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Reading and writing development A longitudinal study from pre-school to adolescence: status report

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Introduction

During the last two decades there has been an increasing tendency to regard reading and writing as linguistic activities. In numerous studies, pre-school children's linguistic and metalinguistic abilities have been related to their emerging reading and writing skills during the first school years. However, the frequency of such studies tends to decrease as the children grow older, and there are very few investigations of reading and spelling skills of adolescents.

Background

When reading and writing are looked upon as linguistic activities to the same extent as speaking and listening, it is logical to find a majority of children with language disorders among students with reading and writing difficulties. This may be so even if speech has normalised. However, all children diagnosed as language-disordered do not have such problems at school. The variation is also considerable among the pre-school children with language disorders both as to type and degree of linguistic problems. Earlier it was not clear what kind of language problems were the most troublesome for the development of reading and writing. Consequently, it had not been possible to predict which language-disordered children were most at risk for reading and writing problems at school.

This is the rationale for a longitudinal study in which we have followed language-disordered and normal children in pre-school, from the age of 6, until grade 4, to the age of 11 (Magnusson & Nauc ler 1989, 1990a,b). The purpose of the study has been to find out which abilities are the most

Table 1. Test periods and test categories.

	<i>pre- school</i>	<i>gr 1 I</i>	<i>gr 1 II</i>	<i>gr 3</i>	<i>gr 4</i>
language comprehension	x	x	x	x	x
language production	x	x	x	x	x
linguistic awareness	x	x	x	x	x
short term memory	x	x			
reading			x	x	x
spelling			x	x	x

important linguistic prerequisites for learning to read and write. This has been accomplished by comparing language-disordered and normal children's linguistic abilities and linguistic awareness in pre-school (i.e. before they were taught to read and write) with their development of reading and writing during the first four years at school. The test periods and test categories are shown in table 1.

The results confirmed the relation between linguistic ability and reading and spelling. At the end of grade 1, the group of language-disordered children spelled significantly more poorly than the matched normal group. They also scored much lower on reading tasks, whether these were decoding, reading aloud or reading comprehension tasks. Furthermore, the disordered group was inferior to the matched normal group on both linguistic awareness tasks and short-term memory tasks. However, in both groups there were subjects who did not conform to the group pattern; in the disordered group there were subjects who performed better and in the normal group there were subjects who performed worse than their matched controls.

In grades 3 and 4 the gap between the two groups regarding both spelling and decoding had almost disappeared. This does not imply that all the subjects were good spellers and decoders. However, when reading comprehension was assessed, the gap between the groups remained.

It was obvious that some of the linguistic and metalinguistic skills the children demonstrated in pre-school were more important than others for their reading and writing development until grade 4, and more decisive for the outcome than both reading methods and amount of time spent on special education (Magnusson & Nauclér 1991). In addition, early linguistic and metalinguistic problems appeared to persist and be manifested as reading and writing difficulties. This is in accordance with the results from other studies investigating both short-term and long-term effects of language

disorders, e.g. Aram and Nation 1980, Aram et al. 1984, Catts 1993, Hall & Tomblin 1978, Hauschild & Elbro 1992, King et al. 1982, Lewis & Freebairn 1992, and Stothard et al. 1998.

After the first years at school reading becomes an increasingly important tool for acquiring knowledge. Thus, being a poor reader is damaging to both the development of literacy and other academic skills. In the end reading problems may prevent students from choosing the kind of education they desire. Therefore, in order to evaluate the full consequences of early language disorders and poor reading in the first grades we are now running a follow-up study with the same subjects as in our earlier study. They are now 18 years old and about to leave school. The aim of the study is to investigate to what extent early language problems have been overcome during adolescence, and to what extent and in what form they may show up after 12 years at school (Nauclér & Magnusson 1998).

A general outline of the study and some preliminary results are presented below, based on the data collected thus far. The primary focus is on whether there are still differences after 12 years between the groups who had language problems before starting school and the normally speaking group. This issue will be addressed by using data from a questionnaire about the subjects' evaluations of their reading and writing skills and about their reading and writing habits. This information will be related to their results on written language tasks in order to evaluate how the subjects' opinions about their own abilities tally with their test scores. The question about differences between the groups is further explored by using data from a number of tests on spoken language abilities, linguistic awareness and short term memory.

Method

Subjects

The longitudinal study began with 115 subjects, 78 language-disordered children with no other known handicap, divided into two groups: (1) 37 subjects with mild disorders who did not have language therapy before starting school but who were checked by a speech pathologists once or twice a year, and (2) 39 subjects with severe disorders who had treatment during their pre-school years. The children in the severely disordered group were individually matched with 39 children with no known language problems, constituting a control group. They had been matched on age, sex and non-verbal cognitive level (Raven's coloured matrices, Raven 1956).

Table 2. Number of subjects.

	<i>Mildly disordered</i>		<i>Severely disordered</i>		<i>Normal group</i>		<i>Total</i>
	<i>Boys</i>	<i>Girls</i>	<i>Boys</i>	<i>Girls</i>	<i>Boys</i>	<i>Girls</i>	
pre-school & grade 1	22	15	27	12	27	12	115
grade 3 & 4	21	12	22	9	24	10	98
grade 12 questionnaire	20	12	21	9	21	10	93
testing	9	10	10	7	10	8	54

For the follow-up study 105 of the original subjects were identified. They have been sent an invitation to take part in the present study by participating in extensive testing (3-4 hours) in addition to answering a questionnaire. Ninety-three adolescents have thus far completed the questionnaire, and 54 of these have also agreed to be tested. More girls than boys have been willing to participate in the testing. The data collection is not complete and it is hoped that some of those who have not answered can be persuaded to take part. The number of subjects in the pre-school study and in the present study is shown in table 2.

Questionnaire

In order to get information about the subjects' reading and writing habits and about how they evaluate their reading and writing skills we administered a questionnaire. The subjects were asked what they read and write: morning papers, evening papers, cartoons, books, magazines, how often they read and write, and how they evaluate their own reading and writing skills. Do they understand what they read at school and at home? Can they read the subtitles on TV? How do they judge their spelling skill? Do they write well enough to meet the demands at school? Do they write in their spare time and, if they do, what do they write?

Tests and materials

The test battery is comprised of a number of tests used in clinical practice and in assessing reading. In addition to these we have used some tasks and procedures developed by us where no standard tasks have been available that met the requirements of the present study. The tasks have been selected to assess the same abilities in both spoken and written language, and also to

Table 3. Assessment of linguistic ability, phonological awareness and short term memory.

LINGUISTIC ABILITY	
<i>Written language</i>	<i>Spoken language</i>
Decoding	Comprehension
Reading comprehension	Production
Written production	Vocabulary
Spelling	Phonology
PHONOLOGICAL AWARENESS	
Metatheses	
Talking backwards	
SHORT TERM MEMORY	
Verbal	
Non-verbal	

test the same language functions as in the earlier parts of the study in order to observe developmental trends.

The subjects' spoken and written language abilities, as well as their phonological awareness, are measured by a number of tests and materials. An overview is shown in table 3.

Decoding is assessed in four different ways: by a word chain test (Jacobson 1993) and by reading aloud: nonsense word reading (Magnusson & Nauclér, unpublished test), single word reading (Johansson 1992) and text reading (Björkquist & Järpsten 1974).

Reading comprehension is examined by four different tasks: a test of single-word reading (Johansson 1992), a written version of the Token Test (de Renzi & Vignolo 1962), a written version of a syntactic comprehension task (Magnusson and Nauclér, unpublished test), and a test of text comprehension (Johansson 1992).

Written language production: The subjects are asked to write about their plans for the future.

Spelling is assessed by administering a test of single-word spelling (Magnusson and Nauclér, unpublished test).

Listening comprehension A non-standardised Swedish translation of the Peabody Picture Vocabulary Test, PPVT (Dunn & Dunn 1981), is used to measure receptive vocabulary. To assess the comprehension of sentences two tests are administered: an oral version of the Token Test (de Renzi & Vignolo 1962), and an oral version of the syntactic comprehension task mentioned earlier (Magnusson and Nauclér, unpublished test).

Spoken language production: To assess spoken language skills the subjects are engaged in conversation, and during the interview they are encouraged to talk as much as possible about their hobbies and other topics of interest.

Word retrieval is measured with phonological as well as semantic triggering.

Phonology is examined by two repetition tasks: repetition of long and unfamiliar words (Magnusson and Naucclér, unpublished test), and repetition of tongue twisters (phrases) (Magnusson and Naucclér, unpublished test).

Phonological awareness is assessed in two ways: by administering a phoneme metathesis task in which the subjects identify and produce spoonerisms (Magnusson & Naucclér 1993), and by asking them to talk backwards (Magnusson and Naucclér, unpublished test).

Verbal short-term memory is measured by repeating orally presented digits and words.

Non-verbal short-term memory is assessed by administering a visuo-spatial task using Corsi blocks (Corsi 1972).

Procedure

The questionnaire was filled out and sent back to us. Those who consent to taking part in the testing are seen on two occasions. The first time they are seen individually for about two hours. All tasks requiring tape recording are done during this session. At the second meeting all paper and pencil tasks are given, either individually or in small groups. This session also lasts for about two hours.

Results

The results from the questionnaire about reading and writing habits and the subjects' evaluation of their own literacy skills are presented first. They are then compared to the results from some of the written language tests, i.e. word comprehension, text comprehension, and spelling. This is followed by one of the tasks that was given in both a written and a spoken version, a syntactic comprehension task. Finally, the results on phoneme metatheses tasks and short term memory tasks are presented.

Questionnaire

After 12 years of schooling there are still differences between groups with and without language disorders in pre-school, both concerning the subjects'

Table 4. Results on word comprehension, text comprehension and spelling tasks in grade 12.

		<i>Severely impaired</i> n=15	<i>Normal group</i> n=17	<i>Mildly impaired</i> n=16
word comprehension (max. 40)	m	25	31	30
	s.d.	8	5	7
	min.	12	21	17
	max.	39	39	40
text comprehension (max. 36)	m	19	24	24
	s.d.	7	4	6
	min.	6	16	9
	max.	28	30	31
spelling (max. 28)	m	20	23	22
	s.d.	5	4	4
	min.	11	15	12
	max.	26	18	27

reading and writing habits and their opinion about their reading and writing skills. The tendency seems to be that the greater the problems in pre-school, the less one reads and writes in adolescence and the lower one judges reading and writing skills. There is also a general tendency for girls to have a lower self esteem than boys. It is possible that subjects with early language problems underestimate their literacy skills compared to subjects who have not had such problems. However, this may be a realistic judgement, since their former problems may remain and show up in a different form. Another interpretation is that the earlier problems have shaped the students self-image. The way one looks upon oneself and one's skills is decisive in many ways, not least in selecting future educational goals.

To what extent this picture corresponds to the results of the testing will be shown in the next part.

Word comprehension, text comprehension, and spelling.

The results on word comprehension, text comprehension, and spelling tests all show the same pattern: The severely disordered group scores significantly lower than the other two groups, but there is no significant difference between the mildly disordered group and the normal group. See table 4.

Table 5. Results on the written and oral versions of the syntactic comprehension task in grade 12.

		<i>Severely impaired</i> n=15	<i>Normal group</i> n=17	<i>Mildly impaired</i> n=19
written version (max. 28)	m	22	25	24
	s.d.	3	3	3
	min.	17	18	19
	max.	28	28	28
oral version (max. 28)	m	19	24	23
	s.d.	3	3	3
	min.	12	16	16
	max.	25	28	28

Syntactic comprehension

As mentioned before, some of the tasks were given in both a written and an oral version, as the syntactic comprehension task shown in table 5.

When the results from the written and the oral versions are compared for the three groups, the pattern is similar, with the severely disordered group scoring significantly lower than the other two groups. As can be seen in table 5, the oral version is more difficult than the written one for all groups. However, the severely impaired group is more penalised than the other two groups when the input is auditory.

Phonological awareness

The results on the phoneme metatheses tasks (spoonerisms) follow the same pattern: the severely disordered group scoring lower than the other two groups, as can be seen in table 6. However, the difference between the groups is not significant.

The recognition task is an easier task and does not differentiate between the groups to the same extent as the production task. On the production task the severely disordered group does not even reach the level of the normal group in grade 4 as shown in table 7.

Short term memory

Also, the scores on the short term memory tasks are lower in the severely impaired group than in the other two groups as can be seen in table 8. However, only the difference between the severely disordered group and the normal group is significant.

Table 6. Results on tests of phoneme metatheses in grade 12.

		<i>Severely impaired</i> n=17	<i>Normal group</i> n=18	<i>Mildly impaired</i> n=19
recognition (max. 12)	m	9.4	10.7	10.2
	s.d.	3.4	2.4	2.7
	min.	4	4	2
	max.	12	12	12
production (max. 12)	m	6.9	8.8	8.8
	s.d.	5.5	3.4	3.8
	min.	0	0	0
	max.	12	12	12

Table 7. Results on tests of phoneme metatheses in grade 4.

		<i>Severely impaired</i> n=17	<i>Normal group</i> n=18	<i>Mildly impaired</i> n=19
recognition (max. 12)	m	5.9	9.4	8.1
	s.d.	2.7	1.7	2.7
	min.	0	6	3
	max.	11	12	12
production (max. 12)	m	4.7	8.6	7.5
	s.d.	4.9	3.1	3.8
	min.	0	0	1
	max.	11	12	12

In the visual memory task the mildly impaired group performs at the same level as the normal group, but on the verbal memory task the mildly impaired group has difficulties that are similar to those of the severely impaired group.

Conclusions

Pre-school children with severe language disorders do not outgrow their problems at school. This is apparent from the reading and writing habits already reported in the questionnaire. Furthermore, the subjects were also right in the evaluation of their reading and spelling skills, as it was shown in the assessment of written and spoken language that the severely disordered group, who judged their skills the lowest, also scored significantly lower on

Table 8. Results on tests of short term memory in grade 12.

		<i>Severely impaired</i> n=17	<i>Normal group</i> n=18	<i>Mildly impaired</i> n=19
Corsi blocks	m	37	39	39
	s.d.	11	16	10
	min.	19	24	16
	max.	58	77	51
digits	m	24	29	25
	s.d.	9	14	10
	min.	10	10	10
	max.	37	50	51

all the assessment tasks than both the mildly impaired group and the normal controls.

The mildly impaired group, however, stands a much better chance. They often scored at the same or at a similar level as the normal controls, both with regard to listening comprehension and reading comprehension.

The other tasks, phonological awareness and short term memory, the former regarded as a prerequisite for reading and spelling development and the latter as highly relevant for this development, show different patterns. There are no significant differences between the groups on the two phonological awareness tasks (recognition and production of metatheses). However, the fact that the severely impaired group does not even reach the mean value of the other two groups in grade 4 already, adds an interesting aspect to the discussion of the direction of causality between reading/spelling and awareness.

Regarding short term memory there are no significant differences between the groups on the visual short term memory task. This is not surprising since only verbal, not visual memory, is thought to be relevant for reading and spelling and for differentiating between good and poor readers and spellers. This is further confirmed by the results on the verbal short term memory task, where the difference between the severely impaired group and the normal group is significant and the difference between the mildly impaired group and the normal one nearly reaches significance.

So the picture we end up with is not too bright: Children who have language impairments in childhood do not outgrow their problems. Even if

the problems may be manifested in another way they still remain after 12 years at school.

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Outline of a computerized Chinese grammar enabling English and Swedish translation

Bengt Sigurd and Gao Hong

Introduction and abstract

This paper presents a computerized grammar which can analyze and generate a sample of pedagogical Chinese sentences, in particular those mentioned in the textbook *Kinesiska är inte svårt* ('Chinese is not difficult') by Göran Malmqvist 1974. Equivalent grammars for English and Swedish have also been constructed allowing translation between the three languages. The grammar model used is the Swetra grammar developed in the MT-project Swetra at the Department of Linguistics, Lund University and used in various translation and generation projects, including the application which generates weather reports in Swedish and English used by SMHI, the Swedish meteorological agency.

The Swetra grammar (see Sigurd (ed.) 1994) is written directly in the DCG (Definite Clause Grammar) format and implemented in Prolog (LPA-Prolog). It has been used for several languages and adapted to various practical needs. Swetra grammar is characterized by its separate functional (-semantic) representation which is abstract enough to be used as an interlingua in automatic translation. The functional representation of Swetra does not show surface details such as word order, case or agreement. Swetra grammar has ways to account for mode, topic, coordinated clauses and subordinate clauses including relative clauses. The word meanings are represented by a standardized English Machineese according to certain conventions.

The construction of a computerized grammar of Chinese can be based on traditional Chinese grammar but it requires reconsideration and taking a number of decisions. The computerized grammars presented pinpoint the differences between Chinese, English and Swedish. The Chinese, English