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The effect of visual memory training on spelling achievement in the classroom

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Many studies point to visual memory as one component
which discriminates good from poor spellers. This experiment
sought to increase students' use of visual memory, and
thereby affect spelling scores in the classroom.

The quasi-experimental study was performed for eight
weeks on three intact fifth grade classrooms in an urban
school, comprised primarily of low socio-economic-status
students. Pretests were administered to all classes to find

a baseline of spelling achievement and extant use of visual memory. Demographic data was learned through school files. One classroom was selected to receive exercises in the course of their spelling instruction which would encourage them to use visual memory to remember correct orthographies, i.e., introducing a spelling cue, then removing it for students to reproduce, a visual memory skill. A second classroom received visual memory training as well, using familiar words not in their weekly spelling lists, to investigate whether students' use of the training would transfer to the spelling task. The third classroom, the control, received no visual memory training whatever, but studied their spelling words in a list-and-copy format with spelling words in view.

Sixty-eight fifth-grade subjects received spelling instruction three times per week from one teacher in a team teaching effort. At the end of each week, students were tested on the ten words which were common to all classrooms, and a class average was calculated. The words had been previously selected to contain a letter combination which is not phonetically regular in words (-ea- has six possible phonemes, as seen in "bread," "dream," "earth," "great," "cereal," and "create").

At the end of the eight weeks, multiple regression statistics were performed to control for classroom differences. The classroom averages for the last four weeks were compared, since the experiment's results might be

expected to be cumulative in nature. Though the control classroom's performance was lower than the others in all areas, the results were not statistically significant at $p < .05$. The hypothesis that visual memory training would increase classroom spelling scores was therefore not proven.

The scores of a subset of students who scored either very high or very low on the visual memory pretest were examined to look for a pattern of achievement among those students who were or were not already using visual memory adequately before the study began. Results showed that most low visual memory students did not achieve as well as those for whom visual memory was already a viable strategy. The results seemed to show that these students did not utilize the offered visual memory strategies to increase their scores.

Visual memory exercises given and sample lesson plans are appended.

THE EFFECT OF VISUAL MEMORY TRAINING ON SPELLING ACHIEVEMENT

IN THE CLASSROOM

by
LINDA M. BAKER

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INTRODUCTION

Spelling correctly is important for effective communication of thought and ideas. Yet many students remain poor spellers, and many teachers are frustrated by their inability to make an impact on their students' mastery of orthography. The review of available literature on the subject seems to point to visual memory as one significant way to achieve correct spellings, especially of phonetically irregular words. It is not clear how, or whether, visual memory can be increased by training. It is also unclear whether all students would benefit equally from this training, due to differences in their present utilization of the strategy, their reading ability, developmental level, practice time, motivation level, and other factors which impinge on students' learning ability. Yet there are fifth grade students whom teachers can identify who are still relying almost exclusively on phonics to spell irregular words which they have seen many times, and who could reasonably be expected to benefit from another strategy for spelling successfully.

The purpose of this study, therefore, was to investigate the role of visual memory in the spelling process as one component which discriminates good and poor spellers, and to

identify a method of training students in the use of this component, thereby increasing overall spelling achievement in classrooms.

REVIEW OF THE LITERATURE

HISTORICAL PERSPECTIVE

Concern over spelling ability has been voiced since the thirteenth century (Storie and Willems, 1988). The ability to spell words correctly is a puzzling phenomenon; it seems to have a low correlation with intelligence (Bannatyne and Wichiarajote, 1969; Ong and Jones, 1982) or reading ability (Bruck and Waters, 1988; Frith, 1978; Frith, 1980). Good spellers themselves have varying ideas of their strategies for arriving at a correct spelling (Olson et al., 1988). Few other subjects seem to generate such overall negative reaction; at the same time, a quick scan of student writing "reveals the prevalence of spelling atrocities" (Cates, 1978). Downing et al., in a 1984 survey of students' attitudes toward spelling, averaged responses from grades one through six, and found that their preference for spelling in relation to five other academic subjects was dead last! Yet its importance makes it crucial that educators utilize the most successful methods and strategies possible in teaching this branch of the language arts.

It is known from research on reading that children's strategies are influenced strongly by instructional methods. Yet similar studies have not been conclusive in spelling, and

there is little understanding among educators about possible approaches to use (Marsh et al., 1980). In fact, spelling instruction, though subject to fluctuations in the importance it receives in the curriculum, remains not very far advanced beyond the 1890's (Venezky, 1980). Researchers find that the overwhelmingly accepted method is still to require teacher-generated lists of words to be committed to memory and regurgitated at the end of the week (Hodges, 1983). Yet the body of current research contributes to the sense that spelling ability is much more complex than a memory of stored individual words. Memory itself is not well understood, nor what component of memory, visual or auditory, is the best channel for remembering correct spellings over time. A satisfactory theory of spelling processes and difficulties is not available at this time (Frith, 1978).

This century has seen much research into the structure of English orthography, and much has been learned. Some researchers concluded that the language is so irregular that it must be reformed. Most visible among these reformers was Sir James Pitman who developed the Initial Teaching Alphabet (ITA), a unique and regular orthography which would enable a child to read and write more easily (Venezky, 1970). It never gained much favor and later studies seemed to show that though ITA-taught children do read and write more easily at first, by the fifth grade they do no better and often lag behind children who began with standard English, because they

do not have a background in the morphology of conventional
orthography (Kavanagh, 1972).

More recent research into morphology has found that
English spellings, though phonetically inconsistent,
particularly in the case of lax vowels, are remarkably close
indicators of word relationships and much less arbitrary than
had been previously assumed (Chomsky, 1970). A system which
rendered "sign" and "signature" to conform only to phonetic
considerations, for example, would erase their
recognizability as close members of the same family, and with
it an important orthographic cue. Harris (1985) notes that
reliance on word root study would help with the schwa sound
in "president" (by knowing "preside"), and "laboratory" would
have all the syllables (by relating "labor"); yet the same
approach would lead to erroneous spellings such as
"abstainence," "rememberance," and proceedure." Clearly,
morphology cannot account for all the vagaries of the English
vocabulary, and spelling instruction, historically, has not
availed itself, on any large scale, of morphology as a
strategy for correct spelling.

SPELLING STRATEGIES

It can also be found that student development has a role
in the use of various strategies in learning to spell. Many
studies have found that most children learn in specific
stages, regardless of the type of classroom instruction

(Beers and Beers, 1980; Gentry, 1978; Henderson and Beers, 1980; Zutell, 1978). Therefore, the cognitive development of each child must be considered, so that spelling can develop naturally and logically; switching too early to repetitive drill and practice can thwart spelling development (Beers and Beers, 1980). Funk and Funk (1987) have found that basic principles of learning, such as immediate feedback, reinforcement, and practice, will produce increased spelling ability, but offered no preferred instructional method. Some research studies focus on the role of spelling patterns and rules in arriving at correct spellings. A knowledge of the rules of orthography and prediction skills are demonstrated to be marks of some good spellers (Barron et al., 1980; Marino, 1980; Rosinski and Wheeler, 1972). One study found a high correlation between knowing the meanings of words and spelling them correctly (Mangieri, 1979).

Some researchers have studied language-aberrant populations to find clues to spelling ability. Some studies have found a correlation between the phonetically inaccurate ("diltum" for "nature") mistakes of poor spellers and patients who had suffered damage to the left (dominant) temporal regions of the brain (Morton, 1980; Nelson and Warrington, 1974; Sweeney and Rourke, 1978). Studies of profoundly deaf and of receptive aphasic children, those who neither comprehend nor produce oral speech, have shown that though their exposure to language in all its forms is much

less than that of normal children, their spelling is as good and often superior (Cromer, 1980; Dodd, 1980; Gates and Chase, 1926). Research into reasons for this anomaly led to a study of the specific strategies which spellers have at their disposal. Studies of tasks which discriminated between good and poor spellers fell into two general categories--auditory and visual strategy tasks. Studies which tried to correlate auditory memory tasks with spelling ability were on the whole unsuccessful (Day and Wedell, 1972; Goyen and Martin, 1977; Lesiak and Lesiak, 1979), though Marsh et al. (1980) found that children begin spelling using a phonemic strategy, to be replaced as they become more experienced.

In experiments using children who were at once good readers and poor spellers, evidence pointed to different strategies being used for reading and spelling--these children still used a phonemic strategy for spelling, but were depending on visual chunking for reading (Bryant and Bradley, 1980; Frith, 1980). Since phonemic information alone leads to only about fifty percent correctness in spelling English words, the use, or addition, of other strategies would increase spelling success (Simon and Simon, 1973). Frith (1980) is puzzled by the fact that her experimental subjects seem to prefer to "read by eye and write by ear," since visual spelling would seem potentially more efficient than the misleading phonetic strategy. Yet

the teaching of visual strategies for spelling has been so far a relatively neglected topic of research (Tenney, 1980).

Many studies recognize the importance of some visual strategy in spelling, especially for phonetically irregular words. Studies which changed the appearance of words, such as by using zig-zag or upper/lower case letters randomly, found that visual appearance did affect spelling success (Tenney, 1980). Tenney (1980) also found that when university students were not allowed to use paper and pencil to spell, they finger-wrote or air-wrote, suggesting they tried to visualize the word concretely. Many studies found that children spelled more accurately when visually prompted than when auditorially prompted (Battle and Labercane, 1985; Ehri and Wilce, 1979; Farnham-Diggory and Simon, 1975; Henderson and Chard, 1980; Naidoo, 1971; Sears and Johnson, 1986; Templeton, 1986). An experiment with adult visualizers and non-visualizers found that visualizers arrive more quickly at the number of letters in a spoken word cue. The experimenters hypothesized that ". . .average spellers spell by rule, good spellers spell by rote" (Sloboda, 1980, p. 247).

Visual memory, however, has not been shown to be the entire key to spelling ability. Fehring's study (1983) found support for the existence of visual cognitive strategy for orthography, but only when accompanied by strategies acquired through experience about the written and oral form of the

language. Ehri (1980) postulated that word forms are stored in memory, which become the symbol for both meanings and sound, increasing the likelihood that conventional spellings, rather than phonetic variants, will be produced. Walker's 1974 study of college-age students found that good visualizers do better when spelling phonetically irregular words, but not significantly better with phonetically regular words. Barron's study (1980) showed that good and poor readers used predominantly a phonological strategy in spelling, but that poor readers are less likely to use a visual strategy to spell words. Barron wondered if phonics instruction in school is predisposing children to use phonetic strategies, while look-say methods may train children to employ a more visual method. A 1976 study (MacGregor) found that among seventh grade experimental subjects the four most important independent variables in successful spelling were reading comprehension, phonetic analysis, vocabulary, and visual memory, in that order. Conversely, a similar 1968 study found a significant relationship for rote memory and phonetic skill to spelling achievement, but none between visual memory and spelling (Russell 1968). However, Olson et al. (1989) found that gifted spellers most often mention visual memory as their preferred method of spelling, regardless of the words' phonetic regularity.

INSTRUCTIONAL METHODS

Spelling strategies are clearly necessary to help students with words which do not yield to easy assimilation. But instructional methods available to classroom teachers which would take advantage of available information are by no means clearly defined. Ehri and Wilce (1979), while agreeing that images improve children's memory for spellings, felt that ". . .it is not known how this capability is acquired or how it might be taught" (p. 39). Ong and Jones (1982), in a study of educable mentally retarded children, found a high correlation between I.Q. and visual memory, and felt that training in visual memory was possible. Hendrickson (1988) feels that visualization is learned and thus trainable, and that preventive optometric training of youngsters who have not learned it well enough would go far to "avoid many of the scholastic (including spelling) and social problems which are certain to follow any lack of skill in eye movements, eye-hand coordination, or other visual-motor activities" (p. 395). A study of adult literacy classes found a small group having trouble learning through phonological means. When instruction was switched to short-term visual memorization, which encourages rote learning of a visual memory, they improved rapidly. The experimenter's conclusion was that phoneme-grapheme rules are a powerful strategy in spelling, but not the only one, and spelling instruction should be

matched to learners, who may each have different methods of learning successfully (Marcel, 1980). Further complicating the subject is the finding that information received from auditory stimulation is held for a second or two in short-term memory, while a visual stimulus is held for only a quarter-second. Some information is available about short-term memory, but little is known how long-term memory, necessary for spelling success, works (Crowder, 1972).

THE VISUAL MEMORY COMPONENT

Some researchers have begun to examine ways of increasing spelling ability by increasing visualization skill. Caban et al. (1978) used eighth graders in a small town public school and instructed an experimental group in spelling by using a mental imagery practice method, as opposed to two other (control) methods. Results were not statistically significant, though there was a small increase in ability of the experimental group. Radaker (1963), on the other hand, induced long-term improvements (statistically significant after one year) in a fourth grade experimental group by two weeks of active imagery training. The training consisted of dramatically visualizing each word, even to stabilizing the image by mentally nailing it to a theater screen or using paste to glue it in memory. The experimenter felt that imagery training forcibly divorces a figure from its ground, clarifying the detail, in this case, letters.

This seems consistent with studies which found that spellers cannot get by with "visual slurring," not attending to each letter in a word, as they can in reading, since spelling requires total recall, where reading requires only recognition of enough to identify the cue (Frith, 1980; Harris, 1985; Hendrickson, 1988; Stanback, 1980). Harris (1985) tested Frith's (1980) hypothesis that readers can succeed by using partial cues, but that spellers cannot. She found a correlation between field dependence and percentage of spelling errors. Furthermore, there are usually more phoneme-to-grapheme possibilities (spelling choices) than options for grapheme-to-phoneme (reading choices), discounting lexical and semantic incongruities (Henderson and Chard, 1980). Another experiment (Roberts and Ehri, 1983) found that spelling retention is increased when subjects are required to retain spellings in memory as orthographic images, rather than by rehearsing and copying words while they are in view. These experimenters made a point of remarking that rehearsing and copying words in plain view are the tasks which spelling programs in schools most often require. With this in mind, it is instructive to read of a 1989 study (Olson et al.) which followed gifted spellers, winners of the Scripps Howard National Spelling Bee in 1987. These successful spellers were asked for their own strategies

for learning new words, hard-to-remember words, and non-phonetic words. In all categories, the favorite strategy used was visual memory.

STATEMENT OF THE HYPOTHESIS

It is possible, through a review of the literature in the area of the role of visual memory in spelling, to find a general consensus of opinion that visual cues are important in the acquisition of spelling skill, especially when non-phonetic words are being introduced. Increasing visual memory and applying it to the acquisition of spelling skill in the classroom seems both possible and promising. It is recognized that there are no doubt many variables to learning to spell successfully--reading ability, practice time, learning mode, maturation, self-confidence, and self-determination, among others. It was hypothesized, however, that classroom instruction in the area of visualization, integrated with a program of spelling instruction, would result in a greater degree of classroom spelling success than in a control classroom which employs the same type of spelling instruction, but without the visualization component. It was further hypothesized that visualization training given independently of spelling instruction will transfer to significantly affect spelling achievement, though to a lesser degree than if used with specific spelling lessons. In this study, spelling success was defined by achievement level on the weekly spelling posttests.

METHODS

SUBJECTS

The subjects for this quasi-experimental study were three intact fifth grade classrooms, all the fifth graders, 36 boys and 34 girls, in an urban school comprised predominately of students of low socio-economic status. There were some differences in the number of girls and boys assigned to each classroom (Classroom A, 10 boys and 13 girls; Classroom B, 12 boys and 11 girls; Classroom C, 14 boys and 10 girls). Two students in Classroom C were identified as being in one of the major minority groups (1 Asian, 1 Afro-American). Classes were previously formed by stratified selection, and equality was attempted in sex, special program needs, and school performance. However, students who moved in and out before the study began somewhat skewed the homogeneity of classrooms; therefore, multiple regression was performed to control for these variables. All fifth grade students were included in the study, save those who received specific spelling instruction elsewhere as part of their special education remediation. One classroom, Classroom A, was randomly selected to contain the experimental subjects who would receive visualization training as a specific technique in conjunction with their

weekly spelling words; a second randomly selected classroom, Classroom B, was given training in visualization techniques using designs and words not in the week's spelling list; the third classroom, Classroom C, was given no visualization training whatever. One teacher taught all spelling classes, in order to control for teacher difference in style, experience, and philosophy.

INSTRUMENTS

All students were administered the "Denver Test of Written Spelling," University of Denver, an instrument in general use in the school district to reveal a starting point for remediation, as a pretest to achieve a baseline of each classroom's mean ability. It was selected because it does not require discrimination of correct/incorrect words on a multiple choice task and thus is directly related to actual spelling tasks. It also can be administered to groups, rather than individually. Words selected from this test included phonetic and irregular words. The pretest was administered close to the regular administration of standardized tests near the beginning of the school year, thus avoiding any undue emphasis on the subject of spelling in the eyes of the students.

Also given at the outset, to establish a baseline of visual memory strategies already in use, was the "Motor-Free Visual Perception Test," R. Colarusso and D. Hammill, Visual

Memory examples 14-21. This test can be adapted for classroom administration and measures visual memory without requiring motor skills to record answers. Also included in this test administration was a visual perception component of eight items modelled after the MFVP, but which require a motor task as well as visual memory; this more nearly approximates the actual written spelling task.

Students received spelling instruction based on "Success In Reading and Writing," A. Adams and L. Lord, the spelling adoption for the school district. Students generate their own spelling words which contain the letter or blend of the week (-fl-, -ph-). This enhances ownership of the words; they are words in a child's own vocabulary; and there is a component which gives them a commonality. For this study, since some words among classrooms needed to be identical, the teacher added, when necessary, some "have-to" words to ensure that all classrooms had the previously selected ten words in their spelling lists. Experimental classes were given instruction and practice in visual imaging and memorization techniques through a series of exercises designed to require remembering visually presented cues. Experimental classroom A (treatment 1) received exercises utilizing the weekly spelling words, and experimental classroom B (treatment 2) received exercises consisting of irregular, familiar words not in their spelling lesson. These exercises were adapted from the kit "Building Auditory and Visual Perception in

Children," M. Gordon, 1977, Visual Memory section h. The exercises contained therein are suitable for classroom administration; no information on their efficiency in teaching visualization strategies is available.

At the end of each week, students were given a test to measure retention of the week's orthographies. Words were either correct or incorrect; no credit was given for partial success. Only the ten words common to all classes were considered in the examination of results from the experiment. These words were selected from student writing and were grouped into categories by letter combinations which are irregular in sound. Each letter combination is displayed in words which present a range of four to seven different sounds it can represent; all words therefore might not be expected to yield easily to phonetic cues. Following is the list of words chosen to be presented to all classes:

Week 1 (-ea-)

bread	dream	heard	great	cereal	create
measure	ear	earth		nuclear	

Week 2 (-ie-)

piece	friend	audience	lie	patient	quiet
believe		experience	tied		science

Week 3 (-ou-)

mountain	should	journal	cousin	shoulder	you
south			country	pour	group

Week 4 (-gh-)

high	enough	ghost	egghead
through	tough	ghastly	foghorn
eight			
weight			

		Week 5 (-oo-)	
overlook	proof	door	flood
goodbye	smooth	floor	blood
cookies	balloon		

		Week 6 (-gu-)	
guard	gusty	language	argue
tongue	gulf	iguana	
guest	gulp		
guilty			

		Week 7 (-al-)	
moral	talent	male	tall
pedal	palace	female	also
several			always

		Week 8 (-ei-)		
freight	receive	foreign	their	height
neighbor	either	.	heir	
reindeer				
sleigh				

PROCEDURE

The experiment was conducted for eight weeks. Threats to internal and external validity affected all classes equally, so were not considered a large factor. One teacher taught all the spelling, as part of a team teaching effort, and classes moved between rooms for their scheduled turn. Each class was seen by the teacher three times per week, for twenty to forty minutes each session, the total number of minutes per classroom equal at 80 minutes per week. Occasionally classes were canceled due to field trips, assemblies, and days off; these times were not made up, but occurred with approximately equal frequency among classes. If students missed a test, they did not make it up; scores were extrapolated at the end of the experiment.

The weekly procedure was consistent among classrooms and loosely adhered to the "Success In Reading and Writing" program; students generated a list of words which share a pattern, and followed the program's suggested practice exercises. After class generation of the weekly spelling lists, students in experimental classrooms studied, using visualization exercises. The exercises were varied to avoid boredom and repetition, but all required that students reproduce a visual cue which was presented, and then removed, a visual memory skill. A traditional study method of reproducing words in view was taught to the control classroom.

RESULTS

Weekly tests were examined and classroom means and standard deviation were found. In addition, several variables, considered in the literature to be valid dependent measures dealing with student achievement, were controlled for by means of multiple regression statistics.

Age, gender, and socio-economic status were discovered through school files. Decisions about S.E.S. were largely made using information gathered for the school free lunch program.

Reading ability was discovered through examining reading levels scored on the school-administered Fall P.A.L.T. (Portland Achievement Level Test), a standardized test given twice yearly to all Portland schoolchildren for the purpose of charting academic progress.

School performance levels were shown by averaging grade point averages for the first two terms of the 1990-91 school year.

Amount of reading done independently was shown by the school-wide Reading Adventure, a library-sponsored measure of the number of minutes students read independently in one month.

Before analysis began, some adjustments to the data occurred. Absent students were awarded a score for the week based on the mean score achieved for that week by the rest of the class, and that student's achieved average for the weeks in attendance. This allowed for the relative difficulty of the week's test as well as the student's overall ability. The scores of two students from classroom A were removed from consideration, since they had been receiving remedial spelling help from a resource classroom. The total number of subjects considered was thus 68. All effects were evaluated for significance at the $p < .05$ level. The class scores were averaged and compared. Though the control classroom showed consistently less achievement than either experimental classrooms A or B, the results were not statistically significant at the $p < .05$ level (see Table I and Figure 1).

TABLE I

TEST AVERAGES

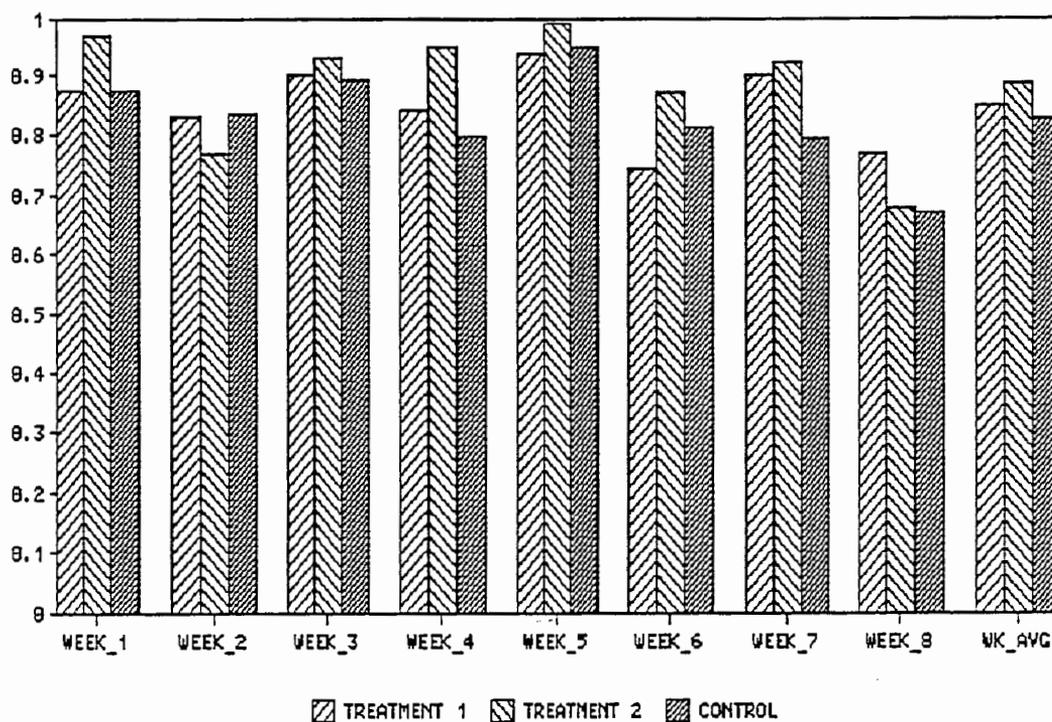|	Treat. 1	Treat. 2	Control
Week 1	.876190	.969565	.875
Week 2	.8333	.769565	.8375
Week 3	.9	.930434	.895833
Week 4	.842857	.947826	.8
Week 5	.938095	.991304	.95
Week 6	.742857	.921739	.8125
Week 7	.9	.921739	.795833
Week 8	.771428	.678260	.670833
8-WK AVG.	.8506	.8853	.8297

Figure 1. Averaged weekly test scores by treatment.

Means and standard deviation of averaged test scores over the eight week period by class are shown in Table II.

TABLE II

MEANS AND STANDARD DEVIATION

	Treat. 1	Treat. 2	Control
N	21	23	24
Avg	.851	.885	.830
SD	.091	.079	.125

Treatment 2 shows the highest average and the least variance among the classes, while the control classroom yields the lowest average and the greatest variance in SD.

Pearson product-moment correlations showed a significant relationship between each class's weekly average and the pre-spelling, reading level, and G.P.A. independent variables. Multiple regression was performed, using pre-spelling and G.P.A. as covariates; since reading level correlated highly with both pre-spelling and G.P.A., its inclusion would not have significantly added to the equation's accuracy. Multiple regression was performed; a significant interaction between treatment and pre-spelling was found when weekly average was used as dependent variable; therefore, no further conclusions could be drawn pursuing that line of inquiry.

Because of the design of this study, it seemed proper to look more closely at the last few weeks' scores than the average of all eight weeks, where the cumulative effect of the training might be expected to be felt. The fact that some weeks' words seemed to be harder for students to spell than other weeks was not a factor in the experiment, since the effect was felt in all three classrooms (see Table III).

TABLE III

AVERAGE FOR WEEKS 5, 6, 7, 8

Treatment 1	.838
Treatment 2	.866
Control	.807

Regression was therefore performed using the average of the last four weeks as dependent variable. P was shown to be at the .101 level.

A secondary question in this study was whether students who already were using visual memory might be helped less by the experiment than those for whom this strategy would be a new spelling strategy. Examination was therefore made of certain students' achievement. A subset of students who scored low (83% and below) and high (100%) on the visual memory pretest was identified for further study. The classrooms yielded an uneven number of students in each category, as shown in Table IV.

TABLE IV

NUMBER OF HIGH AND LOW ACHIEVERS ON
VISUAL MEMORY PRETEST

	Treat. 1	Treat. 2	Control
High	8	6	2
Low	6	1	4

Scores were examined; the differences were not statistically significant at $p < .05$ (see Table V).

TABLE V

AVERAGED HIGH AND LOW VISUAL MEMORY ACHIEVEMENT

	Weeks 1-4	Weeks 5-8	Weeks 1-8
Treat. 1	high .866	high .927	high .896
	low .825	low .808	low .817
Treat. 2	high .875	high .879	high .877
	low .950	low .950	low .950 1 subject
Control	high .913	high .825	high .869
	low .731	low .675	low .704

Since this experiment might be expected to show results cumulatively, rather than averaging the eight weeks, the first four weeks were averaged with the last four.

In the first experimental classroom, however, the opposite trend was shown, with high visual memory students making gains overall, and low visual memory students losing ground. In the second experimental classroom, the high students made very slight gains, and there was only one student in the low subset, who stayed at .950, a very successful score. In the control classroom, all students lost ground the last four weeks, though not at a statistically significant level.

DISCUSSION

This experiment sought to find a method by which classroom teachers could enhance the visual memory of their students, thereby increasing spelling achievement. Overall, the results were inconclusive. Though the control classroom which received traditional, list-and-copy spelling exercises showed the poorest performance, this trend was not statistically significant when compared to the classes which received the visual memory training.

The results of this study bring up several interesting considerations. A period of eight weeks may not be long enough to re-train students in the use of a different strategy. It may be frightening to rely on memory alone, and not have a comforting set of sounds on which to rely.

Long-term memory, necessary for spelling success, and the role visualization plays therein, have not been considered here. Words correctly recalled seconds after the visual cue seem not to have been held in long-term memory, but were forgotten, and correct orthographies with them. It would be helpful to know if the average length of time students could hold words in their visual memory could be increased through training and practice.

Reasons for the relatively more successful showing of the classroom receiving treatment 2 are also interesting to consider. It may be that the exercises themselves were more motivational, since they included words not specifically in their spelling list to remember and reproduce. The feeling of "not doing spelling work" may have cast the entire subject of spelling in a more positive light for the students, giving them the motivation to succeed in the subject.

Exercises that train for an increase in visual memory are not clearly defined. More research is needed into the precise type of exercises which will indeed impinge on visual memory, so that practitioners may use them with some confidence that they will do what they purport to do. Without this, it is difficult to say with certainty that training for visual memory is indeed taking place.

More classroom research into learning styles is needed to ascertain whether a style not presently accessed can become, through intervention, a viable strategy. It may be that visual memory cannot be significantly increased by a short period of intervention. There may be great resistance for students to choose metacognitively to rely on an unfamiliar learning style. Though the number of students in the high and low visual memory subset was small, there did seem to be evidence that students already using visual memory successfully were more successful when presented with these

experimental tasks, which dovetailed perfectly with their learning strengths.

Classroom teachers need specific, empirical knowledge about how their students learn to spell and how to help them succeed. Further studies which contribute to this goal would be a productive line of inquiry for the future.

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APPENDIX A

VISUAL MEMORY EXERCISES

The following exercises were given to both experimental classrooms in the same sequence and frequency. Treatment 1 was given words from the list of spelling words to study, and Treatment 2 was given words which were familiar to them, but which were not being studied as spelling words.

These specific exercises were selected because they all have in common one component. They show students a cue for a short time, remove it, and require that students recreate it in some way, a visual memory skill.

1. Display short sentences on the overhead for a short time. Students have worksheets with all the words, and others, arranged in random order. They are to write the sentence correctly.

2. Display words on overhead, one at a time, for a short time. Students have same words, but with letters scrambled, on worksheet. Students must find scrambled word on worksheet and unscramble letters to write word correctly.

3. Cards are made containing words. Students work with partners, one partner showing the card for a specific time, then withdrawing it; the other partner then recreating the word, using alphabet soup letters. Partners then exchange tasks. Each correct word gets a point.

4. Students are shown a word on the overhead for five seconds, then it is removed. Students write the word from memory. Re-show the word so that students can check their

spelling. Students are instructed not to begin until the image is removed, to control for copying.

    5. Three correctly spelled words are flashed on the overhead in a specific sequence. Students are to write them in sequence. Students are instructed not to begin until image is removed to control for copying.

APPENDIX B

SAMPLE LESSONS FOR WEEK

| Treat. 1 | Treat. 2 | Control |

Day 1
T. displays letters to be included in spelling words. Students generate words with that component, either from prior knowledge or from writing. T. writes words generated on chart. Offered words without the component will be shown and discussed, but not included on the chart. T. ensures that 10 of the words are those previously selected for scoring, adding them as "have to" words if necessary. Students copy list.

| T. gives visual memory exercise #4. Students copy spelling words flashed on overhead. Ss recreate words on paper. Reflash and check. | T. gives visual memory exercise #4. Students copy a word randomly selected by T. and flashed on overhead. Ss recreate word on paper. Reflash and check. | T. asks students to write sentence using spelling words. Share. |

Homework for all classes will be the same--to practice spelling words with a parent for 10 minutes.

Day 2
T. displays chart; reads and reviews words. Displays short sentences on overhead, then removes. Ss write sentences as they remember them. Re-show and check after each sentence.

| T. uses three spelling words in each sentence. | No words in sentences are spelling words. | T. displays chart; reads and reviews words. T. assigns ss to create word chain (Scrabble style using all spelling words. |

Homework for all classes is the same--give students a word-find containing spelling words; they are to circle correctly spelled words.

Day 3

Give students a worksheet with spelling words in scrambled order. Show each word on overhead, then remove and ask ss write word correctly next to scrambled form.	Give students a worksheet with familiar words in scrambled order. Show each word on overhead, then remove and ask ss to write word correctly next to scrambled form.	Give students a worksheet with spelling words in scrambled order. Working from chart or student lists, have ss to write the word correctly next to scrambled form.

Show words on chart, review, and discuss. Ask students to alphabetize words, then practice orally with partners. Last ten minutes--test.