Ethnic diversity in distances between language and arithmetic scores between boys and girls.

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Introduction

As a rule boys score higher marks on arithmetic and girls score higher marks on language (Ten Dam, Van Eck and Volman, 1992). This can party be explained by sex-specific socialization in the family and in education and also by differences in aptitude between men and women. Different demands are made on boys and girls in education, for girls it is especially important to perform well in languages, whereas for boys this goes for arithmetic. Furthermore, research has proved that different demands are also made by men and women. The composition of the family affects the arithmetic scores (McNab and Murray, 1985). The presence of a father in the family stimulates the numerical skills of the sons as well as the daughters. One-parent families with a mother as head of the family lack this influence, resulting in a delay in numerical skills compared to language proficiency.

So far it is assumed that the arithmetic and language performances of ethnic minority pupils do not significantly differ from native Dutch pupils, if social-cultural differences have been taken into account. In these studies, however, a rough ethnic group division has been used (Inspectierapport, 1996). In this study we will examine more accurately whether this also applies to a greater diversity of ethnic minority groups in our country. The major question is whether the distance between the scores on language and arithmetic between boys and girls is ethnically specific, of that there may be different factors to account for these differences. Possibly we can establish whether it is a matter of ethnic-specific socialization with regard to different skills. This ethnic specificity could be expressed in the cultural attention for language versus arithmetic.

Hypotheses

Based on the above-mentioned we have formulated four hypotheses:

Hypothesis 1: *among ethnic minority pupils with highly educated parents exists an equally great distance between language and arithmetic scores as among native Dutch pupils with highly education parents, for boys as well as for girls.*

A possible foundation for this hypothesis is that among female pupils in highly educated ethnic minority groups, a socialization process has occurred, which is comparable to that of Dutch female pupils. As ethnic pupils with highly educated parents are integrated more into the Dutch culture, they are more proficient in languages and as a result the language scores are higher.

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Hypothesis 2: *among ethnic minority pupils with poorly educated parents the distance between language and arithmetic is smaller than among native Dutch pupils with comparably educated parents, for boys as well as for girls.*

A possible foundation for this hypothesis is that the socialization process of these female ethnic minority pupils is at a different stage, because their poorly educated parents still stick to the patterns of their native country (Dekkers, 1996, p. 152-163). The differences are smaller because, due to the low educational level of the parents, the language proficiency has been less developed, in contrast to arithmetic. The reason for this is that arithmetic is rather learned at school than in the family background. Besides, the groups of boys and girls with poorly educated ethnic parents are more on the edge of two cultures than boys and girls of poorly educated native Dutch parents, because they find more difficulty in reconciling both cultures as a result of the different cultural capital of their parents. Especially language proficiency suffers most from this phenomenen, whereas numeric skills are less sensitive to cultural contrasts.

Hypothesis 3: *the distance between language and arithmetic scores among ethnic minority pupils with one ethnic and one Dutch parent lies between the scores of comparable pupils with two ethnic parents and native Dutch pupils.*

The foundation of this hypothesis is that by the presence of one Dutch parent, there is a stronger resemblance with the Dutch situation. It is expected that the language delay is considerably smaller by the presence of one Dutch parent, resulting in greater distances between language and arithmetic scores between boys and girls.

Hypothesis 4: *among different groups of comparable ethnic minority pupils the distances between language and arithmetic scores are different.*

The foundation of this hypothesis could be that the various ethnic groups differ in their migration history and also differ in the cultural pattern that directs their lives. Therefore they differ to the extent of integration in the Dutch society and consequently in their language proficiency. These differences in cultural patterns and migration history may also account for a difference in interest in arithmetic among various ethnic groups.

Data

Our study is based on data which have been collected in the PRIMA-cohort study in school year 94-95. The PRIMA-cohort study has collected the data of groups 2, 4, 6 and 8. In our study we initially want to focus on the performance of pupils of the highest group of primary education, as the differences here have been crystallized out for the most part (Jungbluth, Peetsma and Roeleveld, 1996).

The dependent variable in this study, the distance between language and arithmetic scores, is the standard difference score between language and arithmetic. This has been calculated on the basis of the variables language proficiency and numerical skills. Language proficiency is the total score on a PRIMA-test for language proficiency. We have standardized this score in a z-score for language. In addition to this we have the variable numerical skill: the total score on a PRIMA-test for numerical skills. This score has also been standardized in a z-score for arithmetic. The difference of these two z-scores is the standard-difference-score. So this is the distance between standardized language and arithmetic scores per pupil: a negative score indicates that the arithmetic score was higher than the language score.

The first independent variable is the variable sex: boy (1) and girl (2).

The next independent variables are formed by combinations of the countries of birth of the father and the mother. The countries of birth of the parents in the PRIMA-data have been reduced to fourteen different categories, namely: Holland, Suriname, Antilles, Moluccas, Turkey, Morocco, Greece, Spain, Italy, Portugal, Yugoslavia, China, Vietnam, remaining countries. Considering the results of the child we thought it important to use not just the country of birth of the father or the mother, but to involve both countries of birth simultaneously in our study in order to form different ethnic groups. We have combined these different countries of birth. The number of pupils in some combinations were too small to safely involve in our study. In case the group of boys and girls was smaller than 40 we have not included this combination. Most parents are born in the same country, but there was also a large number of cases there were combinations between various countries. Considering our third and fourth hypotheses also these combinations are interesting. We arrived at eleven combinations of parental countries of birth. The abbreviation of the variable we used in the tables is in brackets.

1) Both parents born in Holland (nedned).
2) Suriname, Antilles and Moluccas have been combined, because these countries are former Dutch colonies. This variable is formed by one Dutch parent combined with a parent born in one of these colonies (nedkol).
3) Turkey and Morocco have been combined, because the immigrants from these countries strongly correspond in their migration history. Holland as the country of birth of the one parent, combined with Turkey or Morocco as the country of birth of the other parent forms this variable (nedturma).
4) Greece, Spain, Italy, Portugal and Yugoslavia are Mediterranean countries. Holland as country of birth combined with one of these countries (nedeur).
5) The categorie 'remaining countries' consists of all other countries, apart from those mentioned before. Holland as country of birth combined with the category remaining countries (nedover).
6) Both parents born in the category colonies (kolong).
7) Both parents born in Turkey or Morocco (turmaong).
8) Both parents born in European countries mentioned under 4 (eurong).
9) China and Vietnam have been combined under denominator Asia. Both parents born in one of these countries (azieong).
10) Both parents born in not closer defined countries (overong).
11) Born in one of the colonies combined with one of the remaining countries, as explained above (kolover)

The independent variable education of the father (oplv) consists of four different categories:

1) maximal primary education
2) maximal junior secondary vocational education
3) maximal senior secondary vocational education
4) higher professional education or university

The variable education of the mother (oplm) has been defined in the same way. Because of the fact that many data on the education of the parents were lacking, we have defined two new variables, namely: when the education of the father or the mother was unknown (noplv/noplm). The missing values on the variables education father and education mother have been replaced by the mean. Notably when the education of the father is unknown, this variable can be read as a one-parent family.

Results

Table 1 Absolute language and arithmetic scores for boys and girls from different etnic groups

	Jongen taal	rekenen	Meisje taal	rekenen
Nedong	1118.5	1201.9	1119.0	1189.5
Nedkol	1107.8	1194.7	1106.3	1176.4
Nedturma	1081.0	1155.8	1089.4	1159.1
Nedeur	1096.8	1185.3	1121.2	1187.6
Nedover	1115.4	1202.8	1112.4	1185.4
Kolong	1087.8	1168.4	1092.8	1161.6
Turmaong	1076.6	1175.5	1074.7	1156.5
Eurong	1077.5	1174.3	1083.6	1159.5
Aziëong	1081.4	1194.1	1098.8	1206.8
Overong	1086.5	1181.1	1092.4	1170.1
Kolover	1088.6	1181.5	1090.9	1151.7

Table 1 shows the absolute language and arithmetic scores of boys and girls from different ethnic minority groups. With the help of this table the different scores in the following tables can be explained more accurately.

Table 2 The difference in the distancess between language and arithmetic scores of boys and girls from different ethnic groups

Nationaliteit	Jongen Z-score (standaarddeviatie)	N	Meisje Z-score (standaarddeviatie)	N	T-waarde (verschil Z-scores)
Nedong	-0.0490 (0.9263)	4004	0.2316 (0.8955)	4047	13.82 (0.2806)
Nedkol	-0.147258 (0.9082)	0.1617	64 (0.7288)	2.06	(0.3089)
Nedturma	-0.0149 (0.8262)	40	0.0812 (0.7791)	42	0.53 (0.0961)
Nedeur	-0.224132 (0.7401)	0.3073	36 (0.9376)	2.71	(0.5314)
Nedover	-0.1426 (0.9577)	193	0.1546 (0.8565)	240	3.36 (0.2972)
Kolong	-0.1403270 (0.8674)	0.1347	334 (0.8040)	4.00	(0.2750)
Turmaong	-0.5589 (0.8574)	738	-0.2262 (0.8040)	814	7.98 (0.3327)
Eurong	-0.500644 (0.6857)	-0.0331	53 (0.7007)	3.31	(0.4675)
Aziëong	-0.8214 (0.8615)	28	-0.6190 (0.8583)	39	0.95 (0.2024)
Overong	-0.4213 (0.8359)	181	-0.0594 (0.8380)	181	4.11 (0.3619)
Kolover	-0.3843 (0.8013)	21	0.2926 (0.6002)	22	3.12 (0.6769)

In table 2 the distances between language and arithmetic scores between boys and girls separately per combination of country of birth of the father and mother have been set side by side. In order to find out whether there are significant differences between boys and girls for the different ethnic groups, we have figured out t-values. T-values greater than 1.95 point out a significant difference in the distance between language and arithmetic scores between boys and girls. In this table 2 we can clearly distinguish differences between boys and girls. Regardless of ethnic groups the boys on average perform stronger in arithmetic than in language. This is different with the girls and certain groups have an advantage in languages over numerical skills, but in other groups this advantage is not found. Typical of this advantage in language is the presence of at least one Dutch parent or one parent originating from one of the colonies.

Table 3 Distance between language and arithmetic scores of boys and girls, divided by their mothers' educational level

	Jongen (standaarddeviatie)	Meisje (standaarddeviatie)	T-waarde (verschil z-scores)
Max. LO	-0.3586	-0.0741	-7.59
	(0.879)	(0.829)	
Max. LBO	-0.0954	0.1800	-9.99
	(0.898)	(0.865)	
Max. MBO	-0.1031	0.2232	-8.66
	(0.948)	(0.928)	
Hbo/Univ	-0.0126	0.2962	-4.94
	(1.021)	(0.879)	

Table 3 shows that the influence of the mother's education on the difference score between language and arithmetic of the children is significant. Applicable to girls is that as the education of the mother is higher, the advantage in language over arithmetic is greater. In fact the same goes for boys: the lower the educational level of their mother, the greater the advantage in arithmetic over language. The size of the advantage in language over arithmetic is therefore sensitive to the social environment: the higher the parental education, the greater the advantage in languages and the greater the backlog in arithmetic.

Table 4 The significant standardized regressions-coefficients of the independent variables ethnic group, parental educational level, pupils' gender, etc. on the dependent variable distance between language and arithmatic scores in group 8

Variabele	Bèta	T-waarde	Bèta	T-waarde
Nedned	referentie categorie			
Nedkol	n.s.	n.s.	n.s.	n.s.
Nedturma	n.s.	n.s.	n.s.	n.s.
Nedeur	n.s.	n.s.	n.s.	n.s.
Nedover	n.s.	n.s.	n.s.	n.s.
Kolong	n.s.	n.s.	-.02	-2.48
Turmaong	-.17	-19.42	-.17	-16.97
Eurong	-.03	-3.61	-.03	-3.64
Azieong	-.07	-7.53	-.07	-7.36
Overong	-.06	-6.70	-.06	-6.73
Kolover	n.s.	n.s.	n.s.	n.s.
Oplv			n.s.	n.s.
Noplv			.03	2.70
Oplm			.02	2.38
Noplm			n.s.	n.s.
Geslacht			.16	17.67
Interacties				
etnische groep*oplv			n.s.	n.s.
etnische groep*oplm			n.s.	n.s.
etnische groep*geslacht			n.s.	n.s.
geslacht*oplv			n.s.	n.s.
geslacht*oplm			n.s.	n.s.
Adjusted R^2		0.03		0.06

n.s. niet significant

Anyway it is obvious that there are differences between the various ethnic groups regarding the distance between language and arithmetic scores. In order to check whether these differences are caused by effects of variables, such as sex or education, we will subsequently use the regression-analysis. In the first two columns of table 4 we show the regression-analysis of the ethnic minority groups on the distance between language and arithmetic scores, without checking for other independent variables. We can see that the ethnic group accounts for a substantial part of the distance between language and arithmetic scores between girls and boys. In the third and fourth columns all variables in the regression-analysis have been involved. With this regression-analysis we examine what variables form the most important explanation for the differences in language and arithmetic scores between boys and girls, including all possible

interactions between the different independent variables. The independent variables have been included in the comparisons in a fixed way. We have included the different independent variables and their interactions as a whole as well as separately in the regression-analysis, but table 4 shows there are no interaction-effects which can account for the distance between language and arithmetic scores. The cause for the differences in distance between language and arithmetic scores must therefore be found in the main effects.

Table 4 shows that there is a sigificant distance between language and arithmetic, when the father's education is unknown, and that this distance is positive. This means that the distance between the score on language proficiency and the score on arithmetic is greater if the father's education is unknown. When the father's education is unknown, we may assume that we are dealing with a one-parent family with the mother as the head of the family.

For the first two hypotheses the results of table 4 mean the following: we can see that the education of the father has no significant effect and the education of the mother has only a slight effect on the distance between language and arithmetic scores. There is no significant interaction-effect between ethnic minority group and the education of the father or mother. Because of this fact the difference between ethnic minority pupils and native Dutch pupils cannot be accounted for by the divergent meaning of the education of the parents, as is assumed in hypotheses 1 and 2. Hypotheses 1 and 2 do not work: education as a separate independent variable shows an effect, but no significant effect is added in combination with ethnicity. The influence assumed by the parents' education is independent of the ethnic origin of the parents. Our third hypothesis is partly confirmed as well as partly rejected by the results of our analysis: we can see that there are no significant differences between pupils with two native Dutch parents and pupils with one ethnic minority parent, which is contrary to hypothesis 3. It is true that the differences between pupils with two ethnic minority parents and pupils with one native Dutch parent are significant. As we can see in table 4, especially girls with one native Dutch parent show an advantage in languages, whereas this advantage is not found with girls with two ethnic minority parents. We can conclude from this that the presence of at least one native Dutch parent is important for an advantage in language and as such determinative for the distance between language and arithmetic scores.

The fourth hypothesis is confirmed in our study. Table 4 shows that the distance between language and arithmetic scores between boys and girls for the different ethnic minority groups differs significantly compared to the reference category: both parents were born in the Netherlands. These differences between the different ethnic minority groups compared to the group of pupils with two Dutch parents can be accounted for by the history of certain ethnic minority groups and their different motives to emigrate. Pupils whose parents come from Turkey or Morocco, differ most from the Dutch situation. The middle group is formed by pupils whose parents both come from China or Vietnam, or countries from the category remaining countries. We can also see a significant difference with the groups of pupils whose parents both come from the colonies or both from European countries, although this difference is smaller compared to the above-mentioned groups. It is therefore inaccurate to include only pupils with Turkish and Moroccan parents in the analysis, if migrants are involved.

Finally pupils whose father's education is unknown and who are probably raised in a family with only the mother, show a greater advantage in language than pupils whose father's education is known.

Conclusion

The distance between language and arithmetic scores is largely accounted for by sex and ethnic minority group, and to a lesser extent by parental education.

Hypotheses 1 and 2 are rejected, because we have not found any interaction-effects between ethnic minority group and education in our study.

It is striking that not all ethnic minority groups differ from the general Dutch pattern, namely that girls on average have higher scores in language, whereas boys on average have higher scores in arithmetic. The presence of one Dutch parent influences the extent to which the child fits into the Dutch pattern, in accordance with hypothesis 3. Also hypothesis 4 is confirmed: the distance between language and arithmetic scores differs per ethnic minority group.

Language and arithmetic performance is therefore not influenced by the same factors. It appears from this study that arithmetic is a much less culturally linked skill than language, resulting in a variation in the distances between language and arithmetic scores of different groups of pupils, depending on the degree of integration in a certain society, the cultural capital of their mother and the presence of a father in the family.

If confirmed in further studies, these results will have two major social implications:

1. School success of ethnic minority groups can be better encouraged by stimulating and rewarding arithmetic performance than encouraging language performance only. Considering the relative advantage in arithmetic of ethnic minority pupils, the current strong emphasis on the language delay and the necessity of doing away with this, may be counter-productive for their school success.
2. If the difference that was found between language and arithmetic performance is an indication for the difference in later preferences for alpha, beta and gamma education, the current increasing rise in the educational level of Dutch women and the growth of the percentage of families without a father will lead to an increasingly lower preference for science subjects and sciences among pupils of pre-university education.

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