

## **Are German Non-Public Secondary Schools More Effective at Teaching Mathematics and Natural Sciences?**

J. Dronkers<sup>1</sup>, J. Baumert<sup>2</sup> & K. Schwippert

<sup>1</sup> European University Institute, Department of Political and Social Sciences, P.O Box 2330, 50100 Firenze Ferrovia, Italy. Phone: +39-055-4685260. Fax: +39-055-4685201. E-mail: [jaap.dronkers@iue.it](mailto:jaap.dronkers@iue.it). Direct all correspondence to the first author.

<sup>2</sup> Max-Planck Institute for Human Development, Lentzeallee 94, D14195 Berlin, Germany. Phone: +49-30-824060. Fax: +49-30-8249939. E-mail: [jbaumert@mpib-berlin.mpg.de](mailto:jbaumert@mpib-berlin.mpg.de).

# Are German Non-Public Secondary Schools More Effective at Teaching Mathematics and Natural Sciences?

## 1. Introduction

Parental choice in education or the free choice by parents to select their children's school is a major topic in educational policy (CERI, 1994). The introduction of more parental choice in educational systems is often advocated as a mean of introducing competition for pupils between schools and thus improving the quality of teaching, decreasing the level of bureaucracy in and around schools and reducing its costs (Chubb & Moe 1990). One of the assumptions of this parental choice debate is that non-public schools are more effective than public ones.

Ground-breaking research in the USA (Coleman, Hoffer & Kilgore 1982; Coleman & Hoffer 1987) but also more recent studies (Hoffer, 1998) show that pupils in USA catholic schools have higher educational outcomes than pupils in public schools, also controlling for their social backgrounds and other relevant differences between public and catholic schools. However, these USA studies on the difference between public and catholic schools face two problems in measuring effectiveness differences: 1. The USA has no centralized educational system, which hampers the comparability of public and catholic schools because there are no equal curricula requirements or comparable final examinations for these schools. Differences in educational outcomes might be explained not by differences in schools' effectiveness but by differences in educational goals and requirements of these schools. 2. Catholic schools are not subsidized by the state. As a consequence all the costs of these catholic schools have to be paid by the parents (who also have to pay taxes to maintain the public school in their district) or by the Catholic Church, which maintain these schools. Choosing a catholic school for their children implies high financial costs for parents (fees, travel & taxes). This willingness to pay substantially more for their children's schooling indicates that the parents of pupils in USA catholic schools do more to promote educational results for their children. Differences in educational outcomes might be explained not by differences in schools' effectiveness but by differences in the importance of schooling perceived by parents of pupils in public and catholic schools.

In contrast with the USA and the England, parents in a number of continental European societies are able to make a real choice between comparable schools, mostly between public and private schools, without paying very high school fees. These private schools are most often Catholic or Protestant schools operating within a national educational system and receiving state funds to cover running costs. This existence of public and private schools side by side within one national educational system is the unintended result of three processes in these European societies: the struggle between the state and the established churches in continental Europe; the fight between the 18th century *anciens régimes* (mostly with one state-church and suppressed religious minorities) and the 19th century liberal governments (which claimed to be neutral to all churches); and the emergence of new social classes in the 19th century (skilled workers, craftsmen, labourers) which rejected the dominant classes, either liberal or conservative.<sup>1</sup> In several European societies (Austria-Hungary, Belgium, France, German *Länder* (states), the Netherlands, Scotland) these processes had more or less comparable results, with public and non-public school sectors, offering parents a choice between schools of the same curriculum and usually at a similar price for the parents.<sup>2</sup> However, the size of the public and non-public school sectors varies strongly between these European societies for specific historic reasons, with the German non-public school sector among the smaller on the continent (OECD 1998: 139). Educational systems like that in Germany with both public and religious school sectors, offering parents a choice between schools of the same curriculum and usually at a similar price for the parents, offer a more

appropriate environment to test the assumption of the parental choice debate that non-public schools are more effective than in the USA or England. This article aims to measure the possible effectiveness differences between public and private schools in Germany.

Despite the increasing irrelevance of church and religion in the everyday life of most European societies, religious schools in these societies have not dwindled away. On the contrary, the non-public school sector in societies with relatively inactive religious populations (France: Langouët & Leger 1994) is growing or is strongly over-represented (the Netherlands: Dronkers 1996). The rise of the percentage of pupils at religious schools does not only apply in societies which have such schools traditionally (Austria, France, the old German *Länder*, Netherlands), but also in those societies in which non-public schools were abolished during the communist regimes (Hungary, the new German *Länder*). Table 1 illustrates this for Germany's old and new *Länder*. The percentage of pupils attending non-public *Gymnasiums*<sup>3</sup> in the old German *Länder* has made a reasonable recovery since their lowest point during the '70s. Since the unification of Germany, the percentage of pupils at non-public *Gymnasiums* in the new German *Länder* has increased from zero to 2.5%. The stability of the percentage of pupils at non-public *Gymnasiums* in the old German *Länder* during the '90s can be explained by the inclusion of East Berlin in the 1998 figures: East Berlin was part of communist Germany. Participation in church activities and the acceptance of orthodox religious views in the old and new *Länder* of Germany is not high (Gabriel in: Schaefers & Zapf (1998).

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About here table 1

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One of the explanations is that non-public schools are generally more effective in their teaching than public schools. Whilst the objective of non-public schools is no longer the religious socialisation of the pupils, they do, however, attempt to achieve more non-cognitive goals with their education that are valued by irreligious parents.

Only a few studies focus on the differences in school effectiveness in European societies: the Netherlands, Scotland, France and Germany.

Research into the cognitive effectiveness of public, Catholic and Protestant schools in the Netherlands (Dronkers 1996; Dijkstra, Dronkers & Hofman 1997; Sturm, Groenendijk, Kruithof & Rens 1998) indicates on average a higher effectiveness of Catholic and Protestant schools<sup>4</sup>, although there are three interesting deviations. Public schools in regions with a majority of Catholic or Protestant schools have a higher effectiveness than public schools in regions with a majority of public schools. Non-religious non-public schools have on average a lower effectiveness than public schools, controlling for social composition of their pupils (Koopman & Dronkers 1994). Orthodox-Protestant schools are not more effective than public schools or less strict Protestant schools.

McPherson & Willms (1986: 279-281) found that, after controlling for the socio-economic composition of schools, pupils at Catholic schools in Scotland performed better in attaining the Scottish Certificate of Education, in English and in arithmetic. These advantages were worth all of one or two examination passes, and added considerably to the young person's chances of finding a job on leaving school, or of gaining admission to favoured post-school courses. The authors note that their findings controvert pessimistic but casual public judgements of the performance of Catholic schools. Such judgements are sometimes based on Catholic schools' unadjusted examination results, which are inaccurate because of the over-representation of Catholic pupils in the lower SES groups compared to the non-Catholic schools.

Langouët & Leger (1994) demonstrated that the dropout between the first- and third-year classes of secondary schools of the French State sector was significantly higher than that

amongst comparable students in the private sector (34% versus 24%). Children of employee and manual labourer parents benefit more strongly from the positive effect of private schools. The same holds for the dropout between the first- and the fifth-year classes in France: 61.5% in the State schools as opposed to 51.3% in the private schools. The children of middle management and employee parents benefited most from the positive effect of private schools. In the end, the graduation rate in the State sector schools is lower for comparable students (21.7%) than in the private schools (28%). The great beneficiaries of French private schools are the children of employee parents, because their graduation rate in private schools is practically equal to the rate of children of middle management parents in both the state and private schools.

Dronkers & Hemsing (1999) provided the first comparison of German public and non-public schools, using longitudinal data from schools in Nordrhein-Westfalen dating from the '70s (Meulemann et al, 1987). They found that pupils of attending Protestant and Catholic secondary schools in Nordrhein-Westfalen have higher educational outcomes than is the case for public school pupils, after controlling for other characteristics. This result could not be explained by a more stringent selection of intelligent pupils in Protestant or Catholic schools or by their parents' higher social class. Pupils at Catholic schools obtain higher grades at the end of their grammar school training, while pupils at Protestant schools attain higher levels in secondary education and are more successful in their further studies. Interestingly, pupils attending non-religious private schools do not have higher outcomes than pupils at public schools, after controlling for parent and pupil characteristics. This difference can be explained by the distinction between value-oriented communities (religious schools) and functional communities (non-religious private schools). Dronkers & Hemsing (1999) also found that pupils at Protestant and Catholic schools in Nordrhein-Westfalen are equally successful at university and obtain equivalent occupational levels as pupils at public schools, after controlling for the divergent outcomes at the end of secondary education and other characteristics.

This first study of Dronkers & Hemsing (1999) has two drawbacks: 1. Religion was still more relevant in German society in the '70s than in the '90s (Daiber, 1995: 55), which made educational effectiveness differences less significant for school choice and thus the differences between public and non-public less clear; 2. Nordrhein-Westfalen is only one of the 18 states of the German Federal Republic, in which education is a state affair only partly coordinated at the federal level. As a consequence the position of non-public education differs between the German states and, thus, the results from one German State cannot be generalized to apply to Germany as a whole. In this article we hope to avoid these disadvantages by using data collected in 1995 at public and non-public schools in three old *Länder* of Germany: Bayern, Nordrhein-Westfalen and Rheinland-Pfalz.

Given this summary of the European research that has been conducted on effectiveness differences between public and non-public schools, our hypothesis is quite simple and descriptive: *pupils at non-public secondary schools in Germany<sup>5</sup> have higher learning results in mathematics and natural sciences than pupils from public schools, after controlling for other school and pupil characteristics.* The processes, which might explain this difference, relate to what are on average better educational administrations, stronger communities of parent and teachers and more parents whose decision for a non-public school was more deliberately motivated. However, it is not our aim to test the effects of these processes. Our objective is merely to establish whether there is a significant difference in learning results between public and non-public schools in Germany.

## **2. Public and non-public schools in Germany in the '90s**

A majority of public and a minority of non-public schools exist side by side in all German *Länder*. In the German Federal Republic the states have the first and primary responsibility to establish and maintain public schools everywhere, but there is also a guaranty in the basic law (article 7, section IV of the German Constitution) for the non-public schools. Non-public schools are allowed if their goals and the quality of their organisation and teachers are on a par with those of the public schools and on the condition that pupils receive no special treatment of pupils on the basis of income or wealth<sup>6</sup>. Non-public schools are only allowed if they have a special pedagogical, religious or philosophical basis<sup>7</sup> (section V of the German Constitution). The schools must also accept the right of the state to supervise them. This guaranty has been upheld by the Constitutional High Court of the German Federal Republic (*Bundesverfassungsgericht*): ‘private schools have a right to independently organized teaching, specially in relation to their goals, their religious and philosophical basis, their teaching methods and content’.<sup>8</sup> As a consequence, the German ministers of education of the *Länder* decided on 10 and 11 September 1951 that non-public schools in Germany are allowed if their internal and external organisation is adequate and equivalent to that of the public schools. However, the organisation of non-public schools needs not to be identical to that of public schools. The same holds for the teachers, whose didactic, pedagogical and subject training should correspond to that of teachers in comparable schools (Friedeburg in: Goldschmidt & Roeder, 1979: 41).

The state awards with many forms non-public schools, although the degree and the conditions that apply differ from state to state and from school type to school type (Vogel in: Goldschmidt & Roeder, 1979: 131-145). This can be seen clearly in table 2, which shows the percentages of non-public schools<sup>9</sup> of the total number of schools in the 18 German states for the different school types in secondary education for the school year 1995/1996 (Statistisches Bundesamt, 1996). The highest percentages of non-public schools are to be found for the highest school type in German secondary education: the *Gymnasium* (grammar schools). Bayern and Rheinland-Pfalz have the highest percentages of non-public *Gymnasiums*, but there are non-public *Gymnasiums* in all other German states. Furthermore, non-public *Gymnasiums* have been established in all former DDR states since the German reunification of 1990. There is also relatively a high proportion of non-public ‘*Realschule*’ (middle general secondary school), with the highest percentage one again in Bayern, followed by the states Hamburg, Berlin, Rheinland-Pfalz and Saarland. However, in the former DDR states (Brandenburg, Meckelenburg-Vorpommern, Sachsen, Sachsen-Anhalt) no non-public *Realschule* were established between 1990 and 1995.

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About here table 2

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### 3. Data and first comparisons

The Third International Mathematics and Science Study (TIMSS) continues the series of international comparative studies of the International Association for the Evaluation of Educational Achievement (IEA) on mathematics and science teaching. The main survey was carried out in 1995/96 cross-sectionally with three age groups. This article makes use of the database of population II, which comprises students of two adjacent grades with the largest proportion of 13- and 14-year-olds. In Germany, grade 7 and grade 8 have been selected as target population.

A representative probability sample of classes stratified according to state and school type was taken, covering 150 schools with one 7<sup>th</sup> and 8<sup>th</sup> grade each. The sample comprises a total of about 7,000 students of each target group.

As an enhancement of the international design, TIMSS-Germany is designed

longitudinally with two measurement points at the end of the 7<sup>th</sup> and the 8<sup>th</sup> grades. The achievement tests are IRT-scaled, a multi-matrix sampling design was implemented using anchor items for the linkage of the rotated test forms and the two measurement points. As distinct from the main international study, TIMSS-Germany also includes information on SES consistent with the international ISCO-standard and measures on basic dimensions of mental ability (for further information on the German TIMSS data and measurement of mental ability: Baumert, Lehmann, Lehrke et al 1997; information on the IEA achievement tests for mathematics, biology and physics: Garden & Orpwood, 1996).

These German TIMSS data contained five non-public schools (2 *Gymnasiums*, 3 *Realschule*) with enough valid data for the core variables in the TIMSS, scattered around in 3 German states: Bayern, Nordrhein-Westfalen and Rheinland-Pfalz (N-pupils=85). We added the data of all public schools of the same type and in the same states and with enough valid data for the core variables (9 *Realschule*, 13 *Gymnasiums*; N-pupils =371) to the data of the five non-public schools. This combination of 27 comparable schools in three comparable states with 456 pupils is our data set.

The pupils, whose learning results are analysed here, are still at the beginning of their secondary school careers. This means that we tend to underestimate the possible effects of attending public and non-public schools.

In these analyses we use the follow variables:

*German State.* In the analyses we will not display the names of the three *Länder*, because the TIMSS data are not fully suitable for a responsible test of the real differences between *Länder* (Baumert, Lehmann, Lehrke et al 1997: 119-126). The sampling of schools within these three states did not result in fully comparable selections of schools of the same quality. In order to control for this sampling bias between the states, we use only two dummies for two states, while the third state is the reference category.

*Gymnasium. Realschule* is the reference category.

*Boy.*

*Highest parental education.* An ordinal variable (six categories) running from completed primary school to completed university, indicating the highest parental educational level

*Parental occupational status.* An interval variable based on the highest parental occupational status (international scale of Treiman, 1977).

*Parental educational goods.* This scale measures the number of goods, which are available in the pupil's home, and which are supposed to be beneficial to the educational success of pupils.

*Both parents live together with pupil.*

*Verbal intelligence.*

*Figural intelligence.*

*Mathematics score in class 8.*

*Biology score in class 8.*

*Physics score in class 8.*

*Mathematics score in class 7.*

*Biology score in class 7.*

*Physics score in class 7.*

The result of our selection of public and non-public schools from the same type and in the same states is given in table 3 for public and non-public schools separately.

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About here table 3

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On the average, the non-public schools in our data set are socially not more exclusive than the public schools, given the parental characteristics. The average mathematics and natural science scores at the end of class 8 do not differ significantly between pupils from public and non-public schools. The same holds for the scores in class 7 of the same group of pupils, with exception of the average biology score, which favoured public schools pupils. The other exception is the average figural intelligence score, which is now higher among from non-public schools pupils. In general, it can be said that the results from table 3 do not support our hypothesis.

However, non-public schools have significantly lower standard deviations for some variables than public schools: the biology and physics score in class 8 and the figural intelligence test. For the other variables, the standard deviation of non-public schools is nearly always lower than that of public schools, although not significantly. This could mean that German non-public schools are more successful than public schools at avoiding extreme bad learning results from their pupils, despite the more or less equal homogenous background of the pupils at public and non-public schools.

#### 4. Multivariate analyses

Table 4 shows the different steps of multivariate regression analyses with the two intelligence scores as dependent variables. In the first step the school type and German State are the control variables, besides to the dummy variable non-public school. In the second step we add the parental characteristics as further control variables. We find the expected differences between *Gymnasium* (grammar school) and *Realschule* (middle general secondary school) for both intelligence scores in both steps.

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About here table 4

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The results from table 4 illustrate that the differences between pupils from public and non-public schools in both verbal and figural intelligence, controlled for differences in German State and school type, are significant and they remain significant after controlling for parental characteristics. This would suggest that either non-public schools select more than public schools on manifest intelligence, unrelated to parental background, or that non-public schools offer a learning environment that better stimulates the growth of their intelligence. We think that the first explanation is less likely, because it is quite difficult for schools to select on pupils' manifest intelligence without selecting on parental background. If this first explanation is correct then non-public schools must have performed this difficult task, because they do not deviate in their pupils' parental background from public schools. In that unlikely case, non-public schools must have preferred intelligent pupils from lower parental backgrounds as opposed to intelligent pupils from higher parental backgrounds. Or in an even more unlikely case, highly educated parents with less intelligent children have preferred public schools, while lesser educated parents with intelligent children preferred non-public schools. Therefore, we believe that the second explanation is more likely, that is that non-public schools offer a learning environment that better stimulates the growth of intelligence.

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About here table 5

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Table 5 highlights the different steps of multivariate regression analyses with the mathematics, biology and physics scores as dependent variables. The German state and school type, besides to

the dummy variable of non-public school are the control variables in the first step. In the second step we add the parental characteristics as further control variables, and in the third step we add the analogous score of class 7. Public or non-public schools do not differ significantly in the mathematics, biology and physics scores in class 8. This is also the case if we control for parental characteristics, the analogous score in class 7 or verbal or figural intelligence. This means that non-public schools are no more effective than public schools at teaching mathematics and natural sciences<sup>10</sup>.

## 5. Discussion

We have to reject our hypothesis that pupils at non-public secondary schools in Germany have higher learning results in mathematics and natural sciences than pupils from public schools. This is clearly not the case, either if one controls for parental characteristics or for intelligence or earlier performances in mathematics and natural sciences.

But pupils in German public and non-public schools differ clearly in their average intelligence levels. The higher level of non-public school pupils cannot easily be explained by these schools selecting their pupils on the basis of their intelligence, because the parental backgrounds of pupils at public and non-public schools do not differ significantly. The most likely explanation seems to be that non-public schools offer a learning environment that stimulates the intelligence. This result corresponds with the thesis of a higher effectiveness of non-public schools, also in Germany. But these higher intelligence scores at non-public schools do not lead to higher learning achievements in mathematics and natural sciences.

How can this contradiction between the rejection of our hypothesis and the higher effectiveness of non-public schools in stimulating intelligence be explained? The explanation might be the difference between the official and the hidden curricula. Public and non-public schools within each German State have the same curriculum and the same final examination and thus public and non-public schools cannot deviate too strongly in the levels of teaching they provide their students<sup>11</sup>. Within these restrictions of the same curriculum and final examination the authorities in non-public schools might focus their efforts less on the highest results in mathematics and natural sciences, but instead concentrate more on learning foreign languages, general knowledge and non-cognitive aspects of education (motivation, social competence, etc.). This preference might result from the religious traditions in these non-public schools (mostly Catholic). But this preference might also reflect the wishes of parents, who may believe that foreign languages, general knowledge and non-cognitive aspects of education<sup>12</sup> are more important for upward social mobility or maintaining a high social position than the best grades in mathematics and natural sciences. As long as non-public schools are more successful in homogenising the learning results in mathematics and natural sciences, parents may believe that less focus on these subjects is not harmful for their children's life careers. If this focus in the hidden curriculum of non-public schools on foreign languages, general knowledge and non-cognitive aspects of education exists, it might explain the contradiction between the equal effectiveness of public and non-public schools in mathematics and natural sciences and the higher effectiveness of non-public schools in stimulating intelligence.

These analyses are clearly inconclusive. The samples used are small for our purpose. The pupils who are analysed are still in the first or second class and have thus only been exposed for a short period to the different effects of public and non-public schools. This means that at the end of secondary school the differences between pupils of public and non-public schools can be greater than presented here. But these outcomes, together with those of Dronkers and Hemsing (1999), justify a more comprehensive study of the difference in effectiveness of public and non-public schools in Germany.

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### **Abstract**

One of the assumptions of the parental choice debate is that non-public schools are more effective than public ones. We test this assumption for German secondary schools with the TIMSS data, collected in 1995. Our hypothesis that pupils of non-public secondary schools have higher learning results in mathematics and natural sciences than pupils from public schools is rejected. But pupils in non-public schools have clearly a higher average intelligence level, which cannot easily be explained by the selection of these schools on the social background of their pupils. The most likely explanation might be that non-public schools offer a more stimulating learning environment.

Table 1: The percentage of pupils in *Realschule* (middle general secondary school) and *Gymnasium* (grammar school) attending non-public schools between 1956 and 1998

| Year  | <i>Realschule</i> | <i>Gymnasium</i> |
|---|-------------------|------------------|
| 1956  | 8.9               | 13.0             |
| 1965  | 8.5               | 13.2             |
| 1975  | 5.5               | 9.6              |
| 1990 (old German <i>Länder</i> )                        | 8.4               | 12.2             |
| 1998 (old German <i>Länder</i> , including East Berlin) | 8.2               | 12.1             |
| 1998 (new German <i>Länder</i> , excluding East Berlin) | 0.03              | 2.5              |
| 1998 (old and new German <i>Länder</i> )                | 7.1               | 10.2             |

Sources: 1956-1975: Köhler in Goldschmidt & Roeder, 1979; 1990 *Statistisches Bundesamt* 1992; 1998: *Statistisches Bundesamt* 1998.

Table 2. The percentages of non-public schools of the total number of schools in the 18 German states for the different school types in secondary education for the school year 1995/1996

| State                       | <i>Hauptschule</i><br>(Junior<br>General) | <i>Realschule</i><br>(Middle<br>General) | Integration of<br><i>Real- and</i><br><i>Hauptschule</i> | <i>Gesamtschule</i><br>(Comprehen-<br>sive school) | <i>Gymnasium</i><br>(Grammar<br>school) |
|-----------------------------|---|--|--|--|---|
| Total                       | 2.89                                      | 7.31                                     | 0.47   | 2.82   | 11.21                                   |
| Baden-<br>Württemberg       | 1.13                                      | 5.37                                     | -  | 0.00   | 11.46                                   |
| Bayern                      | 3.36                                      | 29.77                                    | -  | 0.00   | 16.41                                   |
| Berlin                      | 2.56                                      | 10.34                                    | -  | 3.51   | 7.75                                    |
| Brandenburg                 | -   | 0.00                                     | -  | 0.69   | 4.85                                    |
| Bremen                      | 4.55                                      | 8.89                                     | -  | 9.09   | 8.57                                    |
| Hamburg                     | 11.86                                     | 11.25                                    | 0.00   | 3.28   | 6.76                                    |
| Hessen                      | 0.31                                      | 4.64                                     | -  | 2.38   | 12.59                                   |
| Meckelenburg<br>-Vorpommern | 0.31                                      | 0.00                                     | 0.00   | 0.00   | 1.98                                    |
| Niedersachsen               | 3.25                                      | 4.11                                     | 0.00   | 0.00   | 11.07                                   |
| Nordrhein-<br>Westfalen     | 0.64                                      | 8.17                                     | -  | 6.06   | 16.85                                   |
| Rheinland-<br>Pfalz         | 3.92                                      | 10.08                                    | 0.00   | 0.00   | 16.05                                   |
| Saarland                    | 3.08                                      | 10.00                                    | 7.41   | 0.00   | 13.51                                   |
| Sachsen                     | -   | -  | 0.30   | -  | 2.58                                    |
| Sachsen-<br>Anhalt          | 0.00                                      | 0.00                                     | 0.00   | 0.00   | 4.32                                    |
| Schleswig<br>Holstein       | 15.75                                     | 3.01                                     | -  | 9.52   | 3.03                                    |
| Thuringen                   | 0.00                                      | -  | 0.26   | 0.00   | 4.31                                    |

Source: *Statistische Bundesamt* 1996

Table 3: The means with their t-values and the standard deviations with Levene's test for equality of variances, for public and non-public schools separately.

| Variable                     | Public school | Non-public school | t-value | Levene's test |
|------------------------------|---------------|-------------------|---------|---------------|
| Boy                          | 51%           | 45%               | -       | -             |
| Highest parental education   | 3.4 (1.70)    | 3.0 (1.73)        | 1.54    | .00           |
| Parental occupational status | 50.3 (12.88)  | 50.4 (11.43)      | -.10    | 2.82          |
| Parental educational goods   | 1.3 (.22)     | 1.3 (.20)         | .33     | 3.00§         |
| Living with both parents     | .89           | .79               | 2.13*   | 22.03**       |
| Mathematics score class 8    | 121.4 (26.00) | 119.1 (23.07)     | .77     | 1.88          |
| Biology score class 8        | 117.2 (27.01) | 116.7 (21.20)     | .19     | 4.08*         |
| Physics score class 8        | 116.2 (29.02) | 115.4 (22.22)     | .30     | 6.12*         |
| Verbal Intelligence          | .57 (.83)     | .69 (.72)         | -1.28   | 1.80          |
| Figural Intelligence         | .32 (.86)     | .53 (.72)         | -2.39*  | 9.35**        |
| Mathematics score class 7    | .32 (.91)     | .25 (.76)         | .69     | 3.19§         |
| Biology score class 7        | 1.28 (.86)    | 1.07 (.86)        | 2.01*   | .26           |
| Physics score class 7        | .49 (.86)     | .48 (.72)         | .10     | 2.07          |
| N                            | 371           | 85                |         |               |

\*\* p < .01; \* p < .05; § p < .10

Table 4: Intelligence scores (verbal and figural) and the effect of non-public schools, controlled for German state and school type (step 1) and parental characteristics (step 2).

| Variable                     | Verbal Intelligence |        | Figural Intelligence |        |
|------------------------------|---------------------|--------|----------------------|--------|
|                              | Step 1              | Step 2 | Step 1               | Step 2 |
| Non-public school            | .12**               | .12**  | .12**                | .11*   |
| State A                      | -.11**              | -.11** | -.07                 | -.07   |
| State B                      | -.20**              | -.21** | -.35**               | -.31** |
| <i>Gymnasium</i>             | .37**               | .34**  | .08                  | .07    |
| Boy                          |                     | -.01   |                      | -.07   |
| Highest parental education   |                     | .06    |                      | .01    |
| Parental occupational status |                     | .03    |                      | .00    |
| Parental educational goods   |                     | -.02   |                      | -.05   |
| Living with both parents     |                     | -.06   |                      | -.03   |
| Adjusted R <sup>2</sup>      | .19                 | .19    | .11                  | .10    |

\*\* p < .01; \* p < .05; § p < .10

Table 5: Mathematics, biology and physics scores in class 8 and the standardised effects of non-public schools, controlled for German state and school type (step 1), parental characteristics (step 2) and analogous test scores in class 7 (step 3a) or verbal and figural intelligence (step 3b).

| Variable                 | Mathematics |        |         |         | Biology |        |         |         | Physics |        |         |         |
|--------------------------|-------------|--------|---------|---------|---------|--------|---------|---------|---------|--------|---------|---------|
|                          | Step 1      | Step 2 | Step 3a | Step 3b | Step 1  | Step 2 | Step 3a | Step 3b | Step 1  | Step 2 | Step 3a | Step 3b |
| Non-public school        | -.01        | .01    | .01     | -.03    | -.01    | .00    | .02     | -.04    | .01     | .03    | .01     | -.01    |
| State A                  | -.04        | -.05   | .01     | -.01    | .03     | .01    | .04     | .05     | -.04    | -.05   | -.03    | -.02    |
| State B                  | -.35**      | -.35** | .14**   | .24**   | .29**   | .29**  | .22**   | .20**   | .28**   | .25**  | .23**   | .18**   |
| <i>Gymnasium</i>         | .30**       | .28**  | .16**   | .19**   | .19**   | .14**  | .05     | .07     | .16**   | .15**  | .08§    | .09§    |
| Boy                      |             | .11**  | .06     | .13**   |         | .05    | .01     | .06     |         | .28**  | .13**   | .29**   |
| Highest parental educ.   |             | .15**  | .16**   | .14**   |         | .03    | .03     | .02     |         | .09    | .10*    | .07     |
| Parental status          |             | -.01   | -.07    | -.02    |         | .06    | .05     | .06     |         | -.00   | -.01    | -.01    |
| Parental educ. Goods     |             | .03    | .04     | .04     |         | -.15** | -.14**  | -.14    |         | -.09*  | -.07    | -.08§   |
| Living with both parents |             | .05    | .04     | .07     |         | .06    | .07     | .08§    |         | .01    | .01     | .02     |
| Analog. score class 7    |             |        | .50**   | -       |         |        | .32**   | -       |         |        | .40     | -       |
| Verbal Intell.           |             |        | -       | .22**   |         |        | -       | .18     |         |        | -       | .16**   |
| Figural Intell.          |             |        | -       | .20**   |         |        | -       | .17     |         |        | -       | .13**   |
| Adj. R <sup>2</sup>      | .23         | .25    | .43     | .36     | .13     | .16    | .24     | .23     | .10     | .19    | .32     | .24     |

\*\* p < .01; \* p < .05; § p < .10

## Notes

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<sup>1</sup> Of course the importance of these processes was unequal in the various European nations.

<sup>2</sup> For good reasons, these processes had a quite different effect in the United Kingdom (Archer, 1984).

<sup>3</sup> Comparable to the British grammar school.

<sup>4</sup> The effects cannot be explained by social composition or higher selectivity of pupils.

<sup>5</sup> *Waldorfschulen* (anthroposophical schools) are excluded from this article because they have quite different goals and practices than the other German schools which renders a comparison futile.

<sup>6</sup> 'Die Lehrzielen, Einrichtungen und Lehrkräfte der private Schulen sollen nicht hinter den öffentlichen Schulen zurückstehen und eine Sonderung der Schüler nach Besitzverhältnissen nicht gefördert wird.'

<sup>7</sup> 'Private Volksschulen sind allerdings nur bei besonderem pädagogischen Interesse zuzulassen oder wenn sie als Gemeinschaftsschule, Bekenntnis- oder Weltanschauungsschule errichtet werden sollen.'

<sup>8</sup> 'In der Privatschule wird ein eigenverantwortlich geprägter und gestalteter Unterricht erteilt, insbesondere soweit er die Erziehungsziele, die weltanschauliche Basis, die Lehrmethode und Lehrinhalte betrifft.'

<sup>9</sup> Non-public school is interpreted here in accordance with article 7 of the Constitution and the decision of the German ministers of education of the *Länder* on 10 and 11 September 1951.

<sup>10</sup> The interaction variables 'non-public\*analogous score' or 'non-public\*average intelligence' are also not significant, indicating in addition that non-public schools are no more effective at narrowing the gap between pupils' scores between classes 7 and 8 or in stimulating less intelligent student to do better in mathematics or natural sciences.

<sup>11</sup> This is a major difference with the USA where the freedom of schools to teach subjects at different levels is greater than in Germany and in most other European societies.

<sup>12</sup> There is one indication in the TIMSS data that pupils in German non-public schools deviate from pupils in public schools, because the former score significantly lower on a scale of self-concept of academic ability.