Poverty and School Achievement:

an Additional Indicator for Socio-Economic Status

in School Achievement Studies

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Abstract

International large-scale achievement studies of student achievement employ different indicators to operationalize the socio-economic status (SES) of students. All the different SES variables correlate significantly to students' school achievement in all countries. 'Poverty' as a theoretical construct in sociology has not up to now been included in international questionnaires for such studies, but it now has been included in the German extension of the TIMSS 2007 home questionnaire.

This paper deals with the question whether students from families at risk of poverty perform worse in school than students whose families are not at a risk of poverty. Our analyses of data from TIMSS 2007 Germany show a significant relationship between families' risk of poverty and students' achievement in mathematics or science. To extract the additional effect of poverty relating to social disparity other indicators for the SES of the families were controlled. Our analyses show that in high-SES families the risk of poverty has a greater effect on students' achievement than in low-SES families. We conclude that for in-depth analyses it is beneficial to use a combination of different indicators (e.g., highest level of education, occupational status, social resources, and risk of poverty) in order to consider various aspects of SES when analyzing social disparities in an educational context.

Keywords: *academic achievement, occupational status, poverty, social deprivation*

Introduction

The large international school achievement studies of recent years – especially PIRLS, TIMSS and PISA – revealed to the general public what has been clear to experts for a long time: a (strong) correlation between families' socio-economic status (SES) and students' school achievement can be found in almost all countries (Willms, 2006).

To operationalize SES different instruments are used, all of which are based on established

theories and have been field-tested. However, risk of poverty among students' families has not yet been included in the international questionnaires of these studies although it is an important factor in sociological research as well as in political discourse.

Social Disparities in the Education System

Most common measurements of SES used in empirical research are based on the idea of economic, cultural, and social capital (Bourdieu, 1986; Coleman, 1988):

- Occupational status: several indicators exist for the occupational status of a person, providing information on both the economic and the cultural capital of a family. Most important for educational research are the International Socio-Economic Index of Occupational Status (Ganzeboom, De Graaf, & Treiman, 1992; Ganzeboom, & Treiman, 1996) and the EGP classes (Erikson, Goldthorpe, & Portocarero, 1979).

- Educational attainment: the highest educational attainment level of the parents is an indicator for the cultural capital of a household. Common measurements include the number of years in school or the International Standard Classification of Education (UNESCO, 2003).

- Household possessions: information on different possessions in the students' homes can easily be gathered as indicators of economic and/or cultural capital. Typical examples include number of cars, piano, lawn mower and, especially, number of books at home.

- Income: the income of a household directly measures the economic capital.

- Social networks: the social capital of families can be measured using name generators that ask if the respondent knows anyone who can help with certain problems.

Independent of the kind of indicator used to determine SES, in international comparisons the connection between SES and academic achievement is found to be especially close in Germany (Bos, Schwippert, & Stubbe, 2007). Bonsen, Frey, and Bos (2008) show for TIMSS 2007 that the advantage in educational performance in mathematics and science seen among students from homes with more than 100 books compared to those from homes with less than 100 books is larger in Germany than in any other country with the exception of Hungary for performance in mathematics.

Another important indicator of SES in current sociological research is poverty. Until now this indicator has not been included in the large international school achievement studies. After providing some general information on poverty we will present research findings from the

German TIMSS 2007 data to underline the importance of this measurement.

Poverty and Educational Achievement

In industrial nations 'poverty' usually means 'relative poverty', which should be distinguished from the term 'absolute poverty'. According to the World Bank a person is regarded as poor in an absolute sense if he or she has less than 1 US dollar (adjusted for purchasing power) per day (Chen, & Ravallion, 2004). The European Community defines 'relative poverty' as follows: First the 'equivalent size' of a household is calculated by assigning the first adult a weighting of 1.0, each additional person aged 14 or older a weighting of 0.5, and each child younger than 14 a weighting of 0.3. Then the household net income (including salary, pension, unemployment benefits, interest on investments, income from rent and lease, alimony, etc.) is divided by this 'equivalent household size'. If this value is below the at-risk-of-poverty threshold, which is set to 60 percent of the national median equivalized disposable income, the household is said to be "at risk of poverty" (Bardone, & Guio, 2005).

Numerous studies indicate that the developmental opportunities of children living in poverty for a certain period of time are worse than those of children not affected by poverty. Negative effects can be detected in their physical health as well as in their cognitive development (Beisenherz, 2000). Another considerable problem for the affected children is exclusion from social interaction resulting from poverty (e.g., visits to the cinema or swimming pool, school trips, etc.) resulting in socio-psychological effects (Feustel, 2007). It can therefore be assumed that poverty has a negative impact on the academic achievement of students even if families' SES is controlled (Groh-Samberg, 2009).

Risk of Poverty in the EU

Since 2005 all member countries of the EU collect comprehensive data on income and general living conditions of the population on an annual basis (EU-SILC) to provide the EU and national governments with statistical information upon which to base policy decisions (Guio, 2005). Among other things these statistics provide information on the national risk-of-poverty rate.

In 2007 – the year of the last TIMSS assessment – the median equivalized annual disposable income in Germany was 17,707 euro. Therefore, the at-risk-of-poverty threshold (60 % of this value) was 10,624 euro per year, or 885 euro per month. As can be seen in Table 1, the German risk-of-poverty rate was 15 percent while the average for the 27 EU countries was 16 percent. In the Czech Republic and the Netherlands the rate was relative low (10 %). In the Southern Europe countries Spain, Greece and Italy the proportion was twice as high (20 %). The highest

risk-of-poverty rate was found in Latvia (21 %).

[Take in Table 1 about here.]

In all countries the risk-of-poverty rates differed substantially between different sectors of society. For example, across all countries single parents with at least one dependent child had more than twice as high a risk of poverty (34 %) than the general population.

Research Questions

The following hypotheses will be tested in the empirical section of this paper:

1. There is a correlation between the variable 'poverty' and other indicators for SES. The risk-of-poverty-rate is higher in families with an immigrant background than in families without an immigrant background.

2. Students from families below the risk-of-poverty threshold achieve lower scores in mathematics and science than students not at risk of poverty.

3. The differences in academic achievement between families below and above the risk-of-poverty threshold are greater among families with high SES and in families without an immigrant background. The probable reason for this is that in families with a low SES (or with an immigrant background) the achievement is rather low independent of the household's risk-of-poverty while in families with a high SES (or without an immigrant background) the impact of poverty on achievement is relatively high.

4. There is a correlation between the variable 'poverty' and the school track recommendation given by students' teachers as it is well known that teachers' recommendations correlate with the SES of students' families.

5. The connection between 'poverty' and school track recommendation can be seen even if academic achievement and other indicators for SES are controlled.

Data

In 2007 Germany participated for the first time in the IEA study TIMSS (Trends in International Mathematics and Science Study) involving the primary school population (POP I). Contrary to the international study design in Germany a home questionnaire was used to gather information from the students' parents. This questionnaire included the monthly net household income as well as the household size so that a dichotomous variable for the risk of poverty could be

generated.

The dataset used contains information on 5,200 students and their families. Missing values were imputed with the software NORM 2.03 using single imputation.

Results

The proportion of families below the risk-of-poverty threshold was found to be 30.7 percent (see Table 2). This rate differed depending on the background characteristics of the students' families. Where the head of household had a college degree (ISCED 5) the risk-of-poverty rate was only 9.8 percent. On the other hand, the rate was 35.6 percent where the head of household did not complete upper secondary school (below ISCED 3). Accordingly, more than half (51.7 %) of the families in class VII of the EGP class schema (semi- and unskilled manual workers) were at risk of poverty, compared with only 9.6 percent in EGP class I (higher-grade professionals). Not only SES but also the immigrant background of parents was found to correlate to poverty risk. The risk-of-poverty rate was found to be 22.1 percent in families without an immigrant background but 57.9 percent in families where both parents were born in a foreign country.

[Take in Table 2 about here]

Consistent with the theory the achievement of students from families below the risk-of-poverty threshold was lower than for students from families above the threshold. On the international TIMSS scales there are differences between the two groups of 44 points for mathematics and 53 points for science (see Table 3). By comparison, the differences between children from families with more than 100 books and children from families with less than 100 books are 41 (mathematics) and 51 (science) points respectively, and therefore similar (Bonsen, Frey, & Bos, 2008).

[Take in Table 3 about here]

To answer the research question whether poverty has an additional explanatory power for student achievement even if other indicators for SES are controlled, Table 3 presents the achievement data separated by highest educational attainment level. It can be seen that the differences between students from families below and above the risk-of-poverty threshold are greater among families with academically educated parents. Where the head of household has a college degree (ISCED 5) the differences between the two groups are 52 (mathematics) and 58 (science) points respectively. Where the head of household didn't finish upper secondary school (below ISCED 3) these differences are only 38 and 45 points respectively.

When a comparison is made based on EGP class a similar result can be found (see Table 4). Children of higher-grade professionals (EGP class I) below the risk-of-poverty threshold score 43 (mathematics) and 47 (science) points less than students who are not at risk of poverty. In the other EGP classes these differences are – at least nominally – smaller.

[Take in Table 4 about here]

Among students whose parents were born in Germany the mathematics achievement of those whose parents' income was above the risk-of-poverty threshold was 41 points higher than that of those below the risk-of-poverty threshold. For science the difference was 42 points. For students with an immigrant background these differences were about 10 points less.

[Take in Table 5 about here]

At the end of fourth grade in most federal states (*Länder*) in Germany students' families have to decide on a particular school track: lower, intermediate or upper secondary school. For this purpose the teachers in primary school recommend a certain track. Research shows that this transition from primary to secondary school is an important cause of social disparities in the German educational system (Pietsch, & Stubbe, 2007).

Table 6 shows the total percentage of students recommended for upper secondary school (Gymnasium), as well as separated based on families' poverty risk. While almost half of the students from households above the risk-of-poverty threshold (44.3 %) received a recommendation for upper secondary school (Gymnasium) this proportion was only 17.7 percent for children from families whose income was below that threshold.

[Take in Table 6 about here]

To determine whether this disparity was caused by differences in achievement Table 7 presents the results from four logistic regressions. In the model without covariates the chances of receiving a recommendation for upper secondary school (*Gymnasium*) are more than three and a half times higher for students from families above the risk-of-poverty threshold than for those below this threshold. When achievement in mathematics and science are controlled for model II the chances of receiving a recommendation for upper secondary school (*Gymnasium*) are still almost twice as high for the former group as for the latter.

[Take in Table 7 about here]

To answer the question whether poverty has incremental explanatory power compared with other SES indicators, model III controls the ISEI of students' families. In this model the chances of receiving a recommendation are two and a half times higher for children not at risk of

poverty than for those at risk of poverty. Even where students' achievement and families' SES is controlled (model IV) a significant odds ratio (1.62) can be found in favour of children from households that are not at risk of poverty.

Discussion

Consistent with the theory the empirical analyses showed that households in which the highest educational attainment level and/or the occupational status are rather low the risk-of-poverty-rate is above average. The same holds for families with an immigrant background. The achievement of students whose families are at risk of poverty is generally lower than that of students whose families are not at risk of poverty. Even where the parents' educational attainment, occupational status or immigrant background are considered this difference remains significant. A trend emerges showing that the impact of poverty on academic achievement correlates positively with families' SES. The likelihood of receiving a teacher's recommendation for upper secondary school is higher for students not at risk of poverty even if students' achievement and families' SES are taken into account.

Poverty as a sociological indicator is not an alternative to other SES indicators but an addition. Depending on the research questions to be analysed, the highest level of parental education, indices of occupational status, economic wealth, social capital, etc. are important variables for operationalizing SES.

Nonetheless the empirical results in this paper lead us to the assumption that poverty should be considered for certain research questions in educational research. In line with the theoretical assumptions, 'poverty' has a substantial explanatory power even if other indicators for SES are excluded.

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Table 1: Risk-of-poverty rates (in %) among EU member states in the year 2007

Country	Risk-of-poverty rate
Czech Republic	10
Netherlands	10
Sweden	11
Slovakia	11
Austria	12
Denmark	12
Hungary	12
Slovenia	12
Finland	13
France	13
Bulgaria	14
Luxembourg	14
Malta	14
Belgium	15
Germany	15
Cyprus	16
European Union (27 countries)	16
Poland	17
Ireland	18
Portugal	18
Estonia	19
Lithuania	19
Romania	19
United Kingdom	19
Spain	20
Greece	20
Italy	20
Latvia	21

Source: http://www.epp.eurostat.ec.europa.eu

Table 2: Risk-of-poverty rate by background characteristics of families

	Risk-of-poverty rate	
	%	(SE)
Total	30.7	(1.0)
Highest educational attainment level		
Did not complete upper secondary school	35.6	(1.1)
Completed upper secondary school but no college degree	26.5	(1.6)
College degree	9.8	(1.3)
EPG class		
Higher-grade professionals (I)	9.6	(1.1)
Lower-grade professionals (II)	16.3	(1.4)
Routine non-manual employees (III)	33.0	(2.3)
Small proprietors, farmers (IV)	36.2	(2.0)
Lower-grade technicians, skilled manual workers (V, VI)	38.1	(1.7)
Semi- and unskilled manual workers (VII)	51.7	(1.7)
Immigrant background		
No parent born abroad	22.1	(1.0)
One parent born abroad	39.8	(2.3)
Both parents born abroad	57.9	(2.0)

Table 3: Average achievement in mathematics and science among students from families below and above the risk-of-poverty threshold by highest educational attainment level of the head of household

	Not at risk of poverty			At risk of poverty			
	M	(SE)	SD	M	(SE)	SD	Difference
Mathematics:							
Total	539	(2.1)	63	494	(2.8)	69	44
Did not complete upper secondary school	530	(2.2)	63	492	(3.0)	69	38
Completed upper secondary school but no college degree	546	(3.1)	61	503	(5.4)	66	43
College degree	566	(3.0)	57	514	(9.0)	62	52
Science:							
Total	544	(2.5)	73	491	(3.0)	81	53
Did not complete upper secondary school	533	(2.7)	73	488	(3.2)	81	45
Completed upper secondary school but no college degree	553	(4.1)	71	501	(5.4)	78	52
College degree	573	(3.9)	66	515	(10.9)	74	58

Table 4: Average achievement in mathematics and science among students from families below and above the risk-of-poverty threshold by EGP class

	Not at risk of poverty			At risk of poverty			
	M	(SE)	SD	M	(SE)	SD	Difference
Mathematics:							
Total	539	(2.1)	63	494	(2.8)	69	44
Higher-grade professionals (I)	562	(2.6)	57	519	(7.7)	64	43
Lower-grade professionals (II)	549	(2.6)	59	517	(6.2)	57	33
Routine non-manual employees (III)	536	(5.2)	65	511	(5.4)	53	24
Small proprietors, farmers (IV)	533	(3.5)	58	500	(5.4)	68	33
Lower-grade technicians, skilled manual workers (V, VI)	525	(3.5)	63	495	(3.4)	63	30
Semi- and unskilled manual workers (VII)	507	(3.5)	66	473	(5.2)	77	34
Science:							
Total	544	(2.5)	73	491	(3.0)	81	53
Higher-grade professionals (I)	571	(3.1)	64	524	(9.6)	78	47
Lower-grade professionals (II)	555	(3.2)	69	523	(7.2)	68	32
Routine non-manual employees (III)	542	(6.4)	75	508	(6.7)	71	34
Small proprietors, farmers (IV)	536	(5.0)	68	499	(5.3)	77	36
Lower-grade technicians, skilled manual workers (V, VI)	528	(3.4)	73	488	(4.6)	75	40
Semi- and unskilled manual workers (VII)	506	(4.0)	75	467	(5.5)	88	39

Table 5: Average achievement in mathematics and science among students from families below and above the risk-of-poverty threshold by immigrant background

	Not at risk of poverty			At risk of poverty			
	M	(SE)	SD	M	(SE)	SD	Difference
Mathematics:							
Total	539	(2.1)	63	494	(2.8)	69	44
No parent born abroad	546	(1.9)	61	505	(3.6)	70	41
One parent born abroad	516	(4.3)	64	489	(4.4)	63	27
Both parents born abroad	510	(4.7)	66	481	(4.4)	68	29
Science:							
Total	544	(2.5)	73	491	(3.0)	81	53
No parent born abroad	555	(2.2)	68	513	(3.7)	78	42
One parent born abroad	515	(5.1)	74	482	(6.5)	75	33
Both parents born abroad	495	(5.8)	76	462	(4.7)	78	33

Table 6: Proportion of students (in %) who received a teacher's recommendation for upper secondary school (*Gymnasium*) by risk-of-poverty

	Recommendation for upper secondary school
Total	36.4
Not at risk of poverty	44.3
At risk of poverty	17.7

Table 7: Relative chances [odds ratios] of receiving a teacher's recommendation for upper secondary school by risk-of-poverty

	Model I	Model II	Model III	Model IV
Not at risk of poverty	3.69	1.95	2.57	1.62
At risk of poverty	Reference group (odds ratio = 1)			
McFaddens-R^2	0.05	0.31	0.11	0.32

All *odds ratios* significant (p < .01).
Model I: Without control of covariates; Model II: Control of mathematics and science achievement; Model III: Control of social status (ISEI); Model IV: Control of mathematics and science achievement and social status (ISEI)