Acquisition and retention of written words by kindergarten children under varying learning conditions

JUDY RASH
Coquitlam School District
TERRY D. JOHNSON
NORMAN GLEADOW
University of Victoria

INVESTIGATES the effect of word acquistion by kindergarten children under two conditions of instruction: an isolated-word condition and a word-sentence condition. A review of the literature reveals inconclusive and contradictory findings. Previous studies in the area tend to introduce a teach/test bias, use oral rather than written contexts, and measure only immediate learning. The original contribution made by this study is that all words presented to the subjects were target words in written forms. In addition the teach/test bias was eliminated and the long-term retention period extended considerably. Results indicate that kindergarten children learn words in significantly fewer trials when the target words are presented in a meaningful sentence. When short-term retention was tested in a sentence condition, children learning via this method were significantly superior to children learning via an isolated word method. When tested in an isolated word condition, in new context, and on word designation tasks, no significant differences were noted between the two groups. The same pattern of results was obtained in tests of long term retention.

Acquisition et mémoire de mots écrits chez les enfants de maternelle qui apprennent dans des conditions différentes

CETTE ÉTUDE examine l'effet d'acquisition de mots par des enfants de maternelle dans deux conditions d'instruction: une condition de mots isolés et une condition de mots placés dans une phrase. Un examen des écrits concernant le sujet révèle des découvertes peu concluantes et contradictoires. Les études préalables dans ce domaine tendent à introduire un parti pris pour l'enseignement à travers les tests, à utiliser un contexte oral plutôt qu'écrit, et à mesurer seulement ce qui est appris sur le moment. La contribution originale faite par cette étude est que tous les mots présentés aux sujets étaient des mots cible sous forme écrite. De plus le parti pris pour l'enseignement à travers les tests était éliminé et la période de mémoire à long terme considérablement accrue. Les résultats ont indiqué que les élèves de maternelle apprennent les mots à la suite de beaucoup moins d'essais lorsque les mots cible sont présentés dans une phrase qui a un sens. Lorsque la mémoire à court terme était testée dans une condition de phrase, les enfants apprenant à travers cette méthode étaient considérablement supérieurs aux enfants apprenant à travers une méthode de mots isolés. Lorsqu'ils étaient testés dans une condition de mots isolés, dans un nouveau contexte, et des tâches de désignation de mots, aucune différence significative n'était remarquée entre les deux groupes. Le même modèle de résultats était obtenu pour les tests de mémoire à long terme.

Conocimiento y retención de palabras escritas por niños de kindergarten bajo diferentes condiciones de aprendizaje

SE INVESTIGO EL EFECTO de conocimiento de palabras por niños de kindergarten, bajo dos bases de enseñanza: la categoría palabra aislada y la categoría palabra-oración. Un análisis de la literatura de investigación revela resultados inconclusos y contradictorios. Estudios previos en el área, tienden a introducir el prejuicio de instrucción-test, utilizan

un contexto oral en vez del escrito, y solamente miden aprendizaje inmediato. La contribución original de este estudio estriba en que el total de palabras presentadas a los niños, eran palabras de objetivo concreto en forma escrita. Además, se eliminó el prejuicio de instrucción-test y el período de retención de largo plazo fue extendido considerablemente. Los resultados indican que niños de kindergarten aprenden palabras con menos tanteo cuando las palabras de objetivo concreto se presentan en una oración con significado. Cuando se evaluó la retención de corto plazo en la categoría de oración, los niños aprendiendo con este método eran significativamente superiores a los niños aprendiendo con el método de palabra aislada. Cuando se evaluó en la categoría de palabra aislada, en contexto nuevo, y en una actividad de designación de palabras, no se notaron diferencias significativas entre los dos grupos. Se obtuvo la misma configuración de resultados en tests de retención de largo plazo.

The question of the cues children employ when learning to read and the effective presentation of new words to beginning readers has been a topic of debate for more than three decades. Two reading theorists who represent extreme positions in the discussion are Samuels and Goodman.

Samuels states that the student will try to get the meaning of a sentence using the easiest means possible. If prompts in the form of accompanying pictures or sentence context are present and represent an easier route to meaning then the reader will use them and thus be distracted from the word to be learned (Singer, Samuels, & Spiroff, 1974). Samuels's focal attention hypothesis states that for a word to be learned it must be the focus of the reader's attention. Anything that distracts attention from the word, such as pictorial aids or strong sentence context, will interfere with learning the word. It seems reasonable to assume that a teacher adopting Samuels's hypothesis would teach new vocabulary in isolation. Goodman (1969) argues that syntactic and semantic cues provided by the context are vital sources of information in reading. The reader is said to sample the visual information available, combine this with the contextual information and his/her intuitive knowledge of how language is composed and make tentative hypotheses as to the meaning of the text. Further reading involves the testing of these hypotheses and the formation of new ones. Forcing the reader to rely on visual cues alone makes his/her task more difficult. A teacher adopting Goodman's hypothesis might reasonably assume that new vocabulary should be introduced in a meaninful context (Goodman, 1971).

Investigations into acquisition and retention of new words under varying conditions of presentation are plentiful. Prominent in the literature are Samuels's two studies (1966, 1974) comparing word and picture methods with beginning readers which led him to accept his focal attention hypothesis: that any stimuli other than the target word disrupts the learning of the word and "less capable students (are) more distracted by the stimuli than the more capable students" (Samuels, 1967, p. 341).

Controversial studies by Montare, Elman, and Cohen (1977), Dollinger and Walker (1978), and Arlin, Scott, and Webster (1978, 1979), led these investigators to reach conclusions that contradict Samuels's position. However, since 1978-1979 Arlin et al. have failed to replicate their original findings and reported support for the focal attention hypothesis.

Introducing oral context to the issue, Hartley (1970) concluded that different presentation methods are suitable for different list types; word-oral context was most successful with maximal contrast words and word-alone was most successful with minimal contrast words. Singer, Samuels, and Spiroff (1974) found that Grade 1 students learned words printed in an artificial alphabet more readily when presented in isolation than when presented with a picture cue or in a sentence printed in standard orthography with or without a picture cue. Wood (1976) reported that Grade 1 subjects in a sentence-context group learned eight new words in significantly fewer trials than subjects taught by a word-alone or a word-picture method. No significant differences were found on word-picture

or story-context tests of retention but a teach-test bias was revealed in that both the isolated-word group and the sentence-context group performed significantly better in the condition that matched their instructional mode.

Ehri and Roberts (1979) found that context-trained subjects remembered more about the syntactic/semantic qualities of printed words, whereas isolation-trained subjects remembered more about the orthographic identities of words. Ehri and Wilce (1980) reported these same results with first-grade students learning function words. However, their subjects had previous knowledge of the reading process in that only 6 of the 40 subjects recognized none of the target words on the pretest; both groups were given access to target word meaning; and post-testing time varied for the subjects.

Several studies, however, support the conclusion that even young readers do use context to aid in word identification. Samuels (1966) found that Grade 1 students were significantly better at a word recognition task when the word presented was expected than when an unexpected word was shown. Pearson and Studt (1975) reported that, for both high and low frequency words, fewer letter clues were needed by first-grade and third-grade children as the sentence context increased in richness. Juel (1979) reported that, regardless of ability, all subjects in the second and third grades utilized context; however, more skilled readers relied on context only where internal word cues were minimal (low frequency, hard to decode words).

The key issues in this controversy are the use of an isolated word list as an indicator of reading ability, and the nature of the relationship between reading words in isolation and reading connected text. Studies by Shankweiler and Liberman (1972), and Perfetti and Hogaboam (1975) support the view that there is a strong relationship between identifying words on isolated lists and reading performance in contextual conditions. Dahl (1975-1976) recommends that, by beginning with word training in isolation and advancing towards sentence processing, improvements can be made in reading connected text. Research by Oaken, Wiener, and Cromer (1971), and Fleisher and Jenkins (1977) reveals that training in reading isolated words had no significant effect upon success in contextual reading. However, Blanchard (1980) found that training poor sixth-grade readers in single-word decoding of vocabulary to be encountered in context had a beneficial effect on their subsequent comprehension. Goodman (1965) and Levitt (1970) suggest that words are more successfully identified when encountered in the flow of meaningful written discourse; word recognition scores were significantly higher on story context tests than on isolated word tests. Analyses of errors made by young children reading orally led Clay (1968, 1969) and Weber (1970a, 1970b) to conclude that beginning readers make heavy use of syntactic and semantic information.

The purpose of this study was to try to disentangle some of the controversy about the effect of teaching the initial acquisition of written words in isolation and in context. This work differed from previous studies in several ways: (a) subjects who recognized one or more of the target words on the preliminary screening test were excluded, thereby eliminating those subjects who had already synthesized some knowledge of the reading process; (b) written contexts are used rather than oral contexts; (c) all subjects were tested in both isolated and context conditions in order to minimize the effects of teach/test bias; (d) transfer of word recognition from one condition to a different contextual condition was tested by presenting target words, underlined, in a new sentence context, and by a designation task whereby target words were embedded in new contexts and subjects indicated words they recognized; (e) long-term retention testing was extended to 3 weeks. Thus, in the present research study, there were nine dependent measures, as illustrated in the following diagram.

Acquisition	trials to criterion			
Short-term Retention	isolation test	sentence test	new context test	word designation test
Long-term Retention	isolation test	sentence test	new context test	word designation test

Method

Subjects

The subjects were 115 kindergarten children in six kindergarten classrooms selected from schools in middleclass areas of a Greater Vancouver school district, British Columbia, Canada. Prior to the experiment, all subjects were randomly assigned to one of the two treatment groups, word-alone (WA) or word-sentence (WS), or to a control group. Forty-three subjects were eliminated because of illness, holidays, transfer, little understanding of English, or recognition of one or more of the target words during the preliminary screening. The remaining 72 children were distributed equally among the three experimental groups, resulting in 24 subjects per treatment.

Materials

Eight target words were chosen. They were: television, Our, fixing, tooth, fell, out, Nicki's, needs. These words were formed into two sentences that commented upon events of interest to children:

Nicki's tooth fell out.
Our television needs fixing.

All words except "Nicki's" and "television" appear on the Grade I list in Rinsland's basic vocabulary scale (Rinsland, 1947). It was our conjecture that "Nicki" was a reasonably common name among the children in the population sampled and that "television" was in their aural vocabulary.

Procedure

Each subject met individually with the senior author on three separate occasions in a room available for the experiment.

Occasion 1: The treatment: Step 1 - Preliminary screening. Each target word was presented on a white 5″ x 8″ (12.70 x 20.32 cm) index card in large type. The subject was given 7 seconds to respond. If he/she did not recognize any of the words, the treatment was administered. Twenty-eight children were eliminated because they recognized one or more target words. A control group participated in this initial step.

Step 2 - Training trials. Treatment 1 was the Word Alone (WA) treatment. The target words had been previously arranged into two sets; Set A contained the words "needs," "tooth," "fell," "Our," and set B contained the words "out," "television," "Nicki's," and "fixing." The words were typed in large print on white 2½″ x 5″ (6.35 x 12.70 cm) index cards. Each set of word cards was laid out in a column in the first randomly predetermined non-meaningful order. The words in set B were covered, leaving exposed only the four words in set A. The examiner pointed to each word and said its name. Then, separating the first word in the scheduled order by placing it in front of the subject, the examiner said, "This word is_____. What is this word?" The word was then returned to its position in the column. This procedure was repeated for each of the other words in Set A. Then the examiner covered the words and followed the same procedure for the words in Set B. This cycle was repeated for a total of three training

trials, with a different non-meaningful word order for each trial. Each time, four words were visible to the subject but each word in turn was isolated from the others in the group.

Treatment 2 was the Word Sentence (WS) treatment. The eight target words used in the WA treatment were used in the WS treatment. However, they were arranged in two meaningful sentences: "Nicki's tooth fell out." (Sentence A) and "Our television needs fixing." (Sentence B). Each sentence was typed in large print on 5" x 8" (12.70 x 20.32 cm) index cards. Covering Sentence B card and placing Sentence A card in front of the subject, the researcher read the sentence while pointing to the words. The researcher then pointed to the first word in the sentence, covered it with a small piece of colored transparent acetate, and said, "This word is _____. What is this word?" This procedure was repeated for the other words in the sentence. Then, covering Sentence A, the same procedure was followed with the words in Sentence B. The researcher repeated the cycle for a total of three trials. Each time, four words were visible but each word in turn was indicated with a piece of colored acetate.

Step 3 - Teach/test trials. Following the three trials, each target word was tested in the random order specified by the predetermined list. For both treatment groups, the same procedure was followed. The examiner covered the words in Set B, and pointing to the first word listed for Trial #1, said "What is this word?" Subjects were given 7 seconds to respond. If a correct response was given, the examiner repeated it. If an incorrect response or no response was given, the examiner supplied the correct response for the subject, who repeated it. This was continued until all four words in Set A were tested. The examiner then read all four words in the order in which they were arranged, before repeating the testing procedure with the words in Set B. When a target word had been correctly identified on two consecutive teach/test trials, the subject was considered to have achieved criterion for that target word. The teach/test cycle was continued, excluding that specific word from the testing procedure.

No target words were tested consecutively; when only one word was left to be learned an intervening task was used. This task involved the subject reading his/her own name. Teach/testing continued until each target word had been correctly identified twice on consecutive trials at some point in the session. If 20 teach/test trials had been administered and criterion had not been reached, that target word was designated "unmastered" and the subject was allowed to stop. Thus a range of 16 to 160 trials to criterion for the eight target words was possible.

Throughout this session, four words were visible to the subject at all times; however, as each target word was tested in the word-alone treatment, it was separated from the others and presented in an isolated condition or, in the word-sentence treatment, it was indicated by a small piece of colored transparent acetate.

Occasion 2: Short-term retention. Twenty-four hours after the treatment, each subject was individually tested using the following procedures:

1) *Test of Word Recognition in Treatment Conditions*
   Four cards with Sentence A and four with Sentence B were alternated with the eight isolated target words. The subject was shown one card at a time. If the target word was in isolation he/she was asked, "What is this word?" If it was a sentence card, the researcher pointed to the underlined target word and asked the subject, "What is this word?" No target word was tested on two successive trials. Each response was recorded. This test yielded two scores for separate analysis: word recognition in isolation and word recognition in treatment sentences.

2) *Test of Word Recognition in New Context*
   The eight target words were embedded in eight new sentences (see Appendix). As each sentence was presented, the researcher pointed to the underlined target word and said, "What is this word?"

3) *Test of Word Designation in New Context*

Four sentences, each containing two target words, were placed one at a time in front of the child. The examiner asked, "Are there any words here that you know?" The student was asked to point to the word (if he/she knew any) and read it aloud. After each response the question was repeated until the subject replied, "No". This procedure was included to counteract the possible assumption that each sentence contained only one target word; on previous tests, only one word per sentence has been tested. At no time was verbal feedback given on correctness of the subjects' responses.

Occasion 3: Long-term retention. The researcher returned 3 weeks after the treatments. The procedure used for short-term retention was followed. The preliminary screening test was re-administered to the control group.

Results

Table 1 gives the means and standard deviations for the number of trials required to learn the eight words, and for the number of words retained on the short-term and long-term retention tests. The control group (n = 24) did not learn any of the words over the 3-week period, and was excluded from further analysis.

Acquisition of Target Words

A two-way analysis of variance (Treatment x Sex) computed on the total trials to criterion indicated a statistically significant difference between the two treatment methods, $F(1,44) = 29.27, p < .001$. The word sentence group learned the eight target words in significantly fewer trials. All subjects in the WS group reached criterion with all target words whereas six subjects in the WA group did not reach criterion on at least one word. There were no significant Sex or Treatment by Sex effects.

Retention

A three-way analysis of variance (Test x Treatment x Sex) with repeated measures across all levels of the test factor was computed on the short-term retention data. Although the main effect of treatment was not significant, $F(1,44) = 3.33$, $.05 < p < .075$, there was a significant difference among the tests, $F(3,132) = 34.46$, $p < .0001$, and a significant interaction between tests and treatment, $F(3, 132) = 32.42, p < .0001$. Tukey HSD comparisons showed that the mean score on the words-in-treatment-sentence test was significantly different ($p < .01$) from the means of each of the other three retention tests. This difference was caused by the high scores of the WS treatment group on the words-in-treatment-sentence test (see Table 1). No other pairs of tests were significantly different. A repeated measures analysis of variance conducted on long-term retention data indicated a significant main effect of treatment, $F(1, 44) = 5.66$, $p < .05$, a significant difference among the tests, $F(3, 132) = 22.87$, $p < .0001$ and a significant interaction

Table 1 Summary of performance of experimental groups on the dependent variables of trials to criterion and retention of target words

	Word-alone Group n = 24		Word-sentence Group n = 24	
Dependent Variable	*M*	*SD*	*M*	*SD*
Total Trials to Criterion	56.50	25.22	26.42	10.23
Total Retention Score (24 hours)	11.33	7.64	15.33	7.12
Isolation test	2.96	1.83	3.00	1.82
Sentence test	2.88	1.99	6.42	1.86
New Context test	3.04	2.16	3.00	2.25
Word Designation test	2.46	2.17	2.92	2.28
Total Retention Score (3 weeks)	10.29	8.34	15.96	7.83
Isolation test	2.46	2.04	3.21	2.17
Sentence test	2.33	2.12	6.13	2.38
New Context test	2.88	2.29	3.46	2.04
Word Designation test	2.63	2.16	3.17	2.16

between tests and treatment, $F(3, 132) = 34.79$, $p < .0001$. Tukey HSD comparisons revealed that, once again only the mean score on the words-in-treatment-sentences test was significantly different ($p < .01$) from the means of each of the other three retention tests and that this difference was due to the WS group's high score on the words-in-treatment-sentences test (see Table 1).

An analysis of variance on the gain (loss) scores between the 24-hour and 3-week testing periods showed no significant difference between treatment groups for total retention. All analyses conducted on retention data revealed no significant sex or treatment by sex effects.

Discussion

In this study children who were taught words in sentences learned them with significantly fewer trials than children who were taught the same words in isolation. These results are at variance with those of Singer, Samuels, and Spiroff (1974). Possible explanation for the discrepancy may center around differences in the orthography employed, the semantic richness of the training sentences, or the strength of syntactic and semantic links formed among the target words, or the fact that in this study each word in the sentence condition had to be learned whereas in the Singer et al. study only one word per sentence had to be learned.

In the present study, the ease with which the WS subjects acquired the words gives support to the theoretical formulations of Goodman (1965) and provides experimental support for the observational data of Clay (1968, 1969) and Weber (1970a, 1970b).

When the children were tested in a sentence condition the word-sentence group did significantly better than the word-alone group. At face value this finding could be taken to mean that the word-sentence group had learned the words to greater degree than the word-alone group. However our findings on the other tests contradict this interpretation.

It should be noted that when the two groups were tested with words in isolation they were not significantly different in their performance. It seems reasonable to conclude that the word-sentence group learned what it was taught significantly better than the word-alone group and learned what the word-alone group was taught about as well as that group.

The lack of significant difference between the two treatments on new context and word designation tasks suggest, at first glance, that the treatments were equally effective. Recall, however, that the word-sentence group learned what they knew in significantly fewer trials than the word-alone group. Thus while equal in their ability to transfer acquired knowledge to new situations, the word-sentence group acquired this ability much more economically.

The results of tests of long-term retention given 3-weeks after initial instruction exhibit the same pattern of results as the tests of short-term retention, indicating a reasonably durable effect.

The small amount of forgetting by all subjects in the 3-week period between the intial instruction and the long-term retention tests is surprising. Some retention may be an artifact of the experimental situation. The senior author, who conducted the teaching and testing interviews, was a stranger to the children. The visit to the testing room represented a break from normal classroom routines. It may well be that these extraneous aspects contributed to the memorability of the material.

In interpreting the findings from this study it is important to note the extremely carefully controlled equivalence of instruction. Both groups of children were exposed to exactly the same material in exactly the same manner. The amount of visual information confronting the children at any one time was precisely the same in quantity and content. The type of verbal reinforcement for right or wrong responses was held constant. The single difference in the training procedures was that for the word-sentence group the words were arranged into meaningful sentences whereas for the word-alone group they were presented in meaningless strings.

In order to pinpoint processing strategies responsible for observed differences, we looked, informally, at the kinds of errors made by each group on the test/training trials.

The WA group confused words with the same initial letter more frequently than the WS group suggesting that they were paying closer attention to the visual aspects of the text. The WS group tended to make positional and semantically linked errors suggesting that they were attending to the structure and meaning of the sentence in which target words occurred.

The results, while providing some support for the contextual position, should be viewed within the limitations of the study. It is possible to interpret the results by a simple chunking hypothesis: the word-alone group was given eight items to learn and the word-sentence group only two. However contextualists might justifiably say that that is their point. Human beings seem quite capable of processing at least simple sentences as units. The greater degree of meaningfulness in sentences as compared with words renders the task of learning to read easier to accomplish.

Our research paradigm was not a strong test, for example, of the language-experience position since the language used was generated by adults. It would be useful to compose, for example, adult versus child generated contexts for word-learning. Replication needs to be done with larger groups, different word lists and varying populations before definitive conclusions are drawn. However, the results do suggest, at the very least, that context renders word learning both efficient and durable, as long as key words are tested in context.

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APPENDIX

Sentences for Retention Tests

New Context Sentences

1. Can you come out and play?
2. This is Nicki's bike.
3. I am watching television.
4. The book is Our Family.
5. I fell off the swing.
6. He needs some more paint.
7. Mom is fixing my sweater.
8. I lost a tooth today.

Word Designation Sentences

1. My tooth needs pulling.
2. Our lights went out.
3. Dad's fixing the television.
4. Nicki's thermos fell over.

Announcement to solicit names for Children's Literature Network:

The Networking Committee of the Children's Literature Assembly of the National Council of Teachers of English is compiling a directory of professionals in the field of children's literature. Librarians, teachers, writers, researchers, critics, speakers, reviewers, performers and storytellers, publishers, and others will be included. Persons who want to share their interests and abilities and are willing to complete a survey should send their names and addresses to:

Alice K. Swinger, Chair
Networking Committee of the Children's
Literature Assembly
c/o College of Education and Human Services
Wright State University
Dayton, OH 45435