

IF +N -SG -UTR +DEF -HEAD
THEN +N -SG -UTR +DEF +HEAD

P NOUN_SG_UTR_IND L
IF +N +SG +UTR -DEF -HEAD
THEN +N +SG +UTR -DEF +HEAD

P NOUN_NEU_IND L
IF +N -UTR -DEF -HEAD
THEN +N -UTR -DEF +HEAD

P NOUN_PL_UTR_DEF L
IF +N -SG +UTR +DEF -HEAD
THEN +N -SG +UTR +DEF +HEAD

P NOUN_PL_UTR_IND L
IF +N -SG +UTR -DEF -HEAD
THEN +N -SG +UTR -DEF +HEAD

P NOUN_SG_NEU_DEF L
IF +N +SG -UTR +DEF -HEAD
THEN +N +SG -UTR +DEF +HEAD

• The Input to the machine

• (a text file):

En grön kvarn.
Den gröna kvarnen.
Kvarnen är grön.
De gröna kvarnarna.
Kvarnarna är gröna.
Kvarnen är grön.
Det gröna barnet.
Barnet är grönt.
Barnet är gröna.

• The Output:

• (a text file)

NOM
ART_SG_UTR_IND:=EN
ADJ_SG_UTR_IND:=GRÖN
NOUN_SG_UTR_IND:=KVARN
NEND
CLOSE:=.

ALT_NO

• = No more alternatives

NOM
ART_SG_UTR_DEF:=DEN
ADJ_SG_UTR_DEF:=GRÖNA
NOUN_SG_UTR_DEF:=KVARNEN
NEND

NEND
CLOSE:=.

ALT_NO

NOM
NOUN_SG_UTR_DEF:=KVARNEN

NEND

COP:=ÄR

NOM
SG_INDEF_UTR
ADJ_SG_UTR_IND:=GRÖN

NEND

CLOSE:=.

ALT_NO

NOM
ART_PL_DEF:=DE
ADJ_PL:=GRÖNA
NOUN_PL_UTR_DEF:=
KVARNARNA

NEND

CLOSE:=.

ALT_NO

NOM

NOUN_PL_UTR_DEF:=
KVARNARNA

NEND

COP:=ÄR

NOM

PL_INDEF
ADJ_PL:=GRÖNA

NEND

CLOSE:=.

ALT_NO

NOM

NOUN_SG_UTR_DEF:=
KVARNEN

NEND

COP:=ÄR

NOM

SG_INDEF_UTR
ADJ_SG_UTR_IND:=GRÖN

NEND

CLOSE:=.

ALT_NO

NOM

ART_SG_NEU_DEF:=DET
ADJ_SG_NEU_DEF:=GRÖNA
NOUN_SG_NEU_DEF:=BARNET

NEND

CLOSE:=.

ALT_NO

NOM

NOUN_SG_NEU_DEF:=BARNET

NEND

COP:=ÄR

NOM

SG_INDEF_NEU
ADJ_SG_NEU_IND:=GRÖNT

NEND

CLOSE:=.

ALT_NO

NO

*Barnet är gröna.

On the Starting up of UTFÖR

Eva Magnusson and Kerstin Nauclér

In this paper we will describe UTFÖR (Utveckling, utprövning och utvärdering av träningsmetoder för att förebygga läs- och skrivsvårigheter hos språkstörda barn; 'Development, trial and evaluation of training methods in order to help prevent reading/writing problems in language-disordered children'), a research project aiming to prevent later reading and writing problems by developing training methods for language-disordered preschool children. The effect of such training methods on the development of reading and writing/spelling will be evaluated in grade 1. We will start by giving the background for the project and reviewing previous research in the field. Then we will outline the procedure and describe the work done during the first year of the project.

Background

For a long time researchers have been busy trying to find the causes of reading and writing problems, and dedicated teachers have been working hard at adapting their teaching methods to the latest research findings. In spite of all these efforts, the number of poor readers and spellers is said to have increased. An important reason for this lack of success is that the relationship found between reading/writing and certain other abilities has been given a causal interpretation. Other poorly-developed abilities that have been observed to co-occur with reading and writing problems have mistakenly been identified as the cause of these difficulties and have consequently been considered as something that should be trained in order to eliminate the reading and writing problems. However, other deficiencies can just as well be an effect of the reading and writing problems as a cause for them. A third possibility is that they, as well as the reading and writing problems, may be the manifestations of a common underlying factor.

It is not possible to identify the causes of reading and writing problems by studying other deficiencies that appear simultaneously in individuals who have developed into poor readers and writers. Nor is it possible to trace the

earlier development at a later stage, as retrospective information is unreliable, being both hard to obtain and difficult to interpret. What is needed in order to be able to differentiate causes from effects is longitudinal studies in which the development of relevant abilities is closely followed from a time before children start school and before reading and writing problems appear. Only after the causes have been identified by such a procedure is it possible to remove these obstacles to the development of reading and writing, i.e. by training children who have shown deficiencies in abilities that are essential for learning to read and write.

Among both language clinicians and teachers it is well-known that language-disordered preschool children are at-risk for reading and writing problems at school. This is well in accordance with the view that the reader/writer is engaged in linguistic activities in the same way as the listener/speaker. However, not all language-disordered children encounter problems at school. Therefore, we have no grounds for claiming that language disorders always lead to reading and writing problems. Furthermore, a number of seemingly linguistically normal children also have problems. If we want to prevent reading and writing problems, it is necessary to make detailed studies of linguistic abilities and to identify linguistic factors that are indispensable for learning to read and write.

In our longitudinal studies of language-disordered and normally speaking children (e.g. Magnusson & Nauclér 1987) we have shown that language-disordered children as a group read and spell significantly worse than a group of matched normally speaking children. By detailed analyses of linguistic and metalinguistic abilities, we have been able to determine the best predictors for both language-disordered and normally speaking children's reading and writing achievements at the end of the first school year (Magnusson & Nauclér 1990a and b). Therefore, we are now able to predict which language-disordered children are highly at-risk for reading and writing problems at school. As such predictions can be done before the children start school, we are now at a point where it is possible to develop methods that can prevent reading and writing problems in at-risk children. This can be done by training abilities that are shown to be indispensable for learning to read and write and by doing this already before the children start school.

Previous research

Children who have been diagnosed as language-disordered or language-delayed before they start school run a considerably higher risk than normally speaking children of experiencing reading and writing problems at school. In a follow-up study (Magnusson & Nauclér 1985) we found that about two-thirds of a group of language-disordered children who were followed from one and two years before they started school until grades 4 and 5 needed special/remedial teaching for their reading and writing problems. This should be compared with the proportion of 10% in each year that is usually considered to be in need of such help. Even if the children are enrolled in special teaching programs during their whole school career, the problems seem to remain also after leaving school, which is shown in follow-up studies after ten to twenty years (for a review see Weiner 1985). The linguistic problems are apparent not only in speech and writing but they also have consequences for academic success, vocational training, and social adjustment.

In our longitudinal study of 115 language-disordered and normally speaking children from preschool to grade 4 (Magnusson & Nauclér 1987 and 1990c) we have shown that syntactic ability and phonological awareness are the linguistic and metalinguistic abilities that are necessary in order for preschool children to learn to read and write at school. Phonological ability (as manifested in production), on the other hand, seems to be less important for learning to read and write.

This fits nicely with the findings in other follow-up studies of language-disordered children, e.g. Hall & Tomblin 1978 and Shriberg & Kwiatkowski 1988. They agree that children whose linguistic disorder is restricted to phonological problems run a much lower risk of having reading and writing problems than children with other linguistic problems, e.g. syntactic problems. Bishop & Edmundson 1987 argue that phonological measures have no prognostic value for the development of language-disordered children. This is not accepted by e.g. Aram et al. 1984, who hold the opposite opinion.

Other researchers who have not studied language-disordered children only emphasize phonological awareness and not linguistic ability as a prerequisite for learning to read and write (e.g. Bradley & Bryant 1985, Liberman et al. 1977, Lundberg et al. 1988). Bowey & Patel 1988, on the other hand, find that both phonological awareness and linguistic ability correlate with reading, but argue that phonological awareness alone cannot

predict reading when the differences in linguistic ability are accounted for. It should be noted that those who only stress phonological awareness as a prerequisite for learning to read and write have not tested the linguistic ability of their subjects, except by an occasional vocabulary test.

In the research group at Haskins, where prerequisites for reading have been studied during the last 20 years, both phonological awareness and syntactic competence are regarded as dependent on the ability to use phonological information. Consequently, what might appear to be syntactic problems are at heart deficiencies in 'phonological processing' (Lieberman 1983, Shankweiler & Crain 1986, Smith et al. 1989). None of these studies have been undertaken on language-disordered children.

Even if the need for training studies has often been pointed out, i.e. studies where abilities important for the development of reading are trained, very few such studies have so far been attempted. One reason may be uncertainty about what to train, how to train, and possible effects of such training. Moreover, it is problematic to evaluate training effects, since this cannot be done without comparisons with control groups, which offer both practical and ethical problems. Some of the researchers who consider phonological awareness as the most important ability for learning to read and write have shown that this ability can be trained in preschool children, and that this training has an effect not only on tasks that have been trained (Olofsson 1985) but also on reading (Bradley & Bryant 1985) and spelling (Lundberg et al. 1988). Note that only children with normal language development have been included in these studies.

Questions and hypotheses

The studies of linguistically normal children cited above lead us to pose the following questions: Can phonological awareness also be trained in language-disordered preschool children? If that is the case, does it have a positive effect on learning to read and write?

We have previously found (Magnusson & Nauclér 1990b) that there is a certain relation between phonological awareness and linguistic ability in that linguistically normal children as a group are more phonologically aware than a matched group of language-disordered children. There are, however, some language-disordered children who are as phonologically aware as linguistically normal children. It seems to be the case that only certain types of language disorders prevent the development of phonological awareness (i. e. syntactic problems and phonological problems of a syntagmatic type),

whereas phonological problems of a paradigmatic type do not seem to present an obstacle to this development. The relevant questions are therefore: Can phonological awareness be trained in children with the type of language disorder which usually prevents this development? How can training methods be adapted to different types of language disorders?

The ultimate questions can be formulated as such: Can language-disordered children who have developed their phonological awareness by training learn to read with less problems than language-disordered children who have not had such training? Do language-disordered children who have developed their phonological awareness by training benefit from this ability like linguistically normal children when learning to read and write?

Procedure

Participation of speech pathologists

In order to investigate the questions posed above we planned a study in which language-disordered children were to be trained in phonological awareness before they started school and their reading and spelling achievements were to be evaluated at the end of grade 1. Since preschool children with language disorders are under the care of speech pathologists at hospital clinics, we invited the speech pathologists working in the southernmost province of Sweden to a meeting at the Department of Linguistics in Lund. This was done not only to inform them about our project ideas but also to ask them to share with us their views on possible and impossible training methods and training material already available. Above all, we needed to find out if they were prepared to take an active part in the project by doing the work that we were unable to do (having no clinic) – to provide us with the subjects we needed, i.e. language-disordered preschool children, and to train their phonological awareness.

Seven speech pathologists participated in this first meeting. Contrary to the original plans, they suggested that children of both five and six years of age should be enrolled in the training program, since the age for starting school in Sweden was recently lowered. Both children already enrolled in language programs and children on waiting lists were to be included in the training program, the only condition being that they were phonologically unaware. Their level of phonological awareness was to be assessed by means of a rhyming test and a phoneme identification test developed by Magnusson and Nauclér 1987. A phoneme segmentation test, also from Magnusson and Nauclér 1987, could be added in uncertain cases. The results were to be sent

to us, and with the help of statistically skilled linguists we were able to decide the level at which a child was to be regarded as phonologically aware.

Because we had found in our previous studies of language-disordered children (Magnusson & Nauclér 1990a) that the preschool results on a syntactic test (the Ringsted test developed by Ege) correlate significantly with reading and spelling in the first grade, the speech pathologists were also asked to send us a recent recording of each child's performance of the Ringsted test (B-level) as well as their phonemic status. In order to obtain identical assessments of the performance of all the subjects, the recordings were to be analysed by us. Finally, a nonverbal cognitive test was needed in order to match the training group with a control group (see below). In addition, it was decided that the children's knowledge of letters and their reading ability should be checked by the speech pathologist before the training started.

After a certain time of this training, aimed at developing the children's phonological awareness, a second testing, including the same tests as before the training, i.e. rhyming and phoneme identification, was to be undertaken and the phoneme segmentation test was to be added.

The parents of the children found to be phonologically unaware were asked to give permission for their children to participate not only in the special training program as preschoolers but also in a reading and spelling test at the end of grade 1.

The first meeting with the speech pathologists was followed by several others, approximately every second month, at which new speech pathologists joined in (and a few disappeared). However, the number remained relatively stable. During these meetings, the design and content of the training program were discussed and scrutinized from many different aspects. It was decided that the program should have a well-defined structure and that all participating speech pathologists should use the same procedure. However, since it is necessary to adjust the training to the individual child, the training might vary from child to child, using the same material and with the same goal in mind. For this purpose a 'bank of ideas' was set up. A manual was needed for the pathologists to be able to start at the appropriate level of every single child. In connection with this, the question of individual training vs. group training was discussed. There were no objections to the suggestion that children at the same level of phonological awareness could be trained together.

At this time some of the speech pathologists had started to train those children who had scored below the level we had set for phonological awareness, and others who had joined the project later were still waiting for their children to be assessed for inclusion in the training program. A few speech pathologists who live too far away to be able to come to Lund participated in the meetings by means of the reports that were written and sent to all the co-workers after every such meeting.

Training material

Four subgoals for the training in phonological awareness were agreed upon:

- ability to shift attention from content to form,
- ability to realize that words can be taken apart and put together,
- ability to compare and recognize parts of words of different types (e.g. morphemes and phonemes), and
- ability to segment words into phonemes and put phonemes together into words (analysis and synthesis).

The types of exercises appropriate for obtaining these goals can be divided into two main categories that focus on:

- *how words sound*, e.g. words sound long or short, words sound identical/different at the beginning, in the middle, or at the end;
- *how words are made up*, e.g. words consist of other words, words consist of sound sequences (syllables) and words consist of sounds.

The training was to be organized in accordance with the relatively unanimous view of most researchers in the field implying that:

- words and syllables are easier to deal with than phonemes,
- initial segments are easier to handle than medial and final ones, and
- synthesis is easier than analysis.

The training methods that were finally used were either borrowed from published material for linguistically normal children (e.g. Alstermark & Westberg 1987, Bradley & Bryant 1985, Darnell 1990, Tornéus et al. 1986) or suggested by the speech pathologists themselves.

In order to reach the four subgoals mentioned above, the training was to include four different methods: various ways of dealing with word length,

with rhyming, with identification of phonemes in words, and with segmentation of words into phonemes.

The training material is continuously being revised and will not be published until after the final revision when the project is completed.

Subjects

The subjects who have been involved in the training study during the first year of the project are 46 language-disordered preschool children. For 28 children the training began one year before they started school, i.e. when they were six years old, and for 18 children two years before school, i.e. when they were five years old. The subjects were selected among the language-disordered preschool children who scored below a certain level on a rhyming test and a phoneme identification test. They were all enrolled in a language therapy program and trained by one of the 13 speech pathologists who participate in the project.

Controls

In order to evaluate the effect of the training on phonological awareness and on learning to read and write, the language-disordered children in the training group must be compared with a group of language-disordered children who have not had such training.

Our first idea about the control group was to ask the participating speech pathologists to select from their case loads children of the same age and with the same type of language problems as the children in the training program and let these children take part in a traditionally designed language program. At first such a design seemed attractive as a way of evaluating different training programs independent of the different personalities and therapeutical approaches of the speech pathologists, as the same speech pathologist would give both types of training. However, we soon realized that this procedure was not feasible. The speech pathologists who are involved in the awareness training work with this type of program because they believe their patients will benefit from it. It would thus be a dilemma for the therapists to consciously withhold this type of training from some children whom they think might have been helped by it.

Our next idea was to advertise for controls in a paper which reaches all speech pathologists in the country. We did so, but with not much success, as we did not get as many answers to our call for children as we had hoped. Moreover, we were forced to turn some children down because their speech pathologists had started to work with *Metaphon*, a therapy program in

which phonological awareness is used as a means of developing phonological competence (Howell & Dean 1991). Therefore, we are now recruiting controls only from speech pathologists whom we have first interviewed about their therapy method.

Finding matching controls for the children in the training group proved more problematic than we had expected. We wanted to match the children for age, sex, nonverbal cognitive level, phonological awareness, and type of language disorder. After our earliest matching attempts, when it seemed impossible to find any matching children, we scrutinized our matching principles. Which matching variables are the most important for studying the kind of questions we are interested in? How much variation on each variable can be allowed in matching children?

After lengthy discussions we settled for matching principles that consider phonological awareness and type of language disorder to be the most important matching variables, while more variation is allowed on some of the other variables. All matching is based on data from the pre-testings.

- *Age*: Matching children have to be born the same year but the time of the year does not matter. With this procedure matching children may differ almost a year in age, but all of them start school the same year.
- *Sex*: Boys are matched with boys and girls with girls.
- *Phonological awareness*: Children are matched on the identification score, ± 2 scores.
- *Type of language disorder*: As a first step, the children's disorders are classified either as phonological or as both phonological and syntactic. Next an evaluation is made of the seriousness of the linguistic problems. This is considered less important for the matching than the type of disorder.
- *Nonverbal cognitive level*: Children are matched by their scores on Raven's Coloured Matrices, ± 1 stanine.

Preliminary results

Before the training was started, we decided upon a training period of eight to ten weeks. After that period the children's phonological awareness was to be tested again with the same tasks as in the pre-testing, i.e. identification of phonemes and rhyming. If they had not still reached our criterion for phonological awareness, i.e. at least 18 out of 24 on the identification task, an additional training period could be considered.

Table 1. Phoneme identification results before and after training for 22 six-year-old language-disordered children.

	<i>before training</i>	<i>after training</i>
mean	12.4	18.8
S.D.	4.1	3.7
minimum	0	10
maximum	17	24

Here we will only give some preliminary results from the training of the six-year-old children. Out of the 28 six-year-olds who had been selected for training, 22 children have been post-tested after completing a training period. Since the training was done not in laboratory settings but under natural conditions, it proved to be impossible to keep to a very strict schedule for various practical reasons such as clinical routines, problems in getting the children to attend the training sessions regularly, illness, vacations etc. As a consequence, both the length of the training period and the number of training occasions vary. The training period has on the average been 16 weeks, varying from seven to 21 weeks. During that period the children have been trained on six to 19 occasions, with a mean of 12 occasions.

In Table 1 results from the phoneme identification test before and after training are shown for 22 children. As can be seen in the table, the mean is considerably higher after training, and both minimum and maximum scores have increased. There are no longer any children who do not understand the task, and there are some children who manage all the 24 tasks.

Even if the scores on the phoneme identification test are higher after the training period than before, this is not necessarily an effect of the training. As there are on the average eight months between the pre- and post-testing the increased identification ability might equally be an effect of time.

In order to clarify this question, we need to follow a comparable group of language-disordered children whose phonological awareness is not being trained. As we have not yet been able to find a sufficient number of language-disordered children who can be matched with the children in the training group in all the relevant respects (see Controls), we use data here from our longitudinal study of language-disordered and linguistically normal children (Magnusson & Naclér 1990a). When the longitudinal study started, the children were six years old, and among the tests we used were the same phoneme identification and rhyming tasks as in the training

Table 2. Phoneme identification results in preschool and at the beginning of grade 1 for 20 language-disordered and 12 linguistically normal children.

	<i>language-disordered</i>		<i>normal</i>	
	<i>preschool</i>	<i>grade 1</i>	<i>preschool</i>	<i>grade 1</i>
mean	12.0	16.2	14.3	18.9
S.D.	3.5	5.1	2.3	3.6
minimum	0	0	11	14
maximum	17	24	17	24

study. From the longitudinal study we selected all children who did not reach the awareness criterion, i.e. who scored 17 or below on the identification task at a preschool testing. This gave us 20 language-disordered children and 12 linguistically normal children. In Table 2 the identification results from the preschool testing and testings done at the beginning of first grade are shown for the language-disordered children and the linguistically normal children from the longitudinal study. The time between the preschool testing and the grade 1 testing is at least six months. These scores are therefore comparable to the scores on the pre- and post-testings in the training group.

As can be seen in Table 2, the means of the two groups increase between the testings even if the language-disordered group does not increase as much as the normal group. It should be pointed out that the language-disordered children had been involved in language intervention programs designed to develop their language competence, while the normal children had not been engaged in any structured linguistic activities. When we compare the results of the children from the longitudinal study with those of the children in the training study (see Table 1), we find that language-disordered children who have had awareness training have increased their identification ability more than language-disordered children who have had traditional language training, and even enough to reach the level of the normal group. Moreover, the children who scored the lowest on the pre-testing are those who gain the most.

The conclusion we can draw at this stage in our investigation is that it is possible to train phonological awareness not only in linguistically normal children but also in language-disordered children. The question of how important the type of language disorder is for the success of awareness training cannot be answered until we have made a more detailed analysis of

our data. Even if we know now that language-disordered children's phonological awareness can be developed by training, we do not yet know whether or not the training has a beneficial effect for the children's learning to read and write at school. This remains to be seen.

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