B	SE
Intercept	445.96***	5.52	469.99***	5.21	470.49***	5.31
Male	-43.06***	2.17	-42.14***	2.43	-42.71***	2.43
Immigrant status	-17.42***	5.01	-23.19***	5.11	-23.15***	5.12
HISEI	1.67***	.08	1.44***	.08	1.43***	.08
Truancy German			-17.59***	4.07	-14.67***	4.62
Truancy PE					-3.86	2.31
R^2	.22		.23		.24	

Notes: *PE = Physical Education; *** = p <.001; ** = p < .01; * = p < .05; HISEI values are z-standardized.

Table 4: Regression Model: Covariates, truancy in Science and PE predicting PISA Science Competence (PV Science).

	Model 1: Individual characteristics		Model 2: Subject-specific truancy		Model 3: Subject-specific truancy and skipping PE	
	B	SE	B	SE	B	SE
Intercept	439.73***	5.65	464.13***	5.31	464.69***	5.33
Male	.40	2.52	2.00	2.82	1.47	2.80
Immigrant status	-33.74***	5.43	-39.15***	5.07	-39.28***	5.09
HISEI	1.72***	.08	1.47***	.08	1.46***	.08
Truancy Science			-9.09***	2.04	-7.94***	2.61
Truancy PE					-2.84	2.94
R^2	.18		.18		.19	

Notes: *PE = Physical Education; *** = p <.001; ** = p < .01; * = p < .05; HISEI values are z-standardized.

Students skipping mathematics classes score about 22 points less on the PISA Mathematics scale than students who do not skip Mathematics classes (Table 2). According to a German longitudinal study from PISA 2003, this discrepancy corresponds to one school-year of learning (Ehmke, Blum, Neubrand, Jordan, & Ulfig, 2006).

The development of reading proficiency is apparently not completed at the primary school level, it is continued at the secondary level and German lessons seem to play a significant role for acquiring reading literacy. Even though there are numerous opportunities to practice reading and improve one's proficiency by reading for pleasure (Aarnoutse & van Leeuwe, 1998), students skipping German classes on purpose have a significantly lower proficiency level in reading than students who choose not to skip German lessons.

For Science lessons as an aggregate of Biology, Chemistry and Physics, we find that skipping Science classes correlates with low achievement. Similarly to Mathematics, schools seem to be the main setting for acquiring scientific competence.

Conclusions

1. Truancy is a multidimensional construct and students are picky with regard to the lessons they miss on purpose
2. Subject-specific truancy goes along with a lower proficiency level in the corresponding competence domains, or: Students selecting themselves into the truancy-group achieve lower in the respective subject domain than other students

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