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AUTHOR HODGES, RICHARD E.
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ABSTRACT

RESEARCH EVIDENCE FROM LINGUISTIC STUDIES OF AMERICAN ENGLISH ORTHOGRAPHY AND FROM NEUROPHYSIOLOGICAL AND PSYCHOLOGICAL RESEARCH IN WAYS THAT CHILDREN LEARN INDICATES THAT THE CONTENT AND INSTRUCTIONAL PRACTICES OF CURRENT SPELLING INSTRUCTION PROGRAMS SHOULD BE DRASTICALLY REVISED. INITIAL SPELLING INSTRUCTION SHOULD ENCOURAGE CHILDREN TO ANALYZE THE WRITTEN CODE IN RELATION TO PREVIOUSLY ESTABLISHED PHONEMIC HABITS BY LISTENING FOR THE PLACEMENT OF PHONEMES IN WORDS (TO THE WAYS IN WHICH THEY ARE ENUNCIATED, AND TO THE BASIC REGULARITY WITH WHICH THEY ARE REPRESENTED BY GRAPHEMES IN WRITING). THROUGH THESE MULTISENSORY EXPERIENCES WITH THE SOUNDS, SIGHTS, AND FEELINGS OF WORDS, AN EFFECTIVE SPELLING PROGRAM WOULD ENCOURAGE CHILDREN TO DISCOVER INDUCTIVELY THE BASIC VISUAL STRUCTURES OR STRATEGIES UNDERLYING WORDS, AND WOULD THEN REQUIRE THEM TO REINFORCE THESE INSIGHTS IN THEIR WRITING. (JB)

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RICHARD E. H[illegible]GES

The Psychological Bases of Spelling*

It was six men of Indostan
 To learning much inclined,
Who went to see the Elephant
 (Though all of them were blind),
That each by observation
 Might satisfy his mind. . . . (13)

As John Godfrey Saxe's poem continues, it is learned that each of the six blind men arrived at different conclusions regarding what an elephant looked like as they touched different parts of the animal's body, associating that which they touched with some other object they had experienced.

So it was that one man touched the elephant's ear and concluded that the animal was "very like a fan." Another man touched the beast's tail and determined that an elephant was "very like a rope." The others, in turn, concluded that an elephant was similar to a wall, a spear, a snake, and a tree. Thus, in the end, these six men of Indostan:

. . . Disputed loud and long,
Each in his own opinion
 Exceeding stiff and strong,
Though each was partly in the right,
 And all were in the wrong! (13)

Saxe's poem appears to draw a moral which is analogous to the way in which spelling instruction typically has been devised.

An effective program of spelling needs to consider three factors: 1) the subject matter involved; that is, the American-English language, how it is represented in writing, and the bases for selecting the words to be learned; 2) the nature of the learner; that is, how the child learns to spell; and 3) the kinds of instructional practices which can effectively help the pupil to acquire understandings of his language and to develop competencies in using it. The second of these three components—the nature of the learning process as it is related to spelling—will be examined although we shall look briefly at the other factors since all three are integrally related.

The American-English spelling system, the orthography, traditionally has been assumed to be so inconsistent that each spelling word to be learned requires in the main a separate learning act. Given a twenty-word list for a spelling lesson based upon this assumption, the child is required to perform twenty separate acts of memorization. In an effort to make the process of spelling less difficult, various attempts have been made to organize weekly spelling lessons around some pattern which would help the child remember his spelling words more easily and would motivate him to undertake the intellectual effort required to learn each word. Typical spelling programs of the recent past have been predicated upon several rationales, including:

*This is the second of five articles dealing with research in spelling and fifth in a series of eight articles dealing with research in handwriting and spelling which will be jointly published as a bulletin by the National Council of Teachers of English and the National Conference for Research in English. This series of articles on spelling represents a group study conducted at Stanford University by the Cooperative Research Branch of the U. S. Office of Education under the direction of Dr. Paul R. Hanna.

Dr. Hodges is an Assistant Professor of Education at the University of Chicago.

(1) Grouping words according to their utility in children's writing.
(2) Grouping words around some central theme (*e.g.*, Colonial Life).
(3) Grouping words by their visual similarities (*e.g., nation, function, invitation*).
(4) Grouping words around some spelling rule (*e.g.*, for words ending in *y*, change the *y* to *i* before adding suffixes or the *es* of plural forms).
(5) Simply grouping words largely at random (*e.g., tree, fine, sick*) (6).

Despite such efforts to make spelling instruction more effective, these schemes still require children to study each word in spelling lists largely as individual acts of learning. Because any structural properties that words might have in common have not been widely utilized, the child must acquire as many visual memories as there are words in the spelling list and then practice writing these words to reinforce his haptical memory of them.

Consider, however, the pattern of spelling instruction which is based upon the fact that many American-English words *do* possess basic structural similarities. This instructional program assumes that the orthography is basically a written surrogate of spoken language, even though it is an imperfect reflection of all the components of the oral language system. In such a program, the task of learning to spell involves relating the structure of the written code to the structure of the oral code wherever these two structures match.

The structure of the American-English language and its relationships to spelling instruction.

The American-English language may be described as a coding system by means of which the members of our culture communicate with each other. In an advanced culture such as ours, this code has two parts: 1) a *phonemic* system (an arbitrarily selected set of speech sounds) which in certain sequential patterns comprises the oral language code; and 2) a *graphemic* system (an arbitrarily selected set of graphic symbols) which makes possible a visualization of oral language and comprises the written language code. A moment's reflection makes evident that the spoken language requires only that its users be adept in oral (speaking) and aural (listening) skills while the written code necessitates that its users be facile with aural-oral skills and with visual skills as well. Historically, and in terms of the processes of language learning, spoken language is primal to written language.

Further, oral and written language both require that their users possess two discrete though related abilities: (1) speakers and writers of American-English must be able to *encode* correctly; that is, they must be able to select the appropriate phonemes to produce intelligible speech or be able to select the appropriate graphemes to produce intelligible writing, and (2) they must be able to *decode* correctly the spoken and written messages of others if they are to get meaning from them.

These two distinctions are most important in considering how effective programs of spelling might be fashioned. *The act of spelling is one of encoding the phonemes of speech into the graphemes of the writing system.* Reading, on the other hand, is a task of *decoding*, of translating the written code back into its spoken form. The fact that traditional spelling programs have emphasized visual processes in learning to spell indicates that the encoding and decoding acts have not been fully understood by spelling curriculum specialists. When these two acts are kept distinct, it can be seen that aural-oral processes initiate the individual's act of spelling, with subsequent visual reinforcement of what is writ-

ten; visual processes initiate the act of reading, with subsequent aural-oral reinforcement. In short, spelling and reading are inversely related aspects of the complex process of human communication through language.

Because the oral code is primal to the written code, this system is learned first by users of American-English or any native language. Through a process of imitating older children and adult language models and habituating these learnings, young children normally have attained a functional understanding of oral language by the time they enter into formal schooling experiences (2). The fact that most children speak intelligibly and react to the speech of others is vivid testimony that the structure of oral language is at least intuitively known before formal educative experiences are undertaken.

What the child entering school does not possess, however, is the ability to make explicit his knowledge of the oral code; nor does he typically have much understanding of the written code. These learnings are the central purposes of formal language instruction and are attained through experiences with the oral code in *speaking and listening* and with the written code in *writing and reading*. Spelling instruction proceeds from speaking-listening experiences toward writing-reading experiences.

The structure of knowledge and its relationships to spelling instruction.

Because both oral and written American-English have basically similar structures, there is need to examine briefly the concept of "structure" and its relationship to spelling instruction. Actually, a description of the structure of any field of study is simply a description of a conceptual framework employed by scholars in the field which helps them to make meaningful the facts they find (14). It was in an effort to lay bare the structure of the American-English orthography in order to identify and relate its parts that the recent study of phoneme-grapheme relationships in some 17,000 different words was conducted at Stanford University (10).

The investigation determined that the structure of the American-English orthography closely approximates the structure of the oral code. Further, this study disclosed that, when phoneme-grapheme correspondences are examined in terms of each structural component of oral language, these correspondences appear much more consistent than had previously been thought. It is feasible to speculate that individuals who are proficient spellers intuitively recognize and apply these relationships in their spelling of many words, even though they have not formally been exposed to the structural relationships between the oral and written codes.

Helping children to discover the structural similarities of oral and written American-English takes advantage of the cognitive processes. Acquiring knowledge concerning the underlying principles of spoken and written language promotes the transfer of this knowledge to the spelling of many words. Consequently, remembering the way many words are spelled is enhanced because a knowledge of the relationships between oral and written American-English makes it easier to remember certain facts indicating how these relationships apply to the spelling of words.

The processes of cognition and their relationships to spelling instruction.

A useful way of describing intellectual activities is to assume that these activities are concerned with the *processing of information*. The information (stimuli) to be processed is initially gathered by the sen-

sory mechanisms. This information subsequently is stored within the human cortex, from which it is then selected and processed through a series of complex cognitive functions. The result of this processing is human behavior.

The act of spelling may also be described as one kind of information processing. Words to be spelled are assimilated through the sensory modes of hearing and vision, while the writing of them (the behavior which is sought) represents the results of many complex cognitive processes in which what the ears hear and the eyes see is reinforced by the haptical senses of touch and kinesthetics. Clearly, sensory and motor processes are a part of the act of spelling, but the intervening cognitive processes lie at the heart of effective spelling ability.

The role of the intervening cognitive processes has often been overlooked in efforts to develop spelling programs. Two lines of evidence indicate the importance of taking into account these intellectual processes in fashioning programs of spelling instruction: (1) neurophysiological research clarifies the structure of the human brain in which (2) basic psychological processes take place. Both fields of study—neurophysiology and psychology – clarify how information is processed within the human brain, a matter of fundamental concern to spelling instruction.

Neurophysiology and its relationships to spelling instruction.

Neurophysiological research indicates that human intellectual processes are basically series of *programs,* or plans of action, for responding to situations. These programs develop from the individual's interaction with his environment and are made up of those elements of the situation that are found to be important in guiding behavior when the individual must respond to subsequent situations of a similar nature (12). These experiences, assimilated through the sensory modes, are probably stored in the form of neural traces. Networks of neural "memories" develop and are further added to and modified by each subsequent situation which requires their use. This neural modification and adaptation is what, psychologically, would be called learning. The responses which the individual makes are overt testimony of the kinds of intellectual programs he has devised or learned.

How effective these programs or plans for behavior are in achieving satisfactory responses to situations is dependent upon two factors which have important consequences for spelling instruction. First, *multiple* sensory experiences in learning have the advantage of "triggering" appropriate responses to situations because they enable the individual to select various responses upon the basis of one or more sensory stimulations (5). Consequently, a child who has learned to spell a word by the use of the senses of hearing, sight, and touch is in a good position to recall the spelling of that word when he needs it in his writing because any or all the sensory modes can elicit his memory of it.

Second, the development of effective programs for processing information is more a matter of how *much* information is contained in each element of the program than in the number of elements which are contained in it (11). Thus, the content of spelling programs should include information regarding the basic structural principles underlying the orthography that apply to many words. Such principles, when *inductively learned,* enable the pupil to develop a relatively small set of effective strategies for spelling instead of having to develop nearly as many strategies as there are words to be learned.

These and other neurophysiological in-

sights into intellectual processes indicate that the process of spelling is very much an intellectual process. Consequently, at least in early stages of instruction, children need to be helped to make conscious use of sensory information in developing effective strategies for spelling, even though the ultimate aim of spelling instruction is to reduce the spelling process as much as possible to a reflexive sensori-motor form of behavior.

The means to this goal, however, involve among other things, the deliberate development of basic understandings of the structure of the American-English orthography and the ways in which the sensory modes contribute to spelling power. The pattern of spelling and writing is in the head and not in the hand. In order to accomplish the spelling act effectively, many basic concepts concerning the structure and function of the orthography must be available to the individual in order to guide his spelling and writing of words (9).

Psychology and its relationships to spelling instruction.

Evidence that intellectual activity is a form of information processing is also found in recent significant psychological researches which have important implications for spelling instruction. These studies indicate that effective learning is in large part dependent upon how adequately basic intellectual processes are structured (1).

Intellectual development requires continuous conceptual reorganization in which new information is related to concepts that already have been developed (3). How effectively individuals adapt their patterns of intellectual behavior in the light of additional information is a function of the degree to which they have learned systematically to solve various problems (4). Systematic orderings of information are, in short, *strategies for learning.*

Efficient learning strategies are workable rules for the processing of information (8). These strategies develop from: (1) contiguous experiences with similar kinds of information; (2) assimilating these experiences to form conceptualizations of the situation; (3) frequent opportunities to apply these conceptualizations to the solving of problems; and (4) opportunities to use them in a variety of learning situations (15).

Jean Piaget's basic studies of the development of children's intellectual abilities further indicate the significant role that multisensory learning plays in conceptual development (7). These investigations, which have considerable neurophysiological support, indicate that frequent and early multisensory experiences are necessary if subsequent intellectual abilities are to be developed.

Complex, abstract understandings require a great deal of previous concrete, multisensory learning. Similarly, in the development of children's spelling abilities, experiences should proceed from the concrete to the abstract—from initial multisensory experiences with the sounds, sights, and feeling of words as they are spoken and written, toward the development of conceptual strategies for the study and the writing of words.

Summary and implications.

Available evidence from linguistic studies of the orthography, from neurophysiological research, and from psychological investigations, suggests a rather drastic revision of current instructional practices in the teaching of spelling. Because there is ample linguistic evidence to support the position that oral language is primal to written language and that the written code is in large part a reflection of the oral

code, it becomes clear that aural-oral abilities have the highest priority in the spelling process. The development of these abilities suggests that initial spelling instruction might emphasize children's analysis of the written code in relation to their previously established phonemic habits. In accompaniment with the development of strategies of an aural-oral analysis of words to be spelled, there might also be developed important strategies in recognizing basic visual patterns among words so that children can recognize how words "look" after they have written them, as well as calling attention to the way these words "feel" as they are being written. In combination, these multisensory experiences establish a neural reservoir that permits the pupil to develop effective strategies for learning how to spell.

Furthermore, the lines of evidence that have been presented here suggest that the encoding process of spelling possibly can be learned more readily when children are given the opportunity to discover for themselves that basic structural properties underlie the spellings of many words. Further, children should be given numerous opportunities to apply this knowledge in their writing. The introduction of this kind of instructional program into the spelling curriculum should reduce considerably the necessity to treat each spelling word as a separate learning act in which "excessive overlearning" is required if the words that are learned by memorization are not soon to be forgotten. Obviously, these implications for the spelling curriculum and instruction are in need of extensive field testing.

Clearly, however, all children will not be able to take full advantage of multisensory experiences in learning to spell, particularly those children who are physiologically limited in one or more of the sensory mechanisms. These pupils need to be helped to develop strategies for spelling that are based upon those sensory modes which are readily available to them.

The oral foundation upon which the American-English orthography rests indicates the need for children to develop effective aural-oral abilities if they are to take advantage of the consistency with which the orthography approximates the oral code. Sequential training in helping children to listen for phonemes in relation to their placement in words, to the way in which they are enunciated, and to the basic regularity with which they are represented by graphemes in writing creates a basis for effective spelling power.

The spelling act is much like playing a game of golf. Both acts require the availability of certain basic equipment. For spelling, the individual needs the fundamental sensory modes of hearing, sight, and touch. For golf, the player needs woods, irons, and a putter.

Imagine, then, that a player sets out to play a round of golf having available to him only a putter for making all the shots he will have to attempt. It is unlikely that his final score will be the best that he might attain had he been able to use additional equipment designed expressly for accomplishing certain shots. Such a player is severely handicapped. In order to play the game of golf with proficiency, an individual should have access to many kinds of equipment and know how and when to use them. Furthermore, having a good understanding of the terrain of the course upon which he plays and knowing which clubs can best be used for such a terrain helps him to avoid unnecessary shots.

The act of spelling is similarly demanding of its "players." But the penalties for poor spelling are more severe than are those for poor golfing. Our culture places high value on proficient spelling ability. Yet, much spelling instruction has handi-

capped pupils by forcing them to "play the game" without helping them to develop skills in the use of all the sensory equipment available to them. In addition, children often have not been helped to map out the terrain of the orthography, its structure, so that they will know when to use sensory equipment most effectively. The act of spelling requires basic abilities and effective strategies.

Emerging insights into the learning processes generally, and into the spelling act particularly, in combination with available knowledge of the structure of the American-English orthography, indicate that fundamental revisions should be made and tested in both the content and the instructional practices of spelling programs.

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