In Search of Factors in Deaf and Hearing Children's Reading Comprehension

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THE PRESENT STUDY examined whether specific item characteristics, such as mode of acquisition (MoA) of word meanings, make reading comprehension tests particularly difficult for deaf children. Reading comprehension data on nearly 13,000 hearing 7-to-12-year-olds and 253 deaf 7-to-20-year-olds were analyzed, divided across test levels from second to sixth grade (not necessarily corresponding to chronological age). Factor analyses across item scores suggested that, of the determinants studied, MoA—referring to the type of information (perceptual, linguistic, or both) used in word meaning acquisition—was the only factor that contributed significantly to deaf and hearing children's reading comprehension. For hearing children, MoA influenced item scores at the third- and fourth-grade levels. For the deaf children, MoA influenced item scores through the sixth-grade level.

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Deaf children and adolescents have been found to perform poorly on measures of reading comprehension; the average score for school leavers with hearing loss is at a level comparable to that of third- or fourth-grade hearing children (Allen, 1986; Karchmer & Mitchell, 2003; Traxler, 2000). There is reason to believe that differences in printed word identification do not explain these lower reading comprehension scores (Burden & Campbell, 1994; Merrills, Underwood, & Wood, 1994; Wauters, Van Bon, & Tellings, 2006). To identify factors that explain the low reading comprehension scores, the present study investigated whether specific item characteristics make reading comprehension tests particularly difficult for deaf children. Using data compiled by Wauters and colleagues showing that 7-to-20-year-old Dutch deaf students score far below hearing children on a standardized reading comprehension test, we examined whether the items on reading comprehension tests can be categorized along certain dimensions and whether one or more of these dimensions in particular discriminate between deaf and hearing readers. We also examined the explanatory role of mode of acquisition (MoA) in reading.

Mode of acquisition, as introduced by Wauters, Tellings, Van Bon, and Van Haaften (2003), refers to the way in

which children or adults acquire the meanings of words. Word meanings can be learned through perception of the referents of the words, through linguistic information (i.e., through verbal or written explanation, description, or discussion of the referents), or through a combination of both. For some words, the MoA is determined by the nature of its referents. The meanings of color words, for example, will be learned almost entirely through perception, because no verbal description of colors can be given. The meaning of a word such as *era* will be learned through linguistic information, because a verbal explanation is necessary to convey its meaning. For other words, the MoA is dependent on the context of acquisition. Children may learn the meaning of a word in different ways as a consequence of the time and place of acquisition or even the culture and social economic status of the child. The MoA of a word such as *tundra*, for example, depends on the environment in which the word is learned. Children who live in a country with tundras will probably learn the meaning of *tundra* through perceptual information. However, in countries such as the Netherlands, where tundras do not exist, the word will be learned linguistically or maybe through a combination of perceptual information (obtained through pictures) and linguistic information. In the present study, MoA is treated as a learning environment–dependent characteristic of the acquisition of words rather than as a word characteristic.

For both deaf and hearing children, MoA has been found to influence sentence comprehension (Wauters, Tellings, Van Bon, & Mak, 2006). Reading words that are thought to be learned linguistically takes longer than reading words that are thought to be learned through perception. Moreover, comprehension of sentences containing a word that is thought to be learned linguistically is more difficult than comprehension of sentences with a word that is acquired through perception. If MoA influences sentence comprehension, it will most likely also influence comprehension of a complete text and questions about that text. In the present study, we investigated whether the MoA of test items in a reading comprehension test influence deaf and hearing students' scores on that test and whether differences between deaf and hearing students can be attributed to differences in MoA.

According to some reading researchers (Long, Seely, Oppy, & Golding, 1996; Underwood & Batt, 1996; Van Dijk & Kintsch, 1983; Zwaan, 1996), reading consists of three levels of text representation: identification (at the word level), comprehension (at the sentence level), and interpretation (at the text level). The first level involves the ability to identify printed words. However, as we have already indicated, word identification does not provide sufficient explanation for deaf children's reading comprehension difficulties.

The second level of text representation consists of understanding the meaning of the words in a sentence and combining these meanings into propositions. Vocabulary and syntax appear to be important contributors to success at this level (Aarnoutse & Van Leeuwe, 1988; De Jong & Van der Leij, 2002). Deaf children often have lower vocabulary levels than hearing children (Kelly, 1996; Marschark, Lang, & Albertini, 2002; Paul, 2003). Furthermore, deaf children's vocabulary knowledge has been found to significantly influence their reading comprehension ability (Garrison, Long, & Dowaliby, 1997; Paul, 2003). Deaf children also encounter difficulties with respect to syntax, especially with verb inflectional processes, auxiliaries, relative clauses, and sentence types that deviate from the subject-verb-object order (Berent, 1996, 2001).

The third level of text representation concerns making inferences to interpret the meaning of a text. The ability to make inferences has been found to vary with reading ability (Cain & Oakhill, 1999; Long et al., 1996). According to Cain and Oakhill, two kinds of inferences should be distinguished: text connecting and gap filling. Text-connecting inferences require the ability to integrate information that is explicitly provided in the text in order to establish cohesion between different sentences. Gap-filling inferences require incorporation of information outside the text (general knowledge) with information in the text to fill the gaps. Cain and Oakhill found that readers with poor text comprehension showed more difficulties with text-connecting inferences than skilled text comprehenders and younger reading-age matched children. The ability to make inferences has not—as far as we know—been investigated in deaf children, but it is reasonable to expect this ability to play a role in their reading comprehension difficulties.

Because—as the foregoing suggests—many subskills have been suggested to influence reading comprehension, one may expect factor analyses of reading comprehension tests that vary in the nature of their texts and in the questions posed about those texts to show factors representing these subskills. However, Rost (1989), Rost, Czeschlick, and Van der Kooij (1986), and Zwick (1987) found only one factor in a battery of reading comprehension test scores. This factor can be described as general reading comprehension. In a Dutch study, Boland and Mommers (1986) also concluded that one important factor determined the performance on a series

of reading measures. It is not an uncommon finding that the greater part of the variance in several language measures is explained by one single general factor, even leading Oller (1976; but see also Van Bon, 1992) to propose his unitary competence hypothesis. That a single general factor is found among normally developing children, however, does not preclude that the different measures are based on different underlying competences. Van Bon stated that, even if one general factor is found, this factor does not account for all of the covariance between measures nor for all the reliable variance within a measure, which indicates the presence of underlying competences. If unidimensionality of reading comprehension measures were characteristic of normally hearing children, an expectation to be verified in the present study, this unidimensionality might then give way to multidimensionality in deaf children, who may be expected to show more idiosyncratic development.

In order to verify these expectations, we performed a sequence of factor analytic studies. In the first step in these analyses, we found out whether reading comprehension measures can be grouped according to an interpretable structure of component skills and whether this structure is different for deaf and hearing children. The next step was to investigate whether deaf children score lower on specific skills or on all skills.

The comprehension measures used in our analyses were four-choice items. Restricting the analyses to the dichotomous item scores might conceal an underlying difference, namely in the way in which children decide among the response alternatives of these multiple-choice items. Therefore, we did additional distractor analyses on the specific answers to see whether, when selecting an incorrect answer, deaf children and hearing children differ in their choice of alternatives and whether this is related to specific aspects of the items. Finally, we related the item scores to the MoA of the test items to examine the power of MoA in explaining reading comprehension item difficulty in deaf and hearing children.

Method

Sample

The present study used reading comprehension data on 253 deaf students without additional disabilities (127 boys, 126 girls) between ages 7 years 11 months and 20 years 1 month (M = 14 years 2 months) that had been collected in a study by Wauters, Van Bon, and colleagues (2006). Mean hearing loss was 105 dB, with a range from 80 to 130. Mean IQ was 100, with a range from 65 to 144. Of these 253 students, 17 were in schools for hard of hearing children, 30 were in mainstream settings, and 206 were in schools for the deaf.

Reading comprehension data for hearing children in primary education were obtained from the norming sample of reading comprehension tests, collected by Aarnoutse (1996). Item response data were available for 1,660 second graders, 2,672 third graders, 2,753 fourth graders, 2,843 fifth graders, and 2,925 sixth graders.

Materials

Reading comprehension of the members of the study sample, both deaf and hearing, was measured using the Reading Comprehension Tests (Begrijpend Leestests*;* Aarnoutse, 1996), which are commonly used in the Netherlands with hearing children in grades 2 to 6. Each grade has a different test consisting of 9 to 13 reading texts and 30 to 36 multiple-choice questions with four response alternatives each. The raw score on each test is the number of questions answered correctly.

For the purpose of the present study, all items on the Reading Comprehension Tests were classified in one of four categories: vocabulary item, reference item, inference item, or item that requires understanding of the main idea of the text. Within the inference category, we further distinguished text-connecting inferences and gap-filling inferences (cf. Cain & Oakhill, 1999). Table 1 shows the number of items in the different categories for each grade level. Classification was done by two of the authors of the present article, independently of each other. They agreed on 90% of their classifications, and Cohen's kappa showed an interrater reliability of .91 (p < .001). The remaining 10% of the items were classified after mutual agreement was reached.

MoA ratings were collected for all nouns, verbs, and adjectives in the test

Table 1
Distribution of Items Among Classification Categories, by Comprehension Test Level

	Test level				
Category	*Grade 2*	*Grade 3*	*Grade 4*	*Grade 5*	*Grade 6*
Vocabulary	11	6	2	4	12
Reference	10	2	0	0	0
Main idea	8	8	9	6	4
Text-connecting inference	2	10	11	24	15
Gap-filling inference	5	4	8	2	1
Total	36	30	30	36	32

Table 2
Mean Age and Reading Comprehension Scores, by Test Level

	Deaf students (N = 253)				Hearing students (N = 12,853)		
Test level	*n*	*Mean age (SD)*	*Age range*	*Mean raw score (SD)*	*n*	*Mean age*	*Mean raw score (SD)*
2	93	12.10 (2.11)	7.9 – 18.9	17.39 (7.25)	1,660	7.6	21.67 (7.45)
3	71	14.6 (2.1)	7.10 – 20.1	15.41 (4.73)	2,672	8.6	18.07 (6.45)
4	36	14.10 (2.4)	10.0 – 20.1	18.77 (6.22)	2,753	9.6	19.84 (5.58)
5	26	15.10 (2.3)	10.11 – 18.7	24.46 (4.06)	2,843	10.6	24.45 (6.02)
6	27	15.4 (2.2)	11.11 – 18.11	24.55 (6.36)	2,925	11.6	21.33 (5.90)

Note. Ages are provided in years and months, e.g., 12.10.

items of the Reading Comprehension Tests, that is, in the questions and response alternatives. This selection procedure resulted in a word pool of 731 lemmas in total. (A lemma is a set of words consisting of a basic uninflected form, e.g., LIFE, and its inflectional variants, e.g., *lives*. The MoA ratings in the present study were collected for the uninflected forms.) For 263 of these 731 lemmas, MoA ratings were already available from previous studies (Geerdink, 2002; Wauters et al., 2003). In the present study, 29 adults rated the remaining 468 lemmas in the same way as in previous research. As in the study by Wauters and colleagues (2003), words were rated on a 5-point scale, with 1 indicating acquisition through perception and 5 indicating acquisition through linguistic information. To control for order effects, the 468 words were printed in four random orders that were equally divided among the raters. For each of the 468 lemmas, a mean MoA value of the ratings of the 29 participants was calculated. Including the ratings from previous studies, ratings were available for all 731 lemmas. For some lemmas, an MoA value was available from more than one study. For these lemmas, a weighted mean was calculated. For each item in the Reading Comprehension Tests, an MoA value was obtained by calculating an average for all tokens in an item.

Procedure

The hearing students in the norming sample had completed the Reading Comprehension Test for the grade they were in. Judgments by the individual teachers were used to determine the appropriate Reading Comprehension Test for each deaf student in the sample. Of the 253 deaf students who were tested, 93 were tested at the second-grade level, 71 at third grade, 36 at fourth grade, 26 at fifth grade, and 27 at sixth grade. Because deaf children's reading comprehension level is often not in accordance with their age, the mean age of deaf students taking a test of a certain level was higher than of the hearing students taking that test. Table 2 shows the mean age and the age range by test level of the members of the deaf sample, the mean age by test level of the members of the hearing sample, and the mean raw scores for both deaf and hearing at the successive test levels. At both the second-grade and third-grade test levels, the deaf students scored lower than the hearing students, t (751) = -5.39, $p < .001$; t (2741) = -3.46, $p < .01$. For the fourth-grade and fifth-grade test levels, the deaf and hearing students did not differ, t (2787) = -1.13, $p > .05$; t (2867) = .006, $p > .05$. At the sixth-grade level, the deaf students outperform the hearing students, t (2950) = 2.82, $p < .05$. In interpreting these results, it should be noted that the members of the deaf and hearing samples were compared by test level, not by age. Therefore, one cannot conclude from these results that deaf and hearing children do not differ in reading comprehension.

Results

Three kinds of analyses were done to determine whether reading comprehension performance on the Reading Comprehension Tests can be ascribed to certain item characteristics and whether these are the same or different for deaf and hearing children: (a) factor analyses over dichotomous item scores, (b) distractor analyses that examined whether deaf and hearing children differ in their choice of alternatives, and (c) analyses of the role of MoA in deaf and hearing students' item scores, with control analyses for word frequency and item category.

Factor Analyses

Because the data consisted of dichotomous variables, tetrachoric correlations were used. Confirmatory and exploratory factor analyses were done using the Mplus program (L. K. Muthén & B. O. Muthén, 2001). In the case of multiple factor solutions, promax rotations were done. Criteria for goodness-of-fit measures were derived from Jaccard and Wan (1996). The results for hearing and deaf students are discussed separately.

Hearing Sample

Factor analytic studies on grammatical proficiency showed language measures in this domain to be characterized by one general factor only (Oller, 1976; Rost, 1989; Van Bon, 1992; Zwick, 1987). Therefore, a confirmatory factor analysis was done to test whether a one-factor model was appropriate to describe the reading comprehension performance of the hearing sample. Table 3 shows the goodness-of-fit measures for a one-factor solution in each grade. For all grades, the root mean square error of approximation shows the one-factor model to fit adequately. The other fit measures also point in this direction, indicating that reading comprehension is indeed unidimensional. The one-factor model explained 30% of the variance in grades 2 and 3, and 26%, 22%, and 25% in grades 4, 5, and 6, respectively. No group factors were found to explain the remaining percentage of the variance, which leaves much item variance unexplained.

Table 3

Goodness-of-Fit Measures of the One-Factorial Models, Hearing Sample

Grade	$\chi 2$	*df*	*p*	*CFI*	*TLI*	*RMSEA*	*SRMR*
2	735.12	392	.000	.972	.986	.023	.042
3	1197.17	320	.000	.947	.974	.032	.043
4	3162.42	295	.000	.798	.877	.059	.071
5	887.74	450	.000	.966	.979	.019	.038
6	880.53	369	.000	.965	.979	.022	.037

Notes. CFI, comparative fit index. TLI, Tucker-Lewis index. RMSEA, root mean square error of approximation. SRMR, standardized root mean square residual.

Deaf Sample

For the deaf sample, factor analyses were only done for the data from the tests for grades 2 to 4, because for the grade 5 and 6 tests the number of variables exceeded the number of deaf test takers. A one-factor model explained 28%, 21%, and 33% of the variance for the items from the tests for grades 2, 3, and 4, respectively. At the third- and fourth-grade levels, the root mean square error of approximation was not sufficiently low to conclude that the one-factor model adequately described the common variance in the reading comprehension process. However, two-factor solutions for all three grade levels could not be interpreted in terms of the a priori categories (see Materials). In all three cases, the factors did not seem to be defined by homogeneous collections of items.

Because the two-factor solutions did not show interpretable patterns of item loadings and the one-factor solution was not adequate to describe deaf students' reading comprehension performance either, we cannot draw conclusions regarding the factor structure that underlies the deaf sample's item responses—except at the second-grade level, where a one-factor model was adequate. It is possible, however, that a general factor does underlie the reading comprehension process, but that the heterogeneity of the deaf sample prevented the factor analyses from showing this factor. Therefore, confirmatory factor analyses were done to examine whether the one-factor models for the hearing sample also applied to the deaf sample. In these analyses, the factor loadings found for the hearing students were used to specify the models for the deaf students. Results showed that for the tests for grades 2 and 4, the model found for the hearing students was also adequate for the deaf students: grade 2, $\chi^2(67) = 94.73$, $p = .015$, CFI = .879, TLI = .888, RMSEA = .067, SRMR = .174; grade 4, $\chi^2(23) = 27.517$, $p = .235$, CFI = .933, TLI = .936, RMSEA = .074, SRMR = .260. [Expansions of these statistical abbreviations are provided in Table 3.—*Ed.*]However, for the grade 3 test, confirmatory factor analyses showed that the model for the hearing students was not applicable to the data for the deaf students: $\chi^2(47) = 94.32$, $p = .0001$, CFI = .565, TLI = .565, RMSEA = .119, SRMR = .235. This indicates that on the test for grade 3, deaf test takers did not show the same structure as hearing third graders in answering the test items.

Differences Between Item Categories

Supplementary analyses, testing the influence of the item categories on the item scores, may shed more light on the structure of the Reading Comprehension Tests. Nonparametric Kruskall-Wallis tests were done to measure the influence of item category on p values (proportion of correct answers to an item) for the deaf and hearing samples and on the difference in p value between deaf and hearing samples. At all test levels, no influence of item category on the p values of deaf and hearing test takers was found (all $p > .05$). Also, no influence on the difference in p value between deaf and hearing test takers was found (all $p > .05$).

Distractor Analyses

Chi-square tests were done to examine whether, when giving an incorrect answer, deaf children chose different distractors than hearing children in the multiple-choice Reading Comprehension Tests. These analyses were done for the tests for grades 2 and 3, because for the higher grade levels the number of

deaf students was too small for a fair comparison.

On the test for second grade, deaf and hearing students differed in the distribution of their choices over the three incorrect response alternatives on 15 of the 36 items (see Table 4). Differences occurred mainly on the vocabulary and reference items. Of the items on which deaf and hearing students differed in their choice of alternatives, all items identified as vocabulary items were more difficult for the deaf test takers than for the hearing test takers. For the other categories, no systematic difference of preference was found. This outcome suggests that a difference in vocabulary may lie at the origin of deaf students' reading comprehension problems.

On the test for third grade, the distribution over the incorrect answers was different for deaf and hearing test takers for 10 of the 30 items. Deaf and hearing students differed mainly on the inference items (see Table 4). Score differences between deaf and hearing test takers were not related to specific item categories.

To conclude, the distractor analyses did not provide a clear-cut solution. At the second-grade level, deaf and hearing test takers differed in their choice of alternatives mainly on the vocabulary and reference items. At the third-grade level, they differed mainly on the inference items.

Table 4
Percentage of Items, by Category, on Which Deaf and Hearing Samples Differed in Their Choice of Alternatives

Category	*Grade 2*	*Grade 3*
Vocabulary	45%	17%
Reference	60%	50%[a]
Main idea	12.5%	37.5%
Text-connecting inference	100%[a]	30%
Gap-filling inference	20%	50%

[a]Based on two items.

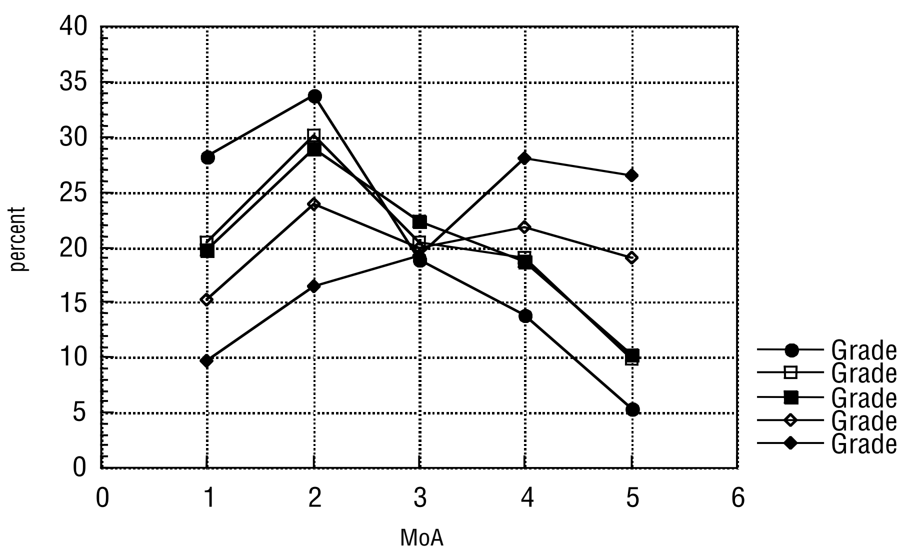
Analysis of the Role of Mode of Acquisition

In order to analyze the reliability of MoA ratings, interrater agreement (McGraw & Wong, 1996) was assessed by means of a two-way random effect model (absolute agreement definition) intraclass correlation coefficient (ICC). As in a previous study (Wauters et al., 2003), a high ICC (.96) was found, indicating a high absolute agreement between the rating patterns of the different participants.

The change over grades in the MoA of words in the Reading Comprehension Tests underscores the validity of MoA, because it is in line with expectations (cf. Wauters et al., 2003). The mean MoA of words in texts and the proportion of words in the different rating scale classes both increase over grades. A low mean MoA indicates that words are acquired mainly through perception, while a high mean MoA indicates that words are acquired mainly through linguistic information. Figure 1 shows the percentage of words rated in the different classes of the MoA rating scale for the different grades. In the grade 2 test, the items consisted mainly of words that were rated as acquired mainly through perception (rating 1). In the grade 3 and grade 4 tests, the items mainly contained words that were rated as acquired through a combination of perceptual and linguistic information (rating 5). In the grade 5 and grade 6 tests, the items consisted of words that are learned mainly through linguistic information.

The MoA ratings by the adult participants were used in studying the influence of MoA on the scores of deaf and hearing students at the different levels of the Reading Comprehension Tests. Correlations were calculated between the MoA ratings of the items and their p values (the proportion of correct answers to an item) for deaf

Figure 1
Percentage of MoA (Mode of Acquisition) Ratings, by Grade Level



and hearing students. In addition, correlations were calculated between the MoA of an item and the difference between the p values for deaf and hearing students. Each item consists of a question and four response alternatives. As a measure of the MoA of an item, the mean MoA rating over the words in that item was calculated and the minimal occurring MoA was included as a threshold measure.

Correlations between MoA and the p values show that, especially for the tests for grades 3 and 4, MoA influenced deaf and hearing students' reading comprehension. At the third-grade level, a higher mean MoA goes together with lower p values (deaf, $r = -.53$; hearing, $r = -.50$; both $p < .01$), indicating that deaf and hearing students give fewer correct answers when the words of an item tend to be acquired through linguistic information. At the fourth-grade level, p values also decrease when the minimum MoA value of an item increases (deaf, $r = -.44$, $p < .05$; hearing, $r = -.54$, $p < .01$). At the fifth-grade level, MoA correlates only with deaf students' reading comprehension ($r = -.35$, $p < .05$), and not with hearing students' reading comprehension. At the third- and sixth-grade levels, MoA also correlates with the difference in p values between deaf and hearing students. At the third-grade level, deaf children give fewer correct answers than hearing children when MoA is high, while no difference occurs when MoA is low, $r = -.39$, $p < .05$ (see Figure 2). At the sixth- grade level, deaf students score higher than hearing students, but this difference decreases when the minimum MoA increases, $r = -.39$, $p < .05$ (see Figure 3). In summary, MoA influences reading comprehension for both deaf and hearing children at the third- and fourth-grade levels, and at the third-grade level even explains the difference between the two groups. At

Figure 2
Relation Between MoA (Mode of Acquisition) and the Difference in *p* Value Between Deaf and Hearing Samples, Grade 3

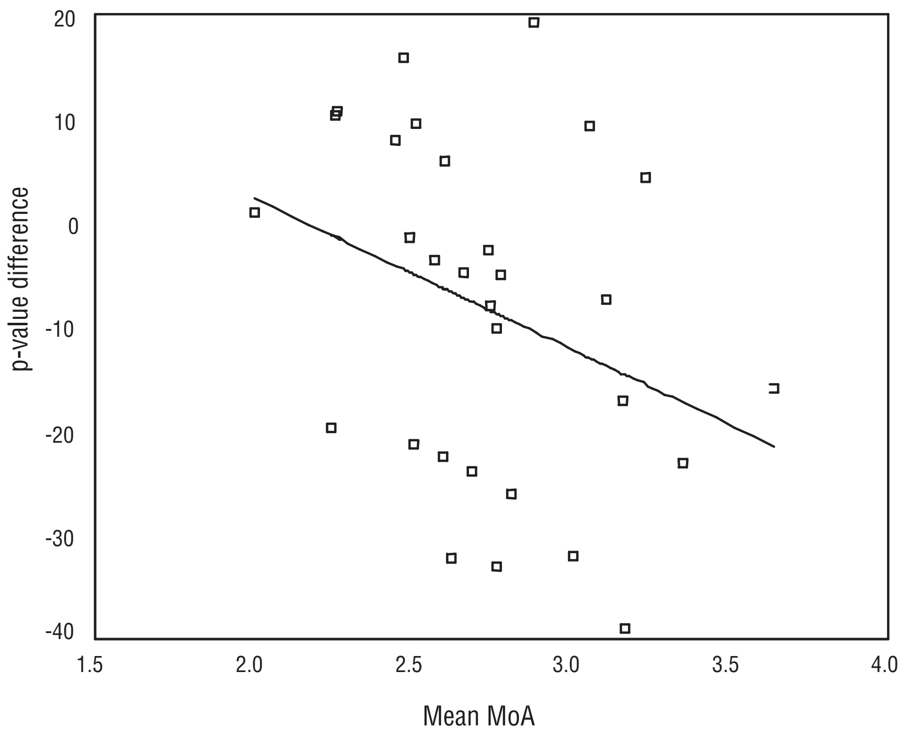
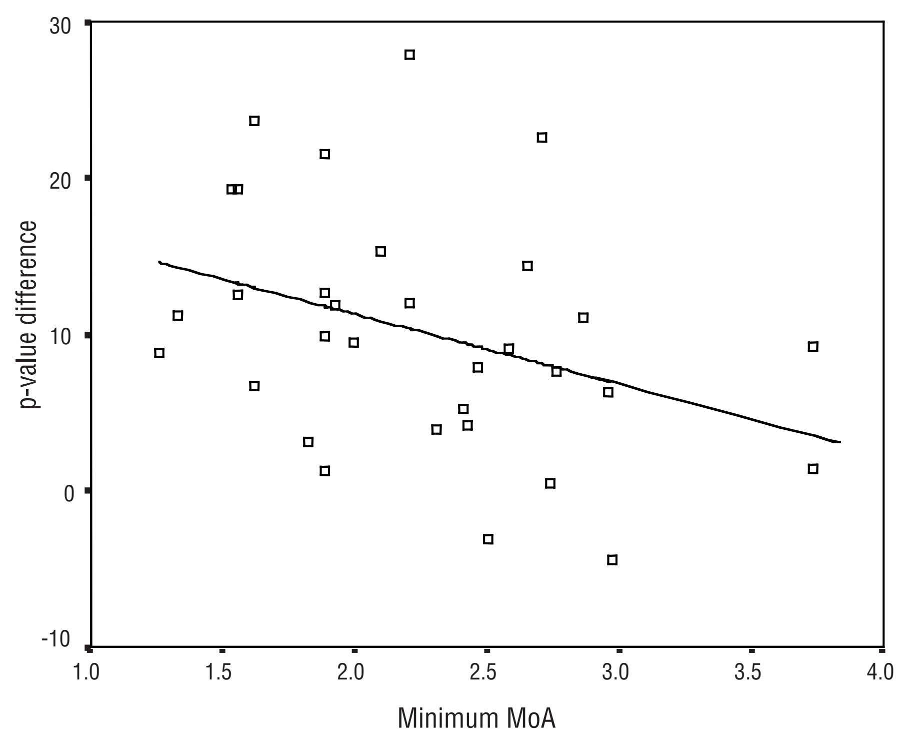


Figure 3
Relation Between MoA (Mode of Acquisition) and the Difference in *p* Value Between Deaf and Hearing Samples, Grade 6



the fifth- and sixth-grade levels, MoA only influences reading comprehension for the deaf children.

The correlation between MoA and the p value of an item could be the by-product of the influence of word frequency. However, no significant correlations were found between word frequency and p values for deaf or hearing students. Moreover, no significant correlations were found between MoA and word frequency, except for the grade 4 test, where higher MoA corresponded to lower frequency, $r = -.37$, $p = .044$.

Discussion

The present study examined whether mode of acquisition and other specific item characteristics influence reading comprehension in deaf students as measured with a standardized multiple-choice reading comprehension test.

Factor analyses were used to determine whether a difference in dimensionality can be found in deaf and hearing students' scores on multiple-choice reading comprehension items and whether this dimensionality could be interpreted as a classification of items that are specifically easy or difficult for deaf and hearing children.

For the hearing students, the factor analyses showed that in grades 2 through 6, reading comprehension could be ascribed to one general reading comprehension factor. This factor explains between 22% and 30% of the variance in reading comprehension.

For the deaf students, we expected to find more than one dimension because they have been found to show difficulties in more than one aspect of reading comprehension. However, the results do not unambiguously point in that direction. Factor analysis for the grade 2 test showed a one-factorial model to adequately describe deaf students' reading comprehension process. For the grade 3 and grade 4 tests, a one-factor model did not fit and the two-factor solutions seemed to be spurious. These results indicate that it is hard to specify and differentially characterize deaf students' reading comprehension in terms of dimensionality. However, for the grade 2 and grade 4 tests, the one-factor model found for hearing students is also applicable to the reading process of the deaf students.

For both the deaf and the hearing test takers, not all variance that can be assumed to be reliable is explained by the one general factor found in the factor analysis. As no group factors were found to explain the remaining variance, it must be assumed that a large proportion of the variance is item specific. Obviously, the Reading Comprehension Tests involve many specific skills and forms of knowledge that cannot be grouped in factors. Explicit testing of an a priori classification of items, with respect to their inherent measure of reading comprehension components, did not point to such factors as determinants of item difficulty nor of differences in performance between deaf and hearing readers.

The results from the distractor analyses show that on some items, deaf test takers preferred a different distractor than hearing test takers when giving an incorrect answer. In second grade, a difference especially occurs on the vocabulary and reference items. In third grade, the difference between deaf and hearing test takers occurs mostly on the inference items. Unfortunately, these results are not compelling enough to make it possible to designate specific factors in reading comprehension.

Overall, the results of the present study point to one general factor in the reading comprehension process for both deaf and hearing children: The supposedly more idiosyncratic development of deaf children does not drastically affect the dimensionality in their reading comprehension process. Moreover, the model for hearing children is presumably also adequate to describe the reading comprehension process of deaf children, indicating that deaf children do not distinctly deviate from hearing children in the process of taking a reading comprehension test. Yet deaf children did score considerably lower than hearing children on the reading comprehension tests discussed in the present study (Wauters, Van Bon et al., 2006). The result that one general factor influences reading comprehension does not preclude the possibility that differences in scores between deaf and hearing children are caused by item differences in MoA. Instead of differences in the dimensionality of reading, differences in MoA may explain the performance gap between deaf and hearing children.

The present study confirmed findings from previous research (Wauters et al., 2003) in which the mean MoA of words in texts was found to increase over grades. Further, the proportion of words in the different classes of the MoA rating scale changed over the grade levels of the test. Over the grade levels, the proportion of mainly perceptually acquired words in the test items decreased and the proportion of mainly linguistically acquired words increased.

Results on the role of MoA showed that at the third- and fourth-grade levels, MoA influenced item scores of deaf and hearing students. The percentage of correct answers decreased as the mean or minimum MoA in an item increased. At the third-grade level, MoA was related to the difference between deaf and hearing students. Deaf students scored lower than hearing students, and when the mean MoA of items increased, the difference between deaf and hearing stu-

dents increased. At the fifth-grade level, MoA influences reading comprehension for deaf students, but not for hearing students. At the sixth-grade level, MoA is only related to the difference in score between deaf and hearing students. Deaf students score higher than hearing students, but this difference decreases when the minimum MoA of an item increases. Interestingly, MoA starts to influence reading comprehension at the third-grade level, when a shift occurs in the test items from containing words acquired mainly through perception to words acquired through a combination of perceptual and linguistic information. At the fourth- and fifth-grade levels, no differences in score occurred between deaf and hearing students, but MoA did influence item scores. At the fourth-grade level, MoA influenced item scores of both deaf and hearing students, indicating that for both groups words that were rated as acquired mainly through linguistic information were difficult to understand. At the fifth-grade level, MoA only influenced deaf students' item scores, indicating that words that were rated as acquired mainly through linguistic information were more difficult for deaf students than for hearing. However, this difficulty did not have repercussions for deaf students' overall score on the test.

Like previous research (Wauters et al., 2003; Wauters, Tellings et al., 2006), the present study found MoA to be a viable construct that influences reading comprehension. In all the analyses in the present study, MoA was the only factor to noticeably influence scores on the items in the Reading Comprehension Tests. Test items from the different test levels were found to show different mean MoA values and different distributions of MoA ratings. Moreover, deaf and hearing students' scores on the items and the difference between deaf and hearing students changed when the MoA value of an item changed. Obviously, the relatively new construct MoA is a relevant factor in reading comprehension and in explaining deaf students' reading comprehension difficulties. However, factors such as morphology and syntax should also be taken into account.

In educating deaf children, it is important to focus on the knowledge of word meanings, since this obviously is a factor in their reading comprehension. Their reading process does not noticeably differ from that of hearing children, but knowing fewer word meanings limits deaf children's understanding.

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CORRECTION TO 2006 REFERENCE ISSUE

The following entry was inadvertently omitted from the 2006 Reference issue of the American Annals of the Deaf in the Programs for Training Teacher section. The American Annals of the Deaf regrets this error.

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Deaf Program Founded: 1980
2005 Graduates: 26; All Graduates: 224