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ABSTRACT

This study investigated the effectiveness of color coding, accomplished by highlighting, used to help students differentiate between exact meaning (explicit information) and implied meaning (implicit information) in both narrative (short story) and expository texts. Subjects were 78 sixth-grade students randomly enrolled in four language arts classes; two classes served as controls and two classes served as an experimental group receiving instruction using color coding. Students were pre- and post-tested using a standardized test with a reading passage containing both explicit and implicit information. Over sixth months, the experimental group was instructed to highlight in yellow information used to answer explicit questions, and highlight in green information used to answer implicit questions. Results indicate both groups showed improvement in narrative text reading skills, but a larger proportion of experimental group members than control group members improved in this area. The control group declined very slightly in expository reading skills, while the experimental group's scores improved; one-third of the control group improved, while 79 percent of the experimental group improved. It is concluded that the color highlighting technique was effective, and that students became accustomed to highlighting all pertinent information, not just the first to appear. (Contains six references.) (MSE)

The Effectiveness of Color Coding on Middle School Students' Ability to Differentiate Explicit from Implicit Information in Narrative and Expository Texts

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Introduction

From the moment one awakens until the time he or she retires at night, 80% of all information perceived is visual (Pruisner, 1993). According to Kueppers (1982), 40% of all information perceived is represented in color. Therefore, one can conclude that color plays an important role in a person's day to day perception of information. For example, the use of color-coded captions for speaker identification in text-audio presentations has resulted in higher degrees of comprehension (King, Lasasso, Short, 1992).

Taking this theory from every day experiences to those in the classroom has shown that the use of color does facilitate instruction. For instance, in the community of New Haven, Connecticut, their high school has used a color-coded curriculum entitled "Words in Color" to assist students in reading (Smith, 1979). According to Geoffrey Smith, "Combinations of sounds are color-coded so that once the code is known, students can figure out any word in their speaking vocabulary even though they have

never read it before." The use of color within New Haven's High School in the Community has resulted in an average gain in reading comprehension of 1.5 years for each year of work (Smith, 1992).

Based on the findings of both the use of color to expedite comprehension in text-audio presentations and in the classroom, the use of color is a viable means of presenting information for long term memory. The tendency to remember information in color is greater than when that same information is presented in traditional black and white formats. Hence this study is an exploratory study attempting to demonstrate the effectiveness of color coding when used to assist students differentiate between explicit and implicit information in both narrative and expository texts through the use of highlighting techniques.

Due to the limited amount of current research on color coding in the classroom, this study opens the door for further research. Many teachers use highlighting important information in a text as a means of notetaking but has its effectiveness ever been studied? How do teachers know if asking students to use highlighters to isolate pertinent facts, ideas, concepts, or opinions within a printed text is a viable instructional method?

Thus, this study serves as a springboard to educators for further investigation.

Statement of the Problem

The purpose of this study is to examine the overall effectiveness of color coding to differentiate explicit and implicit information in narrative and expository texts. Color coding refers to highlighting either explicit or implicit information using two different colors to help students see the difference between information used for exact meaning and implied meaning. For example referring to the previous examples, the answer to question number one would be highlighted in yellow because it is word for word from the text; however, the answer to question number 2 would be highlighted in green because the students would use the fact about the cat to draw a conclusion about the dog's reaction. Explicit information refers to information stated word for word in a text. For example, the big red dog jumped over the fence. If the question was "Where did the big red dog jump?", then "over the fence" would be the correct response. Conversely, implicit information is information that the students use from the text to make predictions, inferences, or draw meaningful conclusions. For example, suppose that the dog spotted a cat darting across the

yard on the other side of the fence. A possible question might be, "What do you think the dog will do once it has jumped over the fence?" The students would refer to the sentence about the cat's whereabouts as support for possible conclusions one of which would probably be to chase the cat.

Narrative texts refer to fictional writing such as short stories; whereas, expository texts refer to non-fiction writing such as that found in encyclopedias, social studies or science books or periodicals. Since students are exposed on a continuum to both types of reading texts, the overall effectiveness of highlighting needs to be examined regarding both types.

Review of Related Literature

No formal research has been done on the use of color coding as a means of improving the differentiation between explicit and implicit information in narrative and expository texts; however, in 1979, Richard Lamberski and Dennis Roberts conducted the following study to determine the relationship between information presented in black/white or color formats and black/white or color coded tests. Their sample consisted of 176 college students randomly assigned to one of four treatment conditions: (1) black/white learning and testing materials; (2) black/white

learning materials but color coded testing materials; (3) color coded learning and testing materials; (4) color coded learning materials but black/white testing materials. The students were given a 21 page learning booklet on the heart immediately followed by a test. The identical test was repeated six weeks later to assess delayed retention. The study strongly indicated that color coded learning materials could be an efficient instructional strategy when used with the black/white test. (Lamberski, 1979, p. 8) According to Lamberski, using color instructionally and in terms of assessment proved difficult for students.

In 1992, Francis M. Dwyer and David M. Moore conducted a similar study. The use of color on the achievement of field dependent and field independent learners showed that color coding was found to be an effective instructional variable for field dependent learners when assessed visually. Color visuals versus black and white versions definitely enhanced student achievement because when used as an instructional strategy, color assisted students to organize information usefully in order to make interpretation easier (Dwyer, 1978). Consequently, color presentations result in better student assessment (Dwyer, Moore, 1992).

In another study, Peggy Pruisner (1992) investigated the impact of color coding on learning. Pruisner randomly assigned 563 seventh grade junior high students to one of four treatment groups: (1) color cued presentation and color cued assessment; (2) color cued presentation but a black/white assessment; (3) black/white presentation but a color cued assessment; (4) black/white presentation and a black/white assessment. The students were asked to demonstrate immediate recall and two week delayed retention on the graphic assessment of the graphic presentation of a previously read Norse myth. The study concluded that the color cued presentation graphic was preferred and that because of this factor student performance was enhanced.

All three studies demonstrate the effective use of color as an instructional strategy. Moreover, since a large portion of a student's curricular experience is visual, the use of color assists in the long term memory process. Therefore, it is not surprising that the color cued assessments used in all three studies proved more beneficial than black and white.

This study compliments and adds to what has already been investigated in terms of using color as an instructional technique.

Statement of the Hypothesis

Due to state and local mandates as determined by state and local boards of education, middle school students' reading comprehension is expected to be reflected on local and state assessment tests. Furthermore, studies show that students at both the middle school and college levels performed better and retained more when color coded or color cued instructional material was used. Consequently, since much of any student's curriculum is presented visually, it is hypothesized that sixth grade middle school students who are exposed to the experiment's stimuli, highlighting, will experience an increase in their comprehension of explicit and implicit information in narrative and expository texts as reflected in test scores.

Method

Subjects

Seventy-eight out of 240 sixth grade heterogeneous middle school students were randomly divided into 4 language arts classes. These classes were randomly selected based on a computer scheduling process prior to the beginning of the school year. Students' names were put into a computer program which generated a schedule without outside influences. Two classes had 18 students, and two had 21 students. For purposes of this study, the 2 classes of 18 served as the control group, and the 2 classes of 21 served as the experimental group. Both the control group and the experimental group were given a pretest and a posttest; however, only the experimental group used the highlighting intervention.

Instruments

The instruments used in the study were teacher selected. All study participants were given the same narrative and expository passages followed by a series of questions to answer selected from the Illinois Goal Assessment Preparation booklet because both reading passages incorporated both explicit and

implicit questions. These passages served as both the pretest and posttest for both groups. The students were instructed prior to the administration of the pretest and posttest that each question could have one, two, or three correct answers but no more than three. Students were further advised to mark all correct responses that applied to each question. After the pretest, the experimental group used a color coding intervention. Six months later, students reread the same passages and answered the same questions in order to establish test reliability.

Research Design:

The following study is a pretest posttest quasi-experimental design using predetermined classrooms as the control and experimental group.

Group	Pretest	Intervention Variable	Posttest
C	O_1	X	O_2
E	O_1	-	O_2

Procedure

Each student was given a narrative pretest and an expository pretest in September. The tests consisted of a reading passage followed by a series of explicit and implicit questions. The tests were scored according to the number of correct responses,

and the scores were reported as percentages. These initial percentages served as benchmark scores. Following the completion of the pretest, over the next six months, the experimental group was instructed to highlight information used to answer explicit questions in yellow and information used to answer implicit questions in green. Both the control group and the experimental group read examples from a variety of literary genres including but not limited to short stories, poetry, myths, legends, novels, biographies, autobiographies, non-fiction articles, and plays.

At the end of the sixth month period, both groups were retested using the same reading passages as used in the pretest. The posttests were scored and again reported as percentages as a means of comparison.

Data Analysis

The test scores for both the control group and the experimental group and the percent difference between the scores are shown. It is important when looking at the scores to know that the pretests were given in September of 1996, and the posttests were not given until March of 1997. Thus there was a six month period during which the highlighting intervention was used frequently.

Table 1

Narrative Scores

Control Group			Experimental Group		
Pretest	**Posttest**	**% Difference**	**Pretest**	**Posttest**	**% Difference**
54	54	0	25	57	+32
55	72	+17	35	72	+37
55	58	+3	43	65	+22
58	79	+21	43	75	+32
60	71	+11	51	82	+31
60	63	+3	51	88	+37
62	74	+12	52	75	+13
63	63	0	54	77	+23
63	74	+11	55	65	+10
65	83	+18	55	70	+15
66	69	+3	57	75	+18
66	77	+11	60	75	+15
68	86	+18	62	75	+13
69	71	+2	62	77	+15
69	80	+11	62	77	+15
71	75	+4	63	80	+17
71	82	+11	63	75	+12
72	80	+8	65	77	+12
72	89	+17	68	78	+10

74	75	+1	68	83	+15
74	83	+9	69	78	+19
74	85	+11	69	82	+13
75	77	+2	69	85	+16
77	80	+3	71	86	+17
77	85	+8	72	87	+15
77	89	+12	72	91	+19
78	83	+5	72	92	+20
78	89	+11	72	87	+15
80	91	+11	72	85	+13
82	89	+7	74	89	+15
83	89	+6	78	90	+12
85	86	+1	80	85	+5
85	86	+1	80	89	+9
86	86	0	80	80	0
88	83	-5	82	87	+5
			82	88	+6
			82	89	+7
			83	88	+5
			84	89	+5
			89	91	+2
			89	94	+5
Mean 71%	Mean 78%	Mean 8%	Mean 66%	Mean 81%	Mean 15%

Both the control group and the experimental group showed improvement in reading narrative text; however, ninety-eight percent of the experimental group improved in comparison to eighty-three percent of the control group. A possible reason for this could be the difference in range between the groups' pretest scores. The control group's range was 34 in comparison to 64 for the experimental group.

Table 2

Expository Scores

Control Group			Experimental Scores		
Pretest	Posttest	% Difference	Pretest	Posttest	% Difference
57	78	+21	56	60	+4
58	74	+16	64	72	+8
61	67	+6	68	72	+4
65	64	-1	68	75	+7
65	72	+13	68	78	+10
66	70	+4	69	81	+12
66	80	+14	71	75	+4
68	72	+4	71	77	+6
68	79	+11	71	81	+10
69	67	-2	72	75	+3
72	73	+1	72	72	0
72	63	-9	73	76	+3
73	79	+6	73	77	+4
75	65	-10	73	80	+7
77	72	-5	73	85	+12

78	68	-10	73	74	+1
78	70	-8	74	80	+6
79	86	+7	76	86	+10
79	86	+7	76	87	+11
80	52	-28	76	89	+13
80	73	-7	76	80	+4
82	81	-1	77	80	+3
82	82	0	78	78	0
82	86	+4	78	83	+5
83	82	-1	78	85	+7
83	76	-7	78	85	+7
84	84	0	78	88	+10
85	77	-8	78	88	+10
85	83	-2	79	92	+13
86	74	-12	80	89	+9
86	83	-3	81	84	+3
86	81	-5	81	89	+8
87	84	-3	81	92	+11
88	88	0	82	93	+11
91	87	-4	83	84	+1
94	89	-5	85	85	0
			85	93	+8
			86	77	-9
			87	78	-9
			88	85	-3
			88	86	-2
			89	87	-2
Mean 77%	Mean 76%	Mean 9.5%	Mean 77%	Mean 82%	Mean 7.2%

When looking at the expository pretest and posttest means for the control group and the experimental group, the control group's mean decreased by 1% while the experimental group's increase by 5%. Thirty-three percent of the control group improved compared to 79% of the experimental group. The mean percent of improvement of those who improved were 9.5 of the control group and 7.2 of the experimental group. Although more students in the experimental group improved, the average rate of improvement was 2.3% less than that of the control group.

A one-tailed t-test was used to determine the significance between the means of the control and experimental groups' narrative and expository posttest scores. The results of the narrative and expository comparisons showed t-values of 3.75 and and 6.85 respectively indicating a significance level of .005. Consequently, the null hypothesis is rejected due to the notable difference in the posttests' means.

Conclusion

Based on the data, one can draw several conclusions. First, the use of color highlighting explicit and implicit information was effective. Its effectiveness was increased by the amount of time over which the intervention was used. The students

regularly highlighted explicit and implicit information necessary to answer explicit and implicit questions from a variety of literary texts. Consequently, they became good at differentiating these types of information. Second, students became accustomed to highlighting all pertinent information required to answer a given question. The possibility of there being more than one correct answer or conclusion to a question as experienced on their pretests and posttests forced students to draw out every piece of information instead of stopping at the first piece of information to answer a question. Students needed to keep reading to make sure that they had highlighted all the answers or information necessary to draw all possible conclusions. This accounted for the exceptionally high improvement of the experimental group on the narrative posttest. Narrative texts by nature provide more opportunity for inferences and conclusions than expository ones; thus, the highlighting intervention encouraged students to delve into the text in order to think about all implicit possibilities. Also, retrieving information used to make inferences and draw conclusions is often more difficult because such information is above the literal level of understanding. Third, students become better discriminate readers over time due to natural development.

Consequently, maturation is a factor to the students' overall improvement. Students who read more are better readers. One would expect students to perform poorly on a test given at the beginning of a school year opposed to taking the same test six months later because the students have matured and have increased experience reading such passages. Thus, their level of concentration is greater. Fourth, by highlighting information students created a visual color coded key enabling them to see explicit and implicit information pulled from the text. Isolating information resulted in more students' increased understanding of what was important. Therefore, instead of struggling to learn every detail, students extracted only the most important information.

Since many teachers use highlighting as an instructional tool to assist students sequester meaningful ideas, facts, concepts, and opinions, this study's results are pertinent. However due to the limited amount of research on this intervention, it is hoped that this study serves as a springboard for further investigation of highlighting as an instructional modality.

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