Analysis and Comparison of the Theoretical Model of the Relationship between Reading and Writing

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Abstract. This study compares and evaluates three alternative theoretical models of the relevant writing relationships. The reading dimensions of this model include components of understanding of places and parts. Dimensions include components of spelling, vocabulary, word structure, and story structure. These models differ with respect to the order in which the dimensions of reading and writing are related. The interactive model allows the use of reading knowledge in writing, and vice versa. Other models (read-to-write; write-to-read) only allow knowledge to move in one direction. These models are evaluated based on the model. The ability to explain the relationships found in the extensive corpus of reading and collecting data from 256 second graders and 251 fourth graders. The interactive model fits the data better than the read-to-write model at the second grade level and the write-to-read model at both grade levels and the read-to-write model are superior to the write-to-write model. Specific relationships are examined and pedagogical implications.

Keywords: Analysis, Model Comparison, Reading, Writing.

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INTRODUCTION

This study compares and evaluates several theoretical models of the relationship between reading and learning to write in the second and fourth grades. The model is evaluated on its ability to explain the relationships found in extensive reading and writing data sets. Each model includes variables that represent word recognition, understanding of words and parts, spelling, syntax, vocabulary, and story structure knowledge but differ in the order of the variable causal relationships. This study is unique in that it hypothesizes and evaluates the systematic order of the relationships between reading and writing variables.

Recently, theorists and curriculum specialists have drawn increasing attention to the reading-writing relationship. They have sought a more thorough understanding of this relationship because of the important implications it can have for many instructional and psychological problems. An understanding of relationships can ultimately lead to the design of more efficient combinations of reading and writing curricula. Such research can enhance theoretical understanding of the use of knowledge and generalizations and the development of other components of processing that are important in reading and writing transactional schemas and theories.

Previous studies on the connection between reading and writing were theoretical (Mosenthal, 1983). The majority of research on the association has not included hypotheses or explanations of the process that went beyond the individual hypotheses examined in the specific studies. This is partially due to the failure of this study to view reading and writing as a collection of interconnected activities that draw on many knowledge bases. Previous studies have frequently described the relationships in terms of the individual reading and writing components. These studies provide an estimate of the amount of effect that one component of reading or writing has on the other, but they do not offer any guidance as to how these effects spread to other facets of the respective process.

There was previous study from Shanahan, T & Lomax, R.G. their research found that three different theoretical theories of the connection between reading and writing were examined and assessed. These models' reading dimensions included elements for word analysis, vocabulary, and passage and sentence comprehension. The reading-to-writing model was superior to the writing-to-reading model, and the interactive model fit the data more closely than the writing-to-reading model and the reading-to-writing model at the second grade level. The consequences for pedagogy and research are discussed after examining certain linkages. However, this study the interactive model allows the use of reading knowledge in writing, and vice versa. Other models (read-to-write; write-to-read) only allow knowledge to move in one direction. These models are evaluated based on the model. The ability to explain the relationships found in the extensive corpus of reading and collecting data from 256 second graders and 251 fourth graders.
Therefore, by defining and examining alternate theoretical theories of the link between reading and writing, this study builds on prior research. These models stand out because they are transparent about the relations' sequential orderings and the mediating impacts between the reading and writing parts. The Shanahan (1984) data source is used in this study to assess the different relational orderings that are described in each model.

Previous investigations into the reading-write relationship have become theory. Most studies of relationships do not require a hypothesis or process description that goes beyond the specific hypothesis tested in a particular study. This is partly because this study has failed to treat reading and writing as a constellation of interrelated processes that make use of a number of knowledge bases. Prior research has often defined relationships in terms of single component reading and writing. Such studies estimate the amount of influence one aspect of reading or writing can exert on another, but they do not suggest. Preceding or replacing the use of lower level knowledge, the more typical sequence of events in children's reading seems to be that lower level processes serve as enabling devices for higher levels (Baumann, 2003).

Writing processing also occurs in a forward direction in interactive models. However, this is based not on the lingering knowledge of the writing process rather on attempting to describe writing in a way analogous to that used for reading. Attempts to describe the cognitive events of writing are still in their infancy (Cooper & Matsuhashi, 2003; Hayes & Flower, 2004). These efforts have not resulted in a clear specification of the sequence of children's writing development. Until a more explicit theory of writing is proposed, this seems the most plausible approach. The magnitude of the relationship will be influenced to some extent by the nature of the operational definitions of reading and writing. To maximize the possibility of identifying the overlap between reading and writing, processes have been defined in analog terms.

The most important aspect of interactive modeling is the cross-dimensional nature of the relationship between reading and writing. At the level of discourse, influence comes from reading to writing. For example, word analysis can affect spelling, but knowledge of spelling is not expected to have a major impact on word recognition; this means that students must be able to interpret the meaning of a word before they can represent that meaning in a written text. On the other hand, writing affects the reading process across levels of discourse. According to this model, lower levels of written knowledge affect higher reading knowledge. The writing component directly affects the reading component immediately above it, and it affects the higher reading component through this direct connection. Knowledge of spelling, for example, can influence vocabulary knowledge in reading, and through this relationship the edge of spelling knowledge can be used in the interpretive process of reading comprehension. Although no one previously proposed a combination of these variables in this order, the order is consistent with the description of the relationship (Freedman & Calfee, 2004; Goodman & Goodman, 2005) where reading ability precedes writing ability but writing is able to inform reading.
The second model is reading to write model, contains the same read and write components, ordered in the same way as in the interactive model. It differs from the most active model, however, all the relationships between the read and write variables come from reading to writing. This model theorizes that reading knowledge can influence writing but no writing knowledge is useful or influential in reading. This model seems to be a plausible characterization of many learning programs. This is evidenced by the lack of writing instruction available in many schools. Traditional senior composition classes are usually preceded by several years of reading and literature training. This instructional approach ensures that reading can have a strong impact on writing, but severely limits the possible effect of writing on reading.

The final model is writing to read model, again includes the same read and write components and relationships in the same process as the model previously described. In this model, however, writing is expected to affect reading, but reading does not affect writing. This model attempts to capture the essence of the theories which state that the development of writing may or does precede the development of reading (Chomsky, 2004; Giacobbe, 2015). Again, none of these theories explicitly concern the ability of the reading and writing components or the sequence of relationships, but they all postulate that writing can be learned prior to the acquisition of reading knowledge. Thus, this model characterizes the general order of development described by these theories, rather than the specific sequence of relationships among the variables proposed in these theories. In contrast to the structure of the interactive model, in this model writing knowledge affects aspects of reading knowledge at an equal and higher level of discourse.

**RESEARCH METHOD**

Twelve grade two and nine grade four participated in this study. These classes represent a heterogeneous sample with respect to race (75% white, 21% black, 4% other), gender (50% male), and socioeconomic status (SES; 36% of schools with SES low). Complete data were obtained from 256 second grade students and 251 grade IV students.

**Test Equipment and Techniques**

The variables that were determined to be associated across the reading-writing sets in earlier research were measured using a set of criteria that maximized validity and reliability. At the two grade levels, measurements were chosen to offer an equal measurement of the reading and writing components. These tests had a comparable structure and demanded the same behaviour from the subjects. To offer the most comparable measurement across grade levels, measurements for the same latent trait in certain instances were taken from various test batteries. This strategy was used to ensure that the results at the two grade levels could be compared and to optimize the magnitudes of the connections.

The reading assessments given to second graders included the Gates-MacGinitie Reading Tests (GMRT), the Stanford Diagnostic Reading Tests (SDRT), the Phonetic Analysis Test, the Vocabulary Test, and a limited cloze test in which students had to replace words from lists that had been removed from passages that...
were appropriate for their grade level. Students in the fifth grade took the SDRT's Phonetic Analysis Exam, Reading Comprehension Test, GMRT's Vocabulary Test, and a restricted cloze test. Each participant was required to take a spelling exam that was appropriate for their grade level. The results were evaluated for standard English spelling correctness, phonemic accuracy, and visual accuracy. Each subject produced two short stories, which were examined for vocabulary variety, mean t-unit length (average number of words per independent sentence with all dependent clauses connected), and the presence of different narrative grammar characteristics (Gregg & E. R. Steinberg). Table 1 contains a list of the latent variables used in the models. This table lists the tests or measurements that served as latent variable indicator variables. Shanahan (1984) provides further information on the actual metrics (validity, reliability, etc.) and the data gathering techniques.

RESULT AND DISCUSSION

Maximum likelihood estimates of the relationships between latent variables in the interactive, read-to-write, and write-to-read models are summarized, respectively. Of the three, interactive models generally provide the best fit for this data, based on the chi square fit index. It was superior (i.e., statistically at the .05 level) to the non-interactive model, in both classes,

<table>
<thead>
<tr>
<th>Model Type</th>
<th>X^2 (df, N)</th>
<th>P &lt; .05</th>
<th>RMSR</th>
<th>AGFI</th>
<th>Non-Interactive Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fourth grade</td>
<td>225.27</td>
<td></td>
<td></td>
<td>.131</td>
<td></td>
</tr>
<tr>
<td>Non-Interactive Model</td>
<td></td>
<td>P &lt; .05</td>
<td>RMSR</td>
<td>AGFI</td>
<td></td>
</tr>
<tr>
<td>Fourth grade</td>
<td>121.18</td>
<td>.082</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourth grade</td>
<td>236.85</td>
<td></td>
<td></td>
<td>.135</td>
<td></td>
</tr>
<tr>
<td>Second grade</td>
<td>127.72</td>
<td>.096</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second grade</td>
<td>249.49</td>
<td></td>
<td></td>
<td>.158</td>
<td></td>
</tr>
</tbody>
</table>

In all three models, much better fit was achieved at the fourth grade than at the second grade level. The exception is that although the most active model is superior to the read-to-write model at the grade two level, both models fit the data roughly equally well at the fourth grade level. It is likely that this is due to a lack of direct instruction in writing beyond the basic skill level (National Assessment of Educational Progress, 1981). If students do not reach a higher level of writing competence, one would expect writing to provide a little knowledge that can be applied to reading.
Test Instruments and Procedures

Table 1. The Result of Normality Test

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unstandardized Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>85</td>
</tr>
<tr>
<td>Normal Parameters</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.1996419</td>
</tr>
<tr>
<td>Absolute</td>
<td>0.002</td>
</tr>
<tr>
<td>Most Extreme Differences</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>0.078</td>
</tr>
<tr>
<td>Negative</td>
<td>-0.002</td>
</tr>
<tr>
<td>Test Statistic</td>
<td>0.003</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.209</td>
</tr>
</tbody>
</table>

The measure used in this study was chosen to provide a maximally valid and reliable measure of the variables identified in the previous study as being correlated across reading-writing devices. Measurements were chosen to provide equivalent measurements of the reading and writing components at two grade levels. These measures are similar in design and require the same action on the part of the subject. In some cases, Actions representing the same latent trait were taken from different test batteries to provide the most similar measurements across grade levels. This approach is taken to maximize the magnitude of the ship relation and to ensure comparability of the results at two slope levels.

Second graders complete the following reading tests: Phonetic Analysis Test of the Stanford Diagnostic Reading Test (SORT); Reading Comprehension Test from the Gates-Mac Genitive Reading Test (GMRT); Vocabulary test from SORT, and a limited cloze test in which the subject substitutes a word, from a list, that has been removed from the section corresponding to the grade level. Fourth graders complete the SORT Phonetic Analysis Test; SORT Reading Comprehension Test; GMRT Vocabulary Test; and limited cloze test. Each subject was asked to complete a spelling test corresponding to the grade level analyzed for standard English spelling accuracy, phonemic accuracy, and visual accuracy. Each subject wrote two stories which were analyzed for mean t-unit length (mean number of words per independent clause with all dependent clauses), vocabulary diversity, and presence of various grammatical features of the story. The latent variables included in the listed model indicate which test or measure is used as the indicator variable of the latent variable.

Analysis

In path analysis, a model is constructed which hypothesizes a causal relationship among a set of variables. A multiple linear regression equation is derived for each dependent variable in the model and consists of the variables that are believed to affect a particular dependent variable. The implicit assumption of path analysis is that the variables are measured without error, in terms of reliability and validity, which are unlikely for variables normally considered in educational or psychological research. Estimates obtained from models with incorrect
measurements may be biased. The logical solution is to get some measure of each hypothetical component or construct in the model. The methodology used is known as the linear structural relationship (LISREL) model developed by Joreskog. The LISREL model consists of a structural equation model and a measurement model. Structural equation models describe the theoretical relationship between components or hypothetical constructs that cannot be observed, known as latent variables, through a series of generalized linear equations (e.g., • path analysis model). The measurement model considers a latent variable as a linear combination of a set of observable indicator variables.

Multiple indicator variables are used to allow the assessment of measurement error (i.e., enhancement of the measurement of a hypothetical construct via the factor analytic model). Subjects were tested on all indicator variables, and a correlation matrix of these indicator variables was created for each class. The L1SREL VI computer program was then used to evaluate a hypothesized process-component model of the read-write relationship. LISREL analysis results in calculating the maximum likelihood estimate of the relationship between latent variables. This structure coefficient is proportional to the nonstandard regression weight. The overall purpose of LISREL analysis is to best reconstruct the observed correlation matrix by applying a theoretical structure to the data. The smaller the residual difference between the observed correlation matrix and the correlation matrix reconstructed based on the defined structure, the better the fit for a particular model. One model fit index is the chi-square fit test, the result of which is a direct function of sample size. For large samples, "good fit" (ie, where the chi-squared value approaches the number of degrees of freedom) usually cannot be found using this index, even though the residue may be substantially zero. For small samples, many competing models can produce a "good fit." The use of the chi-square statistic is to compare models. For example, a new model can be tested against the original model by changing the parameters in the original model. The new model will prove to be a better fit than the original model if the decrease in the chi-squared value is large compared to the difference in degrees of freedom. One index that is not related to sample size is the root mean square residual (RMSR), which is a measure of the correlation of the mean residuals. The second index unrelated to sample size, which also adjusts for the degrees of freedom of the model, is the adjusted index of conformity (AGFI). AGFI theoretically scales between zero and one and is a measure of the relative number of correlations recorded by the model.

DISCUSSION

In the interactive model, all but three hypothesized read-write relationships were positive and significantly different from zero (p <.05). Spelling does not significantly affect reading vocabulary at the second grade level; syntax does not significantly affect reading comprehension at the fourth grade level; and reading comprehension did not significantly affect the story structure at the fourth grade level. The relationships in the reading dimensions of the interactive models are similar to those found in other reading development studies. Knowledge of word analysis has a stronger influence on the reading comprehension ability of second
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Graders than does fourth graders. This is indicated by the sizeable differences in the direct effect of word analysis on understanding and the effect of word analysis on vocabulary knowledge. Vocabulary knowledge is more involved in reading comprehension of older children than is younger children. All of the in-reading relationships of the interactive model are similar in absolute and relative quantities to those of the write-to-read model. This also applies to the reading-to-write model, except that, surprisingly, word analysis has a greater effect on fourth graders' vocabulary knowledge than second graders. The maximum likelihood estimate that summarizes the relationships in the writing dimensions of the three models (when considered with their respective standard errors) is somewhat smaller than the in-reading relationship.

In all models, spelling was more related to the vocabulary diversity of fourth graders than to second graders, although only in the write-to-reading model this difference was significant. Vowel diversity was found to exert a significantly greater effect on the syntax of second grade students than in fourth grade in all three models, although it should be noted that this effect is not significant at the fourth-grade level in the reading-to-writing model. For all three models, the direct effect of vocabulary diversity on story structure was greater for fourth graders than for second graders. Finally, the effect of syntax on the story structure of subjects at both grade levels, in all three models, was negative, although this relationship only differs significantly from zero for second graders in interactive learning and reading-to-writing model. The weak syntactic association with reading is a surprise given the findings of previous studies. However, the scores obtained from these measures were similar to those reported in previous studies of students at the same grade level in terms of means, variants, and simple correlations of these variables with standard comprehension tests. The r-unit measure appears to correlate so well with nearly all of the other writing variables that when these other variables are available in the analysis it becomes redundant.

The relationship between reading and writing reveals some differences between the models. The analysis-word or spelling relationships strong at all grade levels and in all models. Although the relationship appears to be strongest in the write-to-read model, the knowledge of spelling influences word analysis, the comparison of the approximate ratio to standard error reveals that it is actually only slightly stronger than the other models. This small difference may be a reflection of a two-stage model in which children in word recognition and spelling begin to use less phonetic knowledge and more visual information. Spelling requires closer attention to visual information, which in turn can affect word recognition abilities. The reading-vocabulary / writing-vocabulary relationship was higher when reading preceded writing, which shows the importance of reading for this aspect of writing development. Likewise, the effect of comprehension on syntax is superior to that of syntax on comprehension, again highlighting the importance of reading in writing growth. The relationship between spelling and reading vocabulary was higher for fourth graders than for second graders, regardless of the order of the relationship. This increase may be due to the fact that the orthographic structure of words studied in the upper grades often reflects word meaning relationships (for example, declared - declaration) rather than correspondence of simple sound symbols.
CONCLUSION

The writing-to-reading model and the reading-to-writing model both performed a better job of summarizing the linkages, it must be recalled that the interactive model was superior to both, especially at the second-grade level. The conventional method of curriculum design and instruction (i.e., years of reading instruction before the introduction of writing) appears to be unduly wasteful in light of this discovery, it would seem. Such a method falls short of utilizing chances for information exchange in both directions. Contrary to conventional wisdom, our findings imply that writing should be introduced right after reading instruction sentences. The fact that the reading-to-writing model comes close to the interactive model in terms of goodness-of-fit at the fifth-grade level shows how crucial it is to support kids in achieving high levels of writing competency in the early grades.

REFERENCES


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