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ABSTRACT

A study examined the relationship of multiple measures of reading and writing at the second and fifth grade levels. Multiple reading tests (measuring vocabulary, word recognition, sentence comprehension, and passage comprehension) and writing tests (evaluating vocabulary diversity and syntactic complexity, and providing qualitative and quantitative measures of spelling and organization) were administered to 256 second grade and 251 fifth grade students. The relationships of these variables were evaluated through the use of canonical correlational factor analysis, with separate analyses performed for each grade level cohort and for two additional cohorts--beginning readers and proficient readers--derived from the original grade level samples. These analyses indicated that the word recognition factors drawn from the reading set were most related to the spelling variables of the writing set at both grade levels. However, substantial differences were apparent across reading level cohorts. For beginning readers, again, the word recognition factor drawn from the reading set was most related to the spelling variables in the writing set. For the proficient readers, the ability to structure prose in complex ways and to use a variety of vocabulary in writing was related to a prose comprehension factor derived from the reading set. (Author/FL)

The Nature of the Reading-Writing Relationship: A Multivariate Approach

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The Nature of the Reading-Writing Relationship: A Multivariate Approach

Abstract

The purpose of this study was to measure the relationship of multiple measures of reading and writing at the second and fifth grade levels. Multiple reading tests (i.e., vocabulary, word recognition, sentence comprehension, passage comprehension) and writing tests (i.e., vocabulary diversity, syntactic complexity, qualitative and quantitative measures of spelling and organization) were administered to 256 second graders and 251 fifth graders. The relationships of these variables were evaluated through the use of canonical correlational factor analyses (separate analyses were performed for each grade level cohort and for two additional cohorts, beginning readers and proficient readers, derived from the original grade level samples). These analyses indicated that the word recognition factors drawn from the reading set were most related to the spelling variables of the writing set at both grade levels. However, substantial differences were apparent across reading level cohorts. For beginning readers, again, the word recognition factor drawn from the reading set was most related to the spelling variables in the writing set. For the proficient readers, the ability to structure prose in complex ways and to use a variety of vocabulary in writing is related to a prose comprehension factor derived from the reading set.

Recently, there has been renewed interest in the nature of the relationship of learning to read and learning to write. One reason for this upsurge in interest has been a fundamental shift in the theoretical orientations of education and psychology (Anderson, Spiro & Montague, 1977; Calfee, 1981; Curtis & Glaser, 1981; Piaget & Inhelder, 1969). Comprehension, remembering, and learning are no longer described as passive activities in which subjects, essentially with accuracy, record traces of external reality in memory. Instead, according to the constructivist notions that currently predominate, individuals construct or create concepts, representations, and knowledge through a variety of active processes (i.e., assimilation and accomodation, schema construction and extension, cybernetic modeling, etc.). Such theories suggest that learners actively employ prior knowledge to comprehend and to produce information. These explanations are in direct counterpoint to more traditional theories of language, in which reading is considered to be a passive process and writing is considered to be an active one (Harste, Burke & Woodward, 1982).

If reading and writing involve analogous cognitive structures or processes, it is possible that instruction in one would lead to increased ability in the other. Learning that occurs because of reading instruction could be useful in engendering writing achievement, and learning obtained through writing could be beneficial to reading development.

This cross-modal impact of instruction could influence cognitive processes or cognitive structures common to both reading and writing. Some aspects of processing presumably shared by reading and writing are the activation and use of

schemata, construction of meaning parameters on the basis of context, and the use of information strategies (Kucer, Note 1). While the possibility seems plausible that processing in one mode might be enhanced directly by instruction in the other, such processes are not easily measured in either reading or writing.

Another possibility is that the cognitive structures common to reading and writing, or the information organized by these structures, could be influenced by cross-modal instruction. Knowledge of phonemic and orthographic components of print, lexical and syntactic information, and prose structures could be learned through either reading or writing, and such learning could be, theoretically, beneficial to both. Unlike the processing overlaps previously mentioned, the relationship of these structural or informational aspects of reading and writing can be measured.

But why is it important to specify and measure these structural-informational components of the reading-writing relationship? First, any understanding of the generalizability or specificity of such knowledge structures could provide a better understanding of language learning. Second, the renewed interest in increasing the amount of writing instruction in the elementary grades (Shanahan, 1979) presents problems for curriculum designers. Amount of writing instruction might be increased by lengthening the school day, or by reducing the amount of instruction offered in other areas of the curriculum, such as reading (Graves, 1978). The most practicable approach to increasing writing instruction, however, probably requires the combination or integration of instruction across the

curriculum. If reading and writing instruction are to be integrated with maximum mutual benefit and efficiency the complex nature of their relationship must be understood.

The purpose of this paper is to measure the relationship of learning to read and learning to write at an elementary school level. It attempts to identify the nature of specific factors of relationship between the cognitive structures common to reading and writing as indexed by several, quality instruments; and to measure the relative magnitudes of these factors. The nature of the reading-writing relationship is compared across grade level (2nd and 5th) and achievement level cohorts (beginning readers and advanced readers).

Previous Research

Previous studies of the relationship of reading and writing have not provided much information that is useful to curriculum designers. Existing research has done little more than measure simple correlations between single components of reading and writing (Shanahan, 1980). The research techniques used in these studies neglect the existence of collinearity between reading and writing measures. Also, these techniques do not permit the delineation of possible multiple outcomes attributable to specific curricular combinations. The nature of the reading- writing relationship needs to be studied through the use of multivariate procedures which permit the relationships of multiple components or factors of reading and writing to be considered simultaneously.

Another way in which the available research is limited is that it ignores the fact that reading and writing are both developmental processes (Brown, 1981; Guthrie & Seifert, 1976; Henderson & Beers, 1981; King & Rentel, Note 2; Singer, 1978). That is, what is learned in reading or writing at one stage of development can be qualitatively different than what is learned at another stage of development. Studies of the reading-writing relationship have rarely considered how the nature of the relationship might change with learning or development. Research is needed which examines the nature of the relationship of reading and writing at various levels of learning and development.

Previous research has not provided a very accurate or complete picture of the reading-writing relationship. Nevertheless, these studies are useful in that they reveal components of reading and writing that might be expected to contribute to a more comprehensive description of the relationship. These studies have found that (1) spelling and reading are related, especially in the primary grades (Horn, 1960; T. Horn, 1969; Spache, 1940); (2) the best writers have the most highly developed reading vocabularies (Maloney, 1967; Vairo, 1976); (3) reading comprehension is related to the syntactic complexity of writing (Brooks, Note 3; Evans, 1977; Heil, 1976; O'Hare, 1973; Stotsky, 1975; Zeman, 1969); and, (4) reading comprehension is related to the structure or organization used in writing (Gordon & Braun, 1982; Stein, 1978). Such variables should be considered in any multivariate examinations of the reading-writing relationship.

METHOD

Subjects

Twelve second grade and nine fifth grade classes from a desegregated school district located in a Mid-Atlantic state participated in this study. To maximize the generalizability of these findings these classes were selected so as to provide heterogeneous samples with respect to sex (52% males at second grade; 50% males at fifth grade); race (second grade: 75% Caucasion, 21% Black, 4% other; fifth grade: 73% Caucasion, 23% Black, 4% other); socioeconomic status (approximately 36% of each sample was drawn from low SES schools, identified on the basis of proportion of students enrolled in Title I programs or participating in government subsidized free lunch programs); and, locale (25% of each sample was drawn from urban areas; the rest from the suburbs). Complete data was obtained from 256 second graders and 251 fifth graders (86% and 90%, respectively, of the original samples).

Standard scores were computed for all measures. Grade level samples were then recombined into achievement level samples on the basis of the grade level equivalency scores obtained on the standardized reading tests. Students were classified as "beginning readers" if the grade equivalent scores associated with their performance on both the phonics and the comprehension tests were 2.5 and below (58 second graders, 4 fifth graders). Proficient readers had grade equivalent scores of 5.0 and above on the comprehension test and 4.0 and above on the phonics test (123 fifth graders, 14 second graders).

Test Instruments

The measures used in this study were chosen so as to provide maximally valid and reliable measures of those variables identified in previous studies as being correlated across the reading-writing sets. These measures were selected to provide an equivalent measurement of reading and writing at the two grade levels.

The following reading tests were administered:

a). The Phonetic Analysis Test of the Stanford Diagnostic Reading Tests (SDRT). Second graders completed the Red Level (alternate form reliability .91) of this test designed to measure the ability to relate initial and final consonant sounds, and medial long and short vowel sounds to their most common spelling patterns. Fifth graders completed the Brown Level (alternate form reliability .86), designed to assess the subjects' abilities to relate various consonant and vowel sounds to the complex spelling patterns used to represent these sounds.

b). The Reading Comprehension Test of the Gates-MacGinitie Reading Tests (GMRT) was administered to the second graders (alternate form reliability .92) and the Reading Comprehension Test of the SDRT (reliability .89) was administered to the fifth graders. These tests require students to answer multiple-choice questions (i.e., literal, inferential) about several reading passages. Comprehension tests were selected from two different batteries for the second and fifth grades because the tests for these grade levels were more similar across, than within, batteries.

c). The Vocabulary Tests of the SDRT and GMRT were administered to the second and fifth graders, respectively. Both tests measure isolated word meaning knowledge through a multiple-choice synonym selection procedure. These tests have reliabilty coefficients of .79 (alternate form) and .92 (KR-20).

d). A "limited cloze test" was designed according to published guidelines (Cunningham & Cunningham, 1978) found to assure high reliabilities (approximately .90). Students were required to read passages taken from out-of-print basal readers, and to replace words, on the basis of context, which had been deleted from these passages. This test served as a measure of sentence level reading comprehension (i.e, understanding of syntactic structures and vocabulary in sentence context (Shanahan, Kamil & Tobin, 1982)).

No standardized achievement tests designed to evaluate children's writing abilities were found that were appropriate for use in this study. Most such tests are really reading measures; they only assess whether students can recognize various writing techniques (such as the "California Achievement Tests", "Comprehensive Tests of Basic Skills," etc.). Any relationships between such measures and reading would be speciously high, because both are based on reading ability. For this reason, two writing samples were obtained from each student. These samples were written in a narrative-descriptive style, for identical audiences (i.e., groups of children of similar age-grade levels). Writing was initiated through the use of line drawings of a girl walking up a wall and a duck talking on a telephone. The two samples obtained from each child were combined for purposes of analysis. These combined stories were analyzed in several ways:

a). Mean t-unit length (average number of words per independent clause with all dependent clauses attached) was used as an index of syntactic complexity. Hunt's calculation procedures (1965) were used. This measure was designed specifically for use with children's writing, and it has proven to provide a reliable estimate of syntactic complexity which is sensitive to development (Loban, 1976; O'Donnell, Griffin & Norris, 1967).

b). The vocabulary diversity of the writing samples was analyzed. This measure was calculated using a formula (Carroll, 1964) designed to assess number of different words (types) used in writing, independent of the effects of fluency (i.e., total number of words used in writing (tokens). An inflected word count was used, as opposed to a lexical one; that is, each word and its various inflected forms were tallied separately.

c). Writing samples were analyzed for organizational structure using the Stein & Glenn story grammar (Stein, 1978). This analysis requires that stories be divided into episodes or events, and that each of these then be divided into as many as six categories of information (i.e., setting, initiating event, internal response, attempt, consequence, reaction). A count was made of the total number of episodes evident in the two stories. Total number of unique categories filled in the two stories (as many as twelve, or six per story, possible) was also counted. Children's stories frequently omit some of these categories of information, and often they instantiate a category several times (Applebee, 1978). For this reason, total number of information units, irrespective of category repetition, was also computed. One of two trained readers

evaluated each story according to these criteria. The interrater reliabilities for number of events, number of categories, and number of information units were .88, .95, and .94.

In addition to these three measures of prose writing ability, each student completed a spelling test devised by the author. These tests were designed according to guidelines used to construct most spelling tests which require writing (Shores & Yee, 1973). These 25-item tests consisted of words selected on the basis of their frequent appearance in children's writing at these grade levels (Rinsland, 1945; Hillerich, 1978), and their relative spelling difficulty (Greene, 1954). In a pilot investigation, these tests were found to have test-retest reliabilities of .87 and .84.

The spelling tests were analyzed in three ways. First, spelling accuracy was measured by counting the total number of words spelled correctly, according to Standard English. Second, the phonemic accuracy of the spellings were analyzed. Each phoneme represented in an orthographically acceptable manner was counted, without regard to position or standard spelling accuracy. For example, three points would be given for any of the following spellings of "fell": "fel," "phel," "phell." Extraneously inserted letters did not influence the scores, nor did reversals across single letter positions. Test-retest reliabilities were .93 and .91 for the second and fifth grades; inter-rater agreement was .98.

Finally, the "visual accuracy" of the spelling performance was indexed as well. Each misspelled word was transformed one grapheme at a time until it conformed with the standard spelling. Each deletion, insertion, and transposition

that was necessary was counted. Test-retest reliabilities were .96 and .88 at the respective grade levels, and inter-rater reliability for this measure was .92. This test provides a qualitative analysis of the degree to which misspellings look like their standard spelling counterparts. All errors were counted, including those of position and order, important aspects of spelling skills not examined in the phonemic accuracy tests (Cahen, Craun & Johnson, 1971). The more errors evident, the higher the student's score. For this reason, the polarity of this variable was reversed so as to prevent the calculation of speciously negative correlations.

Procedures

The author administered all tests to intact classes. No student completed more than two tests per day. No testing or writing session exceeded 50 minutes. All tests were administered over a five week period. The author, and two paid, trained assistants, scored all of the tests.

RESULTS

Means, standard deviations, maximum scores possible, and mean grade equivalents for the second and fifth grade samples are included in Table I.

Insert Table I about here.

Canonical correlational analysis (SAS, 1979) was used to analyze these data. This procedure was employed because it is designed to identify linear relation-

ships between multiple sets of independent and dependent measures. Furthermore, it permits the nature of these relationships to be specified, and it allows the importance (in terms of variance explanation) of the relationships to be evaluated.

Essentially, this analysis extracts factors or principle components from each set of variables. It identifies these principle components or canonical variates in a way that maximizes the amount of between set correlation (i.e., between reading and writing). Those canonical variates identified with the largest amounts of common variance are selected first. Each additional factor is selected in descending order of importance with regard to amounts of variance extracted. These later factors are drawn under the condition that they be orthogonal to factors identified earlier in the analysis.

As with a factor analysis, the nature of the canonical variates are then interpreted on the basis of correlations of the factors with the original variables. Redundancy analysis is also used in order to measure the importance of the factors. Because it is possible to identify statistically significant canonical variates which explain only trivial amounts of variance in the original sets (Cooley & Lohnes, 1971), only those factors that account for 10% or more of the variance of both sets were interpreted. (This also reduces the possibility of interpreting non-replicable factors).

It is expected that the variables from both sets will have a tendency to "pile up" on the first factor. The first factor often smothers later factors in analyses, such as canonical, which extract orthogonal factors with large amounts

of subject variance. Although this tendency towards a single factor can make interpretation difficult, it is not an overwhelming problem. First, this phenomenon does not prevent the measurement of the total amount of cross-set variance; a major interest in this study. Second, the comparison across samples of the factor structures allows a relative interpretation of the nature of the relationships captured by these single factors.

Second Grade

The canonical analysis of the second grade data resulted in the extraction of four canonical relationships. Only two of these relationships reached acceptable levels of statistical significance, and only one of them explained a meaningful amount of variance in both of the test sets ($Rc = .78$, $F = 10.44$, $df = 32$, $p < .0001$). Table III shows the amounts of variance inthe reading and writing sets explained by each of the canonical variates.

Insert Table III about here.

The structure coefficients or factor-variable correlations for this single meaningful factor are reported in Table IV. The first canonical factor loads heavily on all of the reading tests. The phonics test variance was severely limited by a low test ceiling. Nevertheless, this measure provided the maximum contribution to the canonical variate. The use of a word recognition test with a greater amount of achievement variance might have resulted in a greater relative contribution for phonics. Both the sentence and passage level comprehen-

sion tests explained substantial amounts of variance; although the contribution to the relationship of reading vocabulary was relatively small. This factor appears to be a general reading factor, with some emphasis on word recognition ability (i.e, phonics, cloze).

Insert Table IV about here.

Several of the factor structure coefficients on the writing side were high as well. However, the maximum loadings were derived for those tests used to assess spelling ability. The spelling accuracy test, like the phonics test, resulted in surprisingly high scores. Subjects in this sample spelled more accurately than did those in a pilot study. Although this high performance did not appreciably reduce the relationship of spelling with the other variables, it might have artificially enhanced the relationship of spelling with the visual accuracy measure. The visual spelling measure was designed to estimate this aspect of spelling ability at moderate (50%) levels of spelling performance. As more words are spelled correctly, this measure becomes identical to the spelling accuracy measure. Thus, as spelling accuracy increases it will correlate more nighly with the visual spelling measure. Therefore, the overlap of reading and writing at the second grade level is best described as a general reading or word recognition-word production relationship.

Fifth Grade Level

The fifth grade analysis also resulted in the extraction of four canonical factors, only one of which was statistically signficant ($Rc = .78$, $F = 8.70$, $df = 32$, $p < .0001$). The redundancy analysis, see Table III, indicates that this factor accounted for meaningful portions of variance in the two test sets. The factor structure coefficients for this factor are shown in Table IV.

As was found in the second grade analysis, the canonical variates load heavily on all of the reading measures. The only major difference in reading contributions across the grade levels is the substantial increase in the importance of word meaning to the relationship. This increase suggests that a knowledge of word meanings becomes more important to the reading process as children get older.

The loadings of the writing measures on the canonical variate were largely consistent with those derived at the second grade level. However, the grammatical complexity of writing decreased in importance, as did the number of idea units represented in the writing. Although these reductions appear to be sizeable, it must be remembered that they occured with variables that made relatively small contributions to the reading-writing relationship.

No substantial increases or decreases in the loadings of any of the high contribution variables, with the exception of reading vocabulary, occured across grade level samples. The role of spelling was found, again, to be of critical importance to the reading-writing relationship. All aspects of spelling were found to maintain comparatively large relationships with reading.

It is possible that, because both grade level samples represent a full range of performances, the examination of this relationship across grade levels might have obscured actual changes. For example, the relationship of spelling and reading might have its bases in perceptual development at the second grade level and in language development at the fifth grade level (Templeton, 1981). To avoid this possibility, reading level samples were examined. The reading level

analysis was based on smaller numbers of subjects, and more constrained variance sets (i.e., a narrow range of scores on the phonics and comprehension tests were used in the selection process), than was evident in the grade level samples. This sampling procedure was also expected to cause an artifactual reduction in the relative size of contributions for the two selection variables (i.e., phonics, passage comprehension), because of the reduction in variance which occurs for each. Interpretations of the nature of these factors take account of these variance reductions.

Beginning Readers

Subjects (n=62) from the original second and fifth grade samples were placed in the beginning reader sample. To be place in this group subjects had to have grade equivalent scores on the phonics test of less than 2.5; and, on the standardized reading comprehension test, of less than 2.9. These subjects do not represent a specific reading level sample (i.e., "2nd grade reading level"), but instead they represent a general "beginning reading level" population.

The beginning reader analysis uncovered four canonical factors, two of which were statistically significant. Again, only the first of these factors (Rc = .79, F = 2.78, df=32, .0001), explained moderately high proportions of variance in the reading an iting sets (see Table IV).

Insert Table IV about here.

The factor-variable loadings for this relationship are reported in Table V. This factor is clearly a word production (spelling)-word recognition (phonics) factor. Although the sampling procedure, because it reduced the range of scores, produced a reduction in the amount of variance in the phonics and the comprehension tests, the size of the loading of the phonics variable actually increased slightly from the second grade analysis to the beginning reader analysis. Comprehension fell (.27), as expected. The other reading variables were found to contribute less to the relationship for beginning readers than they did for second graders also. Cloze suffered the smallest reduction (.19) and vocabulary declined the most (.32). In addition to these changes in the reading contribution, small changes were apparent in all writing variables. These changes in writing were relatively equal for all variables, and none was very large, so the nature of the relationship was not changed. Spelling maintained its importance to the relationship, in terms of both absolute and relative magnitudes of factor-variable correlations.

Proficient Readers

Subjects (n=137) from the original grade level samples were placed in a proficient reader sample. To be placed in this group subjects had to have grade equivalent scores on the phonics test of greater than 4.7; and, on the standardized reading comprehension tests, of greater than 5.0. These subjects represent a population of "proficient readers."

The proficient reader analysis resulted in the extraction of one significant canonical factor ($Rc = .73$, $F = 4.33$, $df=32$, $p < .0001$). Redundancy analysis

indicated that this canonical factor explained reasonably large proportions of variance in both the reading and writing sets (see Table IV).

The factor-variable loadings (Table V) reveal that the nature of the reading-writing relationship is different for proficient readers than it is for beginning readers, or for fifth graders. Despite a substantial reduction in the comprehension test variance, this variable maintained its importance to the relationship. Comprehension contributed substantially more variance explanation to the relationship for the proficient readers than it did for the beginning readers (a difference in loadings of .24). In fact, there was very little reduction in the magnitude of this loading from the fifth grade sample to the proficient reader sample (.04). Unlike the beginning reader cohort, however, the importance of phonics declined from the grade level sample to the reading level sample; in this case (.18). The difference in the magnitudes of the phonics loadings across reading levels was even more pronounced (.25).

In addition to the stable comprehension loading and the declining importance of phonics found in the proficient reader analysis, it is notable that the cloze test loading was relatively identical to that found in the fifth grade analysis. Also, although vocabulary was found to be less important than it had been in the fifth grade analysis (decrease of .13), it was substantially more important than was evident in the beginning reader analysis (.43 difference in loadings). All of these changes, taken together, characterize this canonical variate as a reading comprehension dimension. It is best described as a prose, sentence and word comprehension factor (this ordering seems to roughly characterize the relative importance of these variables to this factor).

As for writing, the vocabulary diversity variable increased in importance from the fifth grade sample to the proficient reader sample (.14), and vocabulary diversity was relatively more important in the proficient reader analysis than in the beginning reader analysis (.26). The vocabulary diversity variable provided one of the largest contributions to the reading-writing relationship for proficient readers.

Another interesting difference, apparent across these reading level samples, was found for the story grammar variables. Number of episodes and amount of discrete information contributed at approximately the same levels across cohorts (slightly higher in the beginning reader analysis; differences in loadings of .09 and .06, respectively). However, the number of unique information categories instantiated was found to be relatively more important in the proficient reader analysis (.08). For beginning readers, the three story grammar variables contributed to the relationship at approximately equal levels. This difference, although small, suggests that as children's language develops, their ability to structure a variety of unique types of information in their stories is more important to the reading-writing relationship, than is their ability to just represent sheer amount of information. This category instantiation variable was found to be more important in the proficient reader analysis than in the fifth grade analysis (.14) also; indicating that this difference is due primarily to children's increasing sophistication with stories.

Spelling remained important to the relationship, with both spelling accuracy and phonemic accuracy loading heavily on this canonical variate. The loading of

phonemic accuracy declined across the reading level samples (.15). Both the spelling accuracy and the phonemic accuracy variables declined in importance from the fifth grade sample to the proficient reader sample (.08 and .14, respectively).

The canonical variate derived from these writing tests is more generalized than those found in the other analyses. Although spelling still remains important to the relationship its relative importance has declined. As students become better readers, the vocabulary diversity and the structural sophistication of their writing become more important to the relationship of reading and writing. Thus, the reading-writing relationship for proficient readers is best characterized as a prose comprehension-prose production relationship.

Conclusions and Implications

Reading and writing were found to be significantly related in this study at both the second and fifth grade levels. However, suggestions that writing instruction is sufficient to teach reading (Graves, 1978), or that reading instruction is sufficient to teach writing are clearly inappropriate. Despite the use of multiple tests of reading and writing, neither set was found to be sufficient to explain more than 43% of the variance in the opposite set in any of these analyses. Of course, more fully explicated models or equations might lead to the finding of more substantial overlaps between the sets. It should be remembered, however, that measures representing all structural relationships previously discussed were included in this model. It appears that, at any given point of development, reading and writing consist of both dependent and indepen-

dent abilities. It is possible that a combined curriculum could be useful, but the unique aspects of these two components of language probably are best dealt with separately.

The nature of the reading-writing relationship appears to be stable across grade level cohorts. The only difference in the relationship across grade levels was due to the increasing importance of reading vocabulary. This stability, however, could simply be an artifact of the use of analagous, but grade level appropriate measures. Both grade level samples included a full range of performances on all measures; and, thus, may have obscured changes which occur due to learning and instruction.

For this reason, students were combined across grade levels into reading level cohorts. Selection criteria were established so as to create two widely divergent groups; one group essentially made up of beginning readers, the other of proficient readers. The reading-writing relationships derived for these samples were strikingly different. This suggests that as students learn to read, what can be learned about reading from writing instruction, and vice- versa, changes also. Therefore, it seems reasonable to assume that if instruction in these subjects were to be mutually beneficial, the nature of such instruction would need to be varied across achievement levels.

It appears that phonics knowledge is the most important aspect of reading which relates to writing performance for beginning readers. Also, for beginning readers, spelling, of the writing variables, appears to contribute most highly to the reading-writing relationship. The ability to spell accurately and the

ability to apply basic phonics rules in decoding are closely related. If this relationship were found to be causal, it would be expected that, for beginning readers, phonics instruction would have the most substantial impact upon writing achievement and that spelling instruction would have the greatest impact upon reading achievement.

As students become more proficient as readers, the nature of the reading-writing relationship changes. An examination of this relationship for proficient readers reveals an increasing importance of sophisticated vocabulary and story structure to writing achievement, and the increasing importance of the comprehension of larger units of text to reading achievement. This prose production (vocabulary, story structure)-prose comprehension (words, sentences, passages) dimension would have to be exploited with proficient readers if maximum cross domain influences are to be derived.

The fact that the reading-writing relationship changes with reading development, suggests the possibility that writing curricula could be directly integrated into those materials currently employed for the teaching of reading. A program, so designed, would necessarily have to teach some aspects of literacy related only to reading, or only to writing. But in those areas with substantial overlaps, integrated instruction might allow for maximum achievement in reading and writing with maximum efficiency. Future research needs to explore the possibility of these relationships being exploited instructionally.

References

Anderson, R.C., Spiro, R.J., & Montague, W.E. Schooling and the acquisition of knowledge. Hillsdale, NJ: Erlbaum, 1977.

Applebee, A.N. The child's concept of story. Chicago: University of Chicago Press, 1978.

Brown, A. Metacognition: The development of selective attention strategies for learning from texts. In M.L. Kamil (Ed.) Directions in reading: Research and instruction. Thirtieth Yearbook of the National Reading Conference, 1981.

Cahen, L.S., Craun, M., & Johnson, S. Spelling difficulty- a survey of the research. Review of Educational Research, 1971, 41, 281-301.

Calfee, R. Cognitive psychology and educational practice. Review of Research in Education, 1981, 9, 3-73.

Carroll, J.B. Language and thought. Englewood Cliffs, NJ: Prentice-Hall, 1964.

Cooley, W.W. & Lohnes, P.R. Multivariate data analysis. New York: Wiley, 1971.

Cunningham, J.W. & Cunningham, P.M. Validating a limited-cloze procedure. Journal of Reading Behavior, 1978, 10, 211-213.

Curtis, M.E. & Glaser, R. Changing conceptions of intelligence. Review of Research in Education, 1981, 9, 111-148.

Evans, R. The relationship of reading comprehension to written production of transformationally lengthened prose. Journal of Reading Behavior, 1977, 9, 295-300.

Gordon, C.J., & Braun, C. Story schemata: Metatextual aid to reading. In J.A. Niles & L.A. Harris, New inquiries in reading research and instruction. Thirty-First Yearbook of the National Reading Conference, 1982, 261-268.

Graves, D. Balance the basics: Let them write. New York: Ford Foundation, 1978.

Greene, H.A. The new Iowa spelling scale. Iowa City, Iowa: State University of Iowa, 1954.

Guthrie, J.T., & Seifert, M. Letter-sound complexity in learning to identify words. Journal of Educational Psychology, 1973, 65, 9-18.

Harste, J.C., Burke, C.L., & Woodward, V.A. Children's language and the world: Initial encounters with print. In J.A. Langer & M.T. Smith-Burke (Eds.), Reader meets author/Bridging the gap. Newark, DE: International Reading Association, 1982.

Heil, H. Development of selected language variables in two modes of writing and their relationship to reading comprehension in the primary grades. (Doctoral dissertation, Hoftstra University, 1976). Dissertation Abstracts International, 1977, 38, 137-A. (University Microfilms No. 77-13727).

Henderson, E. & Beers J. Developmental and cognitive aspects of learning to spell. Newark, DE: International Reading Association, 1980.

Hillerich, R.L. A writing vocabulary of elementary children. Springfield, IL: Charles C. Thomas Publishers, 1978.

Horn, E. Spelling. In C.W. Harris (Ed.) Encyclopedia of educational research (3rd ed.). New York: Macmillan, 1960.

Horn, T.D. Spelling. In C.W. Harris (Ed.) Encyclopedia of educational research (4th ed.). New York: Macmillan, 1969.

Hunt, K.W. Grammatical structures written at three grade levels. Champaign, IL: National Council of Teachers of English, 1965.

Loban, W. Language development. Urbana, IL: National Council of Teachers of English, 1976.

Maloney, H.B. An identification of excellence in expository composition performance in a selected 9A population with an analysis of reasons for superior performance. (Doctoral dissertation, Columbia University, 1967). Dissertation Abstracts, 1968, 28, 3564-A. (University Microfilms order No. 68-3551).

National Assessment of Educational Progress. Writing achievement, 1969-79: Results from the third national writing assessment. Denver, Colorado: Education Commission of the States, 1980.

O'Donnell, R.C., Griffin, W.J., & Norris, R.C. Syntax of kindergarten and elementary school children: A transformational analysis. Urbana, IL: National Council of Teachers of English, 1967.

O'Hare, F. Sentence-combining. Urbana, IL: National Council of Teachers of English, 1973.

Piaget, J., & Inhelder, B. The psychology of the child. New York: Basic Books, 1969.

Rinsland, H.D. A basic vocabulary of elementary school children. New York: Macmillan, 1945.

SAS. Statisical analysis system user's guide. Raleigh, NC: SAS Institute, 1979.

Shanahan, T. The writing crisis: A survey and solution. Phi Delta Kappan, 1979, 61, 216-217.

Shanahan, T., Kamil, M.L., & Tobin, A.W. Cloze as a measure of intersentential comprehension. Reading Research Quarterly, 1982, 17, 229-255.

Shores, J.H., & Yee, A.H. Spelling achievement tests: What is available and what is needed. Journal of Special Education, 1973, 7, 301-309.

Singer, H. Research in reading that should make a difference in classroom instruction. In S.J. Samuels (Ed.) What research has to say about reading instruction. Newark, DE: International Reading Association, 1978.

Spache, G. Characteristic errors of good and poor spellers. Journal of Educational Research, 1940, 34, 182-189.

Stein, N.L. How children understand stories: A developmental analysis. Technical Report No. 69, Center for the Study of Reading. Urbana, IL: University of Illinois, 1978.

Stotsky, S.L. Sentence combining as a curricular activity: Its effect on written language development and reading comprehension. Research in the Teaching of English, 1975, 9, 30-71.

Templeton, S. Spelling, phonology, and the older student. In E.H. Henderson & J.W. Beers (Eds.), Developmental and cognitive aspects of learning to spell. Newark, DE: International Reading Association, 1980.

Vairo, F.M. Relationship between story writing skills and achievement in other selected language skills. (Doctoral dissertation, University of Pittsburgh, 1976). Dissertation Abstracts International, 1976, 37, 1059-A. (University Microfilms No. 76-19936).

Zeman, S.S. Reading comprehension and writing of second and third graders. Reading Teacher, 1969, 23, 144-150.

Reference Notes

1. Kucer, S.B. Using text comprehension as a metaphor for understanding text production: Building bridges between reading and writing. Paper presented at the National Reading Conference, Dallas, 1981.

2. King, M.L., & Rentel, V. Toward a theory of early writing development. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, 1979.

3. Brooks, G. An investigation of the relationship of syntactic complexity to reading comprehension. Paper presented at the Annual Meeting of the International Reading Association, Miami, 1977.

TABLE 1. Means, standard deviations, maximum score possible, and mean grade equivalents for second grade sample (n=256) and fifth grade sample (n=251).

MEASURES	SECOND GRADE				Fifth Grade			
	M	SD	Max. Possible Score	Mean G.E.	M	SD	Mean Possible Score	Mean G.E.
Writing Set								
Vocab. Diversity	3.62	.75			5.15	.89		
Avg. t-unit length	6.92	1.82			8.41	1.29		
No. of Episodes	2.76	1.18			5.93	2.57		
No. of Story Categories	6.28	1.84	12		9.08	1.42	12	
No. Info. Units	7.52	3.22			16.63	6.26		
Spelling Accuracy	19.04	6.16	25		12.92	7.37	25	
Phonemic Accuracy	88.35	9.50	93		132.89	11.77	141	
Visual Accuracy	10.39	14.78			24.08	23.22		
Reading Set								
Phonics	37.65	3.29	40	2.5	24.20	7.89	36	5.8
Comprehension	26.70	7.32	40	2.8	37.47	14.46	60	5.7
Cloze Test	15.74	6.96	25		22.36	12.45	50	
Vocabulary	29.17	4.31	36	2.3	26.36	8.26	46	5.2

TABLE 11. Redundancy analysis, second and fifth grade samples. Proportions of variance in original test sets explained by their own canonical variables and by the opposite canonical variables.

SECOND GRADE

	READING		WRITING	
FACTOR	OWN	OPPOSITE	OWN	OPPOSITE
1	.70	.42	.39	.23
2	.12	.01	.05	.00
3	.10	.00	.05	.00
4	.08	.00	.12	.00
TOTAL	1.00	.43	.60	.24

FIFTH GRADE

	READING		WRITING	
FACTOR	OWN	OPPOSITE	OWN	OPPOSITE
1	.57	.31	.34	.18
2	.15	.02	.10	.01
3	.15	.01	.10	.01
4	.13	.00	.06	.00
TOTAL	1.00	.33	.60	.20

TABLE III. Canonical factor structures - grade 2 and grade 5 samples. Correlations of reading and writing variables with canonical variables.

	2nd GRADE		5th GRADE	
MEASURES	Canonical Variable-Reading	Canonical Variable-Writing	Canonical Variable-Reading	Canonical Variable-Writing
Writing				
T-Unit	.32	.41	.19	.25
Vocabulary Diversity	.46	.59	.47	.60
Episodes	.25	.32	.20	.26
Categories	.37	.48	.33	.43
Information Units	.36	.46	.24	.30
Spelling	.74	.95	.71	.92
Phonemic Accuracy	.60	.77	.67	.86
Orthographic Accuracy	.69	.89	.68	.88
Reading				
Comprehension	.81	.63	.79	.61
Cloze	.86	.66	.80	.62
Vocabulary	.65	.51	.89	.69
Phonics	.88	.68	.85	.66

TABLE IV. Redundancy analysis, beginning reader and proficient reader samples. Proportions of variance in original test sets explained by their own canonical variables and by the opposite canonical variables.

BEGINNING READERS

	READING		WRITING	
FACTOR	OWN	OPPOSITE	OWN	OPPOSITE
1	.56	.35	.44	.28
2	.15	.02	.06	.01
3	.12	.00	.06	.00
4	.16	.00	.11	.00
Total	1.00	.37	.67	.29

PROFICIENT READERS

	READING		WRITING	
FACTOR	OWN	OPPOSITE	OWN	OPPOSITE
1	.56	.27	.34	.17
2	.20	.02	.09	.01
3	.11	.01	.12	.01
4	.13	.00	.09	.00
Total	1.00	.30	.64	.19

TABLE V. Canonical factor structures - beginning reader and proficient reader samples. Correlations of reading and writing variables with canonical variables.

MEASURES	BEGINNING READERS		PROFICIENT READERS	
	Canonical Variable-Reading	Canonical Variable-Writing	Canonical Variable-Reading	Canonical Variable-Writing
Writing				
T-Unit	.15	.21	-.01	-.01
Vocabulary Diversity	.38	.48	.54	.74
Episodes	.38	.48	.27	.37
Categories	.38	.49	.41	.57
Information Units	.39	.50	.32	.44
Spelling	.64	.81	.61	.84
Phonemic Accuracy	.69	.87	.53	.72
Orthographic Accuracy	.76	.96	.42	.58
Reading				
Comprehension	.54	.42	.78	.57
Cloze	.67	.52	.82	.60
Vocabulary	.33	.26	.76	.55
Phonics	.92	.72	.67	.49