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## ABSTRACT

To find how well children learn letter-sound correspondences when an orthography is highly regular, and how this ability relates to socioeconomic status (SES) and to reading ability, 240 Finnish children were tested for letter-sound generalizations. The test consisted of 25 synthetic words, constructed to look like Finnish words and to contain the full range of correspondences which occur in Finnish orthography. Children from Grades 1 through 3, stratified by sex and by SES, were tested individually on the word list, with the pronunciation of each word being scored either right or wrong. An analysis of variance on the raw scores showed a significant grade effect at the .01 level, but no SES or sex effect. Mean correct, however, was almost 80% in Grade 1, indicating a surprisingly high level of letter-sound mastery. But the correlations of letter-sound ability with reading ability were only moderately high, ranging from .528 (Grade 2) to .487 (Grade 3). This result indicates that the ability to generalize letter-sound correspondences does not guarantee high ability in reading. (Author)

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Technical Report No. 219

THE LETTER-SOUND GENERALIZATIONS OF  
FIRST, SECOND, AND THIRD GRADE FINNISH CHILDREN

by

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Report from the  
Basic Prereading Skills Component of Program 2,  
Development of Instructional Programs  
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## Statement of Focus

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Technical Report is from the Basic Prereading Skills Project, an element of the Reading and Related Language Arts Project in Program 2, Processes and Programs of Instruction. General objectives of the Program are to develop curriculum materials for elementary and preschool children, to develop related instructional procedures, and to test and refine the instructional programs incorporating the curriculum materials and instructional procedures. Contributing to these program objectives, this element has two general objectives: (1) to investigate ways to test for skill deficits and to overcome them and (2) to develop a kindergarten-level program, including diagnostic tests and instructional procedures, for teaching basic prereading skills. Tests and instructional programs are being developed for visual and auditory skills, including letter and letter-string matching with attention to order, orientation and detail, and auditory matching and blending.

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Arrangements for this experiment were made by Professor O. K. Kyöstiö, Dean of the Teachers College, University of Oulu, who selected the subjects and supervised testing. The testing was done by Mr. Martti Havas, MA, principal of the campus school. Their cooperation in this study is sincerely acknowledged.

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### Abstract

To find how well children learn letter-sound correspondences when an orthography is highly regular, and how this ability relates to socioeconomic status (SES) and to reading ability, 240 Finnish children were tested for letter-sound generalizations. The test consisted of 25 synthetic words, constructed to look like Finnish words and to contain the full range of correspondences which occur in Finnish orthography. Children from Grades 1 through 3, stratified by sex and by SES, were tested individually on the word list, with the pronunciation of each word being scored either right or wrong. An analysis of variance on the raw scores showed a significant grade effect at the .01 level, but no SES or sex effect. Mean correct, however, was almost 80% in Grade 1, indicating a surprisingly high level of letter-sound mastery. But the correlations of letter-sound ability with reading ability were only moderately high, ranging from .528 (Grade 2) to .487 (Grade 3). This result indicates that the ability to generalize letter-sound correspondences does not guarantee high ability in reading.



## I Introduction

The development of English letter-sound generalizations and their role in learning to read have been explored by Venezky (in press), Calfee, Venezky, and Chapman (1969), and Johnson (1970). These studies have shown inter alia that American children generalize the invariant consonant and the long and short vowel correspondences early in the primary grades, but fail to generalize several other predictable patterns until the end of grade school, and even then not to the level that is theoretically possible. One cause of these differences in generalizations might be the differences in numbers of common word exemplars introduced in primary level reading texts for each pattern. Another cause might be in the task itself, that is, in the conceptual difficulty which the child faces in learning variant responses for letter patterns, based on such features as position of the letter within the word, graphemic environment, and part of speech, in addition to learning exceptions to each pattern.

This complexity and irregularity within the English letter-sound system has often been the basis for claims by linguists, educators, and spelling reformers that a modified English orthography is needed for teaching reading efficiently. Bloomfield (1933, pp. 500 f.), for example, wrote:

Although our writing is alphabetic, it contains so many deviations from the alphabetic principle as to present a real problem, whose solution has been indefinitely postponed by our educators' ignorance of the relation of writing and speech. . . The difficulty of our spelling greatly delays elementary education, and wastes even much time of adults. When one sees the admirably consistent orthographies of Spanish, Bohemian, and Finnish, one naturally wishes that

a similar system might be adopted for English.

Evidence in support of these claims has failed to materialize in the years since Bloomfield made them. Experiments in England and in the USA with lta, a reformed, transitional orthography, have failed to show a convincing improvement in reading acquisition, and studies of reading in countries like Finland where according to Bloomfield the orthography is "admirably consistent" have revealed a more than negligible reading problem in the primary grades. "Among normal [Finnish] school children, specific reading and writing impairment occurs in from 5 to 10 per cent according to various investigators. . . In a study made in Finland in the elementary schools in the community of Espoo, reading and writing impairment was found in about 13.5 per cent of the children" (Arajärvi et al., 1965, pp. 144 f.).

However, to date no experimental data have been available on the letter-sound abilities of children who learn to read with highly regular orthographies, or on how these abilities relate to general reading ability. The present study was planned as an exploratory study to answer these questions. More specifically, the purposes of the present study were:

1. To ascertain the letter-sound abilities of first, second and third grade Finnish children of different socioeconomic backgrounds, and
2. To find how letter-sound ability relates to general reading ability and to socioeconomic status.

### Reading in Finland

Finnish children enter first grade at the age of seven. Reading instruction typically

begins within the first four months of Grade 1 and centers on an alphabet which consists of the 26 letters of the Roman alphabet plus two superscripts  $\text{å}/\text{ä}$  ( $\text{ö}$ ). Of these symbols, however, only 19 letters and one superscript ( $\text{ä}$ ,  $\text{ö}$ ) are required for Finnish words. The remainder occur solely in loan words, the majority of which are borrowed from Swedish.

Finnish, in contrast to English, has a highly predictable relationship between letters and sounds. Nevertheless, this system deviates from a one-sound, one-symbol system in a number of ways:

1. Long vowels and long consonants, al-

though phonemically distinct, are spelled by doubling the symbols for their shorter counterparts.

2. The letter a represents the vowel /a/ when it occurs by itself, and the vowel /æ/ when it occurs with a superscript ( $\text{ä}$ ). Similarly, o represents /o/ by itself, and /œ/ with a superscript ( $\text{ö}$ ).
3. The letter n represents /ŋ/ before k; in combination with g it represents /ŋ:/. Otherwise, it represents /n/.

## II Method

### Subjects

The subjects were 240 children of both sexes, divided into three grade levels (1, 2, and 3) and five socioeconomic levels, selected from public schools in the North of Finland: Hyrynsalmi (rural), Kemijärvi (urban), Pelkosenniemi (rural), Raahe (urban), and Oulu (urban). The five-level socioeconomic scale is the same scale used by the school systems in Finland. The categories are defined for father's occupation as follows:

1. Professional (doctor, lawyer, professor)
2. Managerial
3. Clerk (bank, office, factory)
4. Laborer
5. Farmer or fisherman

### Stimuli

The stimuli were 25 synthetic Finnish words, constructed with the aid of a Finnish linguist to include all of the deviations from a one-letter, one-sound system which exist in common Finnish words. All of the short consonants

and short vowels occurred at least three times each in the list; in addition, the list contained eight occurrences of long vowels, five occurrences of long consonants, six diphthongs, five medial consonant clusters, and four different environments for n: adjacent to a vowel, before g, before k, and before a non-velar consonant. Stimulus items were hand-lettered in upper case letters on separate 3 1/2" x 5" cards, using a common, primary level script.

### Procedure

Each child was tested individually in a quiet room by a native speaker of Finnish. Prior to testing the child was told that he would see some printed words which he probably had not seen before, but he should try to pronounce each one as best he could. Two random orderings of the test items were used, with three real words at the beginning for warm-up and two real words at the end for boosting morale. Responses were scored directly on a score sheet as either correct, incorrect, or no response/wild response.

### III Results

The number of correctly pronounced synthetic words (out of 25) was summed for each of the 240 Ss and a 3 x 5 x 2 unequal-n analysis of variance was run on these data, Grade by SES by Sex.<sup>1</sup> At the .01 level, there was a significant main effect for Grade ( $F(2, 210) = 5.30$ ), but not for SES and not for Sex. (The means for grade, SES level, and sex are shown in Table 1.) The grade effect was one of increasing mean correct with increase in grade level: from 19.8 at Grade 1 to 21.4 at Grade 3. These gains by grade should not obscure the strikingly high level of mastery of letter-sound correspondences at the end of first grade—almost 80% correct. Mean correct by SES showed a trend toward decreasing mean correct with decrease in SES, but with irregularities at each grade level. Sex differences are slight, with

girls doing slightly better than boys overall.

#### Correlations with Reading

The reading score which each child received at the end of the school year in which the testing was done was obtained from school records. (All schools used a uniform 10-point scale for grading. The distribution of these scores in Grade 1 is approximately normal with a mean of 7.63 and standard deviation of 1.02.) Correlations of total correct on the synthetic words with reading scores are shown in Table 2 for each grade level (collapsed across SES) and for each SES (collapsed across grade levels). The correlations for grade levels, although all but one are significant at the .01 level, are only moderately high, and account on the aver-

Table 1  
Mean Number of Synthetic Words Correctly Pronounced

	Grade			SES					Sex	
	1	2	3	1	2	3	4	5	M	F
<u>n</u>	81	79	80	48	48	48	48	48	120	120
Mean	19.76	20.87	21.45	21.94	20.35	20.90	19.83	20.44	20.12	21.22

<sup>1</sup>The unequal-n analysis, using least squares estimation procedures, was employed because one S was inadvertently drawn from the wrong grade.

Table 2  
Correlations of Total Correct on  
Synthetic Words with Reading Grade

Grade	n	r
1	81	.508*
2	79	.528*
3	80	.487*

  

SES	n	r
1	48	.529*
2	48	.657*
3	48	.515*
4	48	.538*
5	48	.267

\*  $p < .01$ .

age for only about 25% of the observed variance.

## Errors

Of the 6000 responses (240 Ss by 25 test items), only 13 were classed as "wild," indicating that the basic task of generating oral words from printed words was fully mastered by all subjects, even those at the first-grade level. A rank ordering of the test items according to total errors on each (see Table 3) shows that long words (graphemically or phonemically) and words with long consonants tended to have the greatest number of errors. An alternate and equally plausible hypothesis, however, is that the most difficult words are those that are similar to real words: verräntä:veräntä, "porch"; laikkomuus:laittomuus, "illegality"; jouma:juoma, "drink"; keksäle:kekäle, "firebrand."<sup>2</sup> But since specific errors were not recorded and the words with long consonant spellings are also the longest words, the relative contributions of these two factors cannot be determined.

<sup>2</sup>This hypothesis was first suggested by Professor O. K. Kyöstö.

Table 3  
Rank Ordering of Stimulus Items  
According to Total Errors on Each

	Total Errors	Percentage of Errors (n/240)
verräntä	101	42.1
laikkomuus	90	37.5
jouma	75	31.2
keksäle	71	30.0
mintellä	70	29.2
pelkkano	65	27.1
pyönyt	55	23.9
syyro	52	21.7
istöota	52	21.7
yhdikse	48	20.0
hiepä	44	18.3
kiimi	38	15.8
lönkö	37	15.4
jangu	37	15.4
mölkä	36	15.0
millo	35	14.6
jöyhi	24	10.0
rapi	15	6.5
toole	13	5.4
röovi	13	5.4
paaho	12	5.0
nuru	12	5.0
tyhe	10	4.2
hulvu	10	4.2
vuusa	7	2.9

#### IV Discussion

The high degree of predictability of Finnish orthography is reflected in a uniformly high ability of school children by the end of first grade to pronounce unfamiliar words from their spellings. The mean correct of nearly 80% which was attained at the end of first grade is remarkably high, especially since the test items were constructed to sample all of the difficult spelling patterns in Finnish, and hence were slightly more difficult than the average reading materials to which first graders are exposed. Improvement in letter-sound ability from Grade 1 through Grade 3 is moderate, although statistically significant. That third graders do not approach 100% correct is probably due to two factors: (a) the difficulty of a few test items (even three college-educated adults tested in a pilot study did no better than 90% correct), and (b) the lack of attention to letter-sound patterns beyond the beginning of second grade in the teaching of reading.

The failure to find a significant effect from socioeconomic status was surprising in view of the overwhelming influence which this factor has in the United States, but not so surprising in view of the social and economic composition of Finland. With a small (4.7 million), nearly stable population, and one of the highest per capita incomes in Europe, Finland has almost no poverty. In addition, it has one of the most homogeneous populations in the world, with over 90% of its people speaking and able to read the same (native) language and professing the same religious faith. Immigration over the last 20 years has been negligible, hence there are no minor-

ities outside the mainstream of Finnish life.

But even with this high ability across grade level, sex, and SES to relate spelling to sound, the relationship of this ability to general reading ability is, at best, moderate and tends to decline with increasing grade level. (A similar decrease in the correlation between letter-sound ability and reading ability was found by Calfee, Venezky, and Chapman [1969] for third- and sixth-grade children in the United States.) This is, even with the limitations created by the reading scores used in this study, a strong result that should be considered seriously in view of the claims of some spelling reformers and educators that an irregular orthography is the root of all reading problems. Finland has one of the most regular, if not the most regular orthography in use today, yet reading failure is not unheard of in Finland, and more importantly, the correlation between letter-sound ability and reading ability accounts for only about 25% of the variance in these scores.

This limited relationship indicates that high letter-sound ability by itself does not guarantee high reading ability—that other factors, such as word recognition and intelligence, are also important and become more important for reading ability as the child progresses through the primary grades. Failure to generalize letter-sound correspondences, on the other hand, is no doubt a reliable predictor of reading failure, but the lack of symmetry in this relationship is a strong indicator of the complexity of the reading task and the as-yet-unassayed variables which lead to successful acquisition of literacy.

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