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The Effects of Immediate Feedback on Reading Achievement

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Abstract

A 2 (immediate vs. delayed feedback) X 3 (low, moderate, and high reading ability) quasi-experimental study was done to evaluate immediate versus delayed feedback effects on reading performance measures such as sentence and passage comprehension, as well as reading speed. Sixty-seven students in third and fifth grades participated in this study that lasted for six months. The treatment effect showed that students in the immediate feedback condition were significantly superior on measures of passage comprehension and composite comprehension. On the reading ability effect low ability group had significantly higher gain scores than the other two groups on sentence and composite comprehension. However, the moderate group had the greatest gain score in speed of reading compared to the other two ability groups.

The Effects of Immediate Feedback on Reading Achievement

It is a common educational practice in this country to encourage students to read books, based on the belief that skill in reading is partly an outgrowth of the amount of time and practice students devote to independent reading. In order to motivate and monitor student independent reading, schools resort to a variety of practices such as requiring a book report or a parent's signature verifying that the student has read the books. However, the book report usually does not provide immediate feedback because teachers grade them when they have time. Another option available to schools for monitoring student independent reading is to use a computer mediated system that quizzes students on their independent reading and provides them with immediate feedback about how well they comprehended the book. The purpose of this study was to determine what effects immediate versus delayed feedback might have on aspects of reading achievement such as comprehension, vocabulary, and speed of reading. Another purpose of this study was to find out if the different feedback conditions might have different effects on children with different reading abilities.

Immediate Feedback

E. L. Thorndike's (1932) law of effect helps explain the important role of feedback in learning. He stated that behaviors that lead to satisfaction increased the probability that these same behaviors would occur again under similar circumstances. Skinner (1969) modified Thorndike's law of effect and fit it into a more general framework of reinforcement theory. According to Skinner, reinforcement can be considered to be a type of feedback that informs the learner about the adequacy of their responses and also increased the probability that the behavior will occur in the future.

Like Skinner, Gagne (1988) also thought that informational feedback could be considered to be a form of reinforcement. Reinforcement works because expectancies establish at the beginning of the learning loop are confirmed or disconfirmed during the feedback phase. According to McClenaghan and Ward (1987), feedback has two important functions. First, it can motivate students, and second, it can provide information that they can use to correct or improve their learning. For example, a student might have a goal to read a book with high comprehension in order to get a good grade on a quiz. If on the computer quiz the score is not as high as the student had expected, the student might be motivated to read the next book more carefully in order to do better on the next test. Thus, through mechanisms such as motivation and information provided, feedback has an important impact on learning.

Zahorik (1987), for example, stated that when students are told about the correctness of their answers, it helps them to alter their studying style which then leads to improved achievement. Furthermore, according to Zahorik, immediacy of feedback is important because it provides students with information about how well they are doing. If the behavior is incorrect, the immediate feedback allows the learners to make corrective modifications and prevents continued practice of the incorrect behavior. On the other hand, if the behavior is correct, immediate feedback can motivate students to continue. In addition, feedback gives learners information about the progress they make towards their goals (Borich & Tombari, 1997; Eggen & Kauchak, 2004).

Since the late 1960s, a number of investigators have studied the effects of immediate versus delayed feedback on learning (e.g., Clariana, 1999; Jurma, Froelich, & Deidre, 1984; Pound & Bailey, 1975; Prather & Berry, 1973; Reddy, 1969). In general,

they have found there is an interaction effect between the immediacy of feedback and the difficulty of the task. If the task is difficult then immediate feedback is beneficial, but if the task is easy then delayed feedback may be preferable (Clariana, 1999). Others found immediacy of feedback along with information on the correctness of the student's responses, improved learning and retention (Epstein, Lazarus, Calvano, Matthews, Hendel, Epstein, & Brosvic, 2002; Epstein & Lazarus, 2002). One reason that tutoring is often highly effective is that it provides the learner with immediate feedback.

The purpose of this study was to test the effects of providing immediate feedback on reading achievement. In order to test the effects of immediate feedback on reading achievement, this study used the Accelerated Reader® program as the tool for providing immediate feedback on quizzes that students took on the library books they had read. To test the effects of delayed feedback, students in the control condition used book reports on the books they had read. The students in the immediate and delayed feedback conditions had exactly the same learning conditions such as access to school library books to take out for independent reading, time devoted to reading, and method of reading instruction. The only difference was that the immediate feedback group took the computer quiz when they completed a book and get immediate feedback about how well they did on the quiz. On the other hand, the delayed feedback group wrote a book report when they finished a book and received feedback from teachers when they had time to grade it.

Method

Design

This study used a 2 (immediate vs. delayed feedback) \times 3 (lower, moderate, and higher reading ability) quasi-experimental design to estimate the effects of immediate feedback on reading achievement. The first factor was treatment and the second factor was reading ability. Students were classified to one of the three categories based on the *Standardized Test of Assessment of Reading*® (STAR Reading) test.

In this study the students were not randomly assigned to each condition by the researchers, but they were randomly assigned to classrooms by the teachers in order to avoid a biased distribution of students to classrooms. Then what the researchers did was to randomly assign conditions to classrooms. Each treatment had two classrooms. All four teachers in this study were experienced, averaging 22.5 years of experience. The least experienced had ten years of service and the most experienced had 29 years.

Participants

Sixty-seven students participated in this study. Thirty-nine students were in the control condition and 28 students were in the immediate feedback condition. The number of participants for each cell is shown in Table 1. This study was conducted in a k-6 St. Paul, Minnesota elementary school with 532 students. Sixty-four percent of the students at this school received free or reduced priced lunch compared to the state average of 28%. Ethnicity of the school consisted of 43% White, 33% Asian (Hmong), 15% African-American, and 9% Hispanic. All the third and fifth graders enrolled in Minnesota public schools take the Minnesota Comprehensive Assessment examination in reading to determine achievement. Comparing reading achievement in the school where this study was done to the rest of the state, one observes that the students in the school lagged

considerably behind the rest of the state, and that the poverty level, as indicated by the number of free lunches, is considerably higher than the rest of the state.

Materials

The Standardized Test of Assessment of Reading® (STAR Reading). Students were pre- and post-tested on the STAR Reading Test (Renaissance Learning Inc., 1999). This is an individually administered, nationally normed computer-adaptive assessment of a student's level of reading achievement that takes about ten minutes to complete. For purposes of the research, the STAR Reading test provided an objective measure of each student's reading ability and reading level for the reading materials. The concurrent validity of the GRADE with Iowa Test of Basic Skills ranged from .60 to .89. The split-half reliability of the STAR Reading ranged from .89 to .93. The test-retest reliability of the STAR Reading ranged from .79 to .94.

The Group Reading Assessment and Diagnostic Evaluation® (GRADE). GRADE (American Guidance Service, 2001) is a new norm-referenced, research-based test of reading achievement that provides for each grade level alternative forms (A and B). Students in this study were given GRADE tests for vocabulary, sentence and passage comprehension, form A in the pre-test and form B in the post-test. These tests were administered by the classroom teachers. The concurrent validity of the GRADE with Iowa Test of Basic Skills ranged from .69 to .83. The test-retest reliability of the GRADE ranged from .77 to .98.

Curriculum Based Measurement (CBM). CBM task was used as an index to determine the subject's reading speed. Participants read a text for one minute and a word

per minute rate (WPM) was calculated. The article for measuring CBM was selected from *Standard Reading Passages* (Children Educational Service, 1987).

Accelerated Reader Program®. The Accelerated Reader program® (Renaissance Learning Inc., 2000) was used in the immediate feedback group to provide the immediate feedback. In this program, after a student has finished reading a library book the student takes a short quiz on a computer that evaluates how well the student comprehended the book. As soon as the test is completed, the computer provides the score on the comprehension test in percentage and provides the student with the option of getting the correct answer for each question that the student missed.

Procedure

This study lasted for six months. The immediate and delayed feedback classrooms had three reading blocks—one block had 60minutes, second block had 15 minutes, and the last block had 15 minutes—so that all the students in the study had the same amount of time devoted to reading. What was done during each block is listed below.

First block (60 minutes). During the first 60 minutes block, teachers in the immediate and delayed feedback groups conducted what may be termed a balanced reading program (Pressley, 1998), where the students were given explicit instruction in word recognition and comprehension skills combined with reading or listening to authentic texts.

Second block (15 minutes). For the next 15-minute block, both teachers in the immediate and delayed groups conducted what is termed a “Reading To” program. Each day when “Reading To” the students the teacher read good literature to the whole class

while the students listened. Discussions were held on various aspects of the book such as its plot, characterization, and emotional reactions of the characters to events in the story.

Third block (15 minutes). During the final 15-minute block, the teachers in both the immediate and delayed feedback groups conducted an “Independent Silent Reading” program. In this reading situation the students in both the immediate and delayed treatments read books independently for 15 minutes each day. In both conditions, students read selected color-coded books from the library that matched their reading level. The only difference between the two treatments was that the students in the immediate feedback condition after completing a book took a quiz that was administered by a computer, and the students got immediate feedback on how well they did on the quiz. The students in the delayed feedback condition also read books independently for the same amount of time and they wrote book reports. These reports were graded at the convenience of the teacher when they had time.

The GRADE reading achievement tests and the CBM task were administered for both immediate and delayed feedback groups in the beginning of this study as pre-test measures, and at the end of this study as post-test measures of achievement.

Results

Design and Analysis

A 2 (treatment) X 3 (reading abilities) design was used in this present study. Because significant differences were found on pretest scores between the delayed and immediate feedback groups, we used gain scores from pretest to posttest as the unit of analysis. These gain scores were analyzed using a multivariate analysis of variance

(MANOVA). Because each cell had different numbers, adjusted means were used to report the results in this study.

Descriptive Statistics

Table 1 presents the means and standard deviations of the data from the gain scores of the four dependent measures (vocabulary meaning, passage comprehension, and comprehension composite, the combination of sentence and passage comprehension, on the GRADE test, and CBM in word per minute rate) by treatment group and the reading ability. Visual inspection of Table 1 suggests that in general the immediate feedback groups had higher gain scores in the six months that this study was conducted than did the delayed feedback groups. The MANOVA was used to determine if there were significant differences between groups.

Overall Analyses

On the pre-test, no significant difference was found between groups on the STAR Reading test, so no pre-existing group differences were found. A variance analysis MANOVA was used to simultaneously test the effects of the independent variables (treatment and reading ability) on the gain scores of four dependent measures. The main effects for treatment and reading ability were significant on gain scores, and no interaction was found.

Main Effects—Treatment

The MANOVA revealed a significant main effect for treatment on gain scores for passage comprehension ($F(1, 61) = 15.39, p < .001, \eta^2 = .20, MSE = 16.22$) and on gain scores for composite comprehension (passage and sentence comprehension, $F(1, 61) = 12.12, p < .001, \eta^2 = .17, MSE = 25.59$). The group receiving immediate feedback ($M =$

7.14, $SD = 3.76$) had a significantly higher mean gain score on the passage comprehension test than did the delayed feedback group ($M = 2.64$, $SD = 4.38$), and this difference was almost three times as high. In addition, the group receiving immediate feedback ($M = 9.64$, $SD = 5.08$) had a significantly higher mean gain score on the comprehension composite than did the delayed feedback group ($M = 4.69$, $SD = 5.34$), and this difference was more than twice as high. In terms of effect size, the treatment effect can explain 20% of the variance of the gain score on the passage comprehension and 17% of the variance of the gain score on the comprehension composite. The immediate feedback groups had higher mean gain scores on the other three dependent measures than the delayed feedback groups; however, the difference did not reach significance.

Main Effect—Reading Ability

In addition, a significant main effect for reading ability was found on three dependent measures: GRADE comprehension composite ($F(2, 61) = 3.72$, $p < .05$, $\eta^2 = .11$, $MSE = 25.59$), vocabulary meaning ($F(2, 61) = 5.04$, $p < .01$, $\eta^2 = .14$, $MSE = 21.45$), and CBM word per minute rate ($F(2, 61) = 5.51$, $p < .01$, $\eta^2 = .15$, $MSE = 274.13$). The means and standard deviations for each reading ability group on each dependent variable are listed in Table 2. The group with low reading ability ($M = 9.24$, $SD = 5.93$) had a significantly higher mean gain score on the composite comprehension than did the high reading ability group ($M = 4.41$, $SD = 4.08$), but not significantly higher than the moderate reading ability group ($M = 6.70$, $SD = 6.00$). On the vocabulary meaning, the group with low reading ability ($M = 6.00$, $SD = 5.98$) had a significantly higher mean gain score than did the high reading ability group ($M = .94$, $SD = 3.73$), but not

significantly higher than the moderate reading ability group ($M = 3.85$, $SD = 4.15$). On the CBM word per minute rate, the moderate reading ability group ($M = 42.00$, $SD = 18.79$) had a significantly higher mean gain score than the high reading ability group did ($M = 26.75$, $SD = 12.58$), and the low reading ability group ($M = 30.08$, $SD = 13.85$).

Discussion

In American schools, one of the common practices used to increase reading achievement is to have students read books. After they have completed reading a book, students are often asked to write a book report as a way to monitor and verify their reading. One of the problems that students encounter who write these book reports is that they often fail to get immediate feedback from their teachers on their reports. An alternative methodology available to schools for monitoring the quantity and quality of independent book reading is to have students take a computer administered quiz on a book the student had just completed. The question that we addressed in this research was related to the effect of immediate versus delayed feedback on student reading achievement.

To measure reading achievement, we used curriculum based measurement as an indicator of reading speed and the GRADE test to assess vocabulary, sentence comprehension and paragraph comprehension. On the pre-test measures, we found no differences among groups on the STAR reading test, but on the GRADE tests we found differences among the groups on the pretest measures. Therefore, we used gain scores from pre-test to post-test as the unit of the analysis. In order to determine cause and effect, a quasi experiment was used. In this study, the immediate feedback condition had students take a computer administered quiz on the books that had been read, and they

received immediate feedback on the quiz score. In the delayed feedback condition, the students wrote a book report and received feedback when teachers had time to score it. With the exception of the different feedback conditions, everything was the same for the immediate and delayed feedback groups.

In this section we will discuss the treatment and reading ability (low, moderate, and high) effects. On the treatment effect, in general, students in the immediate feedback condition had significantly higher gain scores than students in the delayed feedback condition on measures of passage comprehension and composite comprehension (passage and sentence comprehension).

One might speculate as to why students in the immediate feedback condition gained significantly more on passage comprehension and composite comprehension than did the students receiving delayed feedback. Two possible explanations come to mind but we have no evidence to support either position. First, it may be that the immediate feedback motivated students to read their library book more carefully in the hope that this would lead to higher comprehension scores on the computer test. The second possibility is that the immediate feedback motivated the students to read more books. As we have said previously, these are hypothesis without evidence to support them.

As has been reported by Stanovich (1986), who coined the phrase Mathew effects in reading, those who read more get better. But the question still remains as to why immediate feedback in the computer administered quiz condition seemed to motivate more than the delayed feedback condition where the students wrote a book report. In the immediate feedback condition when the students began the program they often received low scores on the quiz, and their teachers encouraged them to read their books more

carefully and to strive to get a higher score on the next quiz. Students took this advice to heart and they slowly improved their scores. During the period of this study, students could not only see their improvement immediately, but they could also see their improvement test by test. In fact, if a student got a perfect score of 100% on the quiz, no matter what was happening in the class, the student who got the perfect score was permitted to yell, "Yes." That is, immediate feedback improved motivation and the motivation lead to increases in reading and comprehension.

On the reading ability effect, we found that low ability students made significantly greater gains than high ability students as measured on the GRADE tests of composite comprehension, as well as vocabulary. However, on the measures of reading speed, students with moderate reading ability had significantly higher gain scores than students with high and low reading ability.

The significant differences among reading ability groups may be explained in the following ways. With regard to comprehension, the low reading ability groups have more room to improve than the higher ability groups. Thus, on the comprehension test the poor readers have higher gain scores than good readers. On the CBM reading speed tests, the students with moderate reading ability have highest gain scores than students with low and high reading ability. One possible explanation for the different performance on reading speed is that the low reading ability students are still struggling with the automaticity of word recognition, so their reading speed improvement is not as good as the moderate reading ability group. For the high ability students who were already reading at faster rate on the pretest, there is a limit to how fast one can read orally, so the high ability group experiences ceiling effects on the post-test whereas the

low reading ability group does not. In other words, although the low and high ability students show some improvement in reading speed, in actuality they gain less than the moderate ability students do.

There are several implications from this study. First, the immediacy of feedback appears to have a positive impact on student achievement. Second, the students in both immediate and delayed feedback groups had their teachers tell them that they should read their books carefully. However, the group that received immediate feedback on the quiz was able to evaluate more easily how well they were doing and adjust and self-regulate their behavior accordingly. Thus, in order to help students self-monitor and regulate their independent reading behaviors to enhance comprehension, they need to know what their goal is for each task and they need frequent and immediate feedback. In conclusion, teachers should provide frequent and immediate feedback to students in order to improve their achievement.

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Table 1

The Mean Gain Scores and SD's for Each Condition on Five Dependent Variables

Treatment		Delayed Feedback			Immediate Feedback			
Reading Level		Low	Medium	High	Low	Medium	High	
GRADE Test	Passage Comprehension	<i>M</i>	5.30	1.42	2.30	8.29	7.21	5.86
		<i>SD</i>	4.85	4.00	3.77	4.39	3.17	4.38
	Vocabulary	<i>M</i>	5.00	3.68	.20	7.43	4.07	2.00
		<i>SD</i>	6.11	3.32	3.46	5.94	5.21	4.12
	Curriculum Based Measurement (unit: WPM)	<i>M</i>	29.97	41.16	24.33	30.24	43.14	30.19
		<i>SD</i>	15.11	14.03	12.55	13.01	24.37	12.72
Sentence + passage comprehension	<i>M</i>	7.70	4.11	2.80	11.43	10.21	6.71	
	<i>SD</i>	6.53	5.18	3.05	4.50	5.32	4.46	
STAR Test	<i>M</i>	246.70	412.11	631.70	241.43	416.57	602.14	
	<i>SD</i>	62.51	112.22	161.97	81.23	94.37	151.40	
		<i>N</i>	10	19	10	7	14	7

Table 2

The Marginal Mean Gain Scores and SD's for Treatment and Reading Level on Five Dependent Variables

		Delayed Feedback		Immediately Feedback		Low		Medium		High	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
GRADE	Passage	2.64	4.38	7.14	3.76	6.53	4.77	3.88	4.64	3.76	4.29
	Vocabulary	3.13	4.50	4.39	5.35	6.00	5.98	3.85	4.15	.94	3.73
	CBM	33.97	15.46	36.68	20.07	30.08	13.85	42.00	18.79	26.75	12.58
	Comprehension composite	4.69	5.34	9.64	5.08	9.24	5.93	6.70	6.00	4.41	4.08
STAR	Test	426.00	181.10	419.18	166.50	244.53	68.41	414.00	103.47	619.53	153.55
<i>n</i>		39		28		17		33		17	