

Acquisition of Writing Skills

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Acquisition of writing skills is viewed as a reduction of alternatives. Various levels and aspects of early writing are examined—including mirror-image reversals—in terms of a selection from an adjustable number of alternatives. It is argued that allowing information processing to proceed in adaptive stages will result in writing skills that are more accurate, complete, and individualized.

The principle of uncertainty reduction and information is pervasive (Bakan, 1974; Moxley, 1974b) and has been convincingly applied to reading (F. Smith, 1971). The following similarly examines the acquisition of writing skills by young children in terms of the child's selection from alternatives. In particular, a contrast is made between tasks which require the child to obtain the ultimate answer in one step from the full range of alternatives and tasks which permit the child several selections in sequential steps that reduce alternative considerations. The difference is between a strategy for "jumping to conclusions" and one for progressively reducing alternative considerations. In the following, "writing" is to be considered primarily as the production of visible language, however the process, and is not to be thought of as merely what a child can do when restricted to a pencil and a sheet of paper. The formation of words, for example, by typing or by placing "tiles" with letters on them (as in "Scrabble") is also a production of visible language which can be accomplished by very young children.

I. An Example from Handwriting

It has long been recognized that children four to five years of age commonly make some reversal errors in writing (Davidson, 1935; Wilson & Flemming, 1938). Comments by children are revealing

of the nature of the task: "Which way shall I make it?" "Which way shall I turn it? I don't know—I'll turn it any way" (Hildreth, 1932). These comments indicate that the child is considering alternatives, this way or that way, this direction or that direction; and the child is having difficulty in making a selection from whatever alternatives he is considering.

Observation of these children at work gave unmistakable evidence that the youngest children in the beginning stages of learning to make numbers and letters frequently have no clear notion of the direction in which the letter or number should be turned. In many cases, it appeared to be purely a matter of chance whether a letter was turned to the right or to the left, and hesitation and great indecision marked the performance until the final choice of direction was made. (Hildreth, 1932, p. 8)

Given this problem of "turning," the range of possible misdirection includes not only mirror reversals of the entire figure but also the reversal of any particular stroke, including reversals of parts of the figure when that figure is composed of more than one stroke. A "5" is composed of more strokes than a "1," has more "turnings," more decision points, and different parts of it may be turned in different directions. Other complicating decisions that would contribute to reversals and other errors include where to begin and where to connect, especially when the child must lift his writing instrument in order to make the next stroke. Considering the range of possible combinations of alternatives, it is not at all surprising that children might produce a variety of forms before "selecting" the "standardized" version.

A. Mirror-images

The prevalence of left-right mirror-image reversals in particular demonstrates the difficulty of selecting the standard version under certain conditions. The somewhat slow development of standardized directionality from left-right alternatives also has its historical precedent.

Unlike handedness, which appears to be at least to some degree genetically determined, the direction of reading and writing seems to be merely a matter of convention. About AD 1500

there were as many scripts written and read from right to left as there were written and read from left to right. . . . Even today, however, Hebrew and Arabic are written from right to left. . . . Some early scripts, known as boustrophedon (literally an "ox-turning," or the plowing of alternate furrows in opposite directions), consisted of alternating left-to-right and right-to-left lines. In some instances the alternate lines were complete mirror images of each other, so that only the appropriate directional scan would provide each symbol with its correct orientation and meaning. (Corballis & Beale, 1971, pp. 102-103)

Given such arbitrariness in directionality, it is understandable that children would have difficulty in producing discriminative responses for the standardized direction. Reversal and rotational transformations that are seldom critical in identifying familiar objects in a three-dimensional world suddenly become critical when children are required to make graphic discriminations in a two-dimensional one (Sidman & Kirk, 1974).



The particular difficulty of mirror-image discriminations, in which the axis of alignment appears to be critical for the likelihood of mirror-image reversals, is also understandable.

In particular, it must be noted that any object has more than one mirror image, depending on the relation between the orientation of the figure and the axis of separation. If a figure is itself symmetrical about one of its axes, and the axis of separation is parallel to its axis of symmetry, then the mirror image is identical to the original figure. Otherwise the mirror image and the original figure differ from one another. The mirror image of \sqsubset is commonly taken to be \sqsupset , and this is indeed true if the figure is rotated around its base or its open end. However, if it is rotated around either arm, its mirror image is \sqsubset .

As for the present findings, when the child correctly copies \sqsubset underneath, or correctly copies \sqsupset alongside, one might regard his copy either as a faithful reproduction of the original or as a mirror image, since these are indistinguishable. (Huttenlocher, 1967, p. 1175)

Thus, a child might adopt a reproduction strategy in which he copies by moving the line he's drawing near to the axis of separation (which lies between the model and the form he's making) where the model is near and by moving the line far from the axis

where the model is far (and produce a mirror image). Or he may adopt a reproduction strategy in which he copies by moving the line he's drawing near the axis of separation where the model is far, and far where the model is near (and produce an exact copy). Whichever way he does it, there may not always be a discernible difference in the end result. This ambiguity increases the difficulty of the child in determining whether the method of reproduction he selected can be relied upon in other instances.

Greater difficulty is especially experienced in left/right orientation (or in the horizontal direction) by adults (Sekuler & Houlihan, 1968; Wolff, 1971) and children (Huttenlocher, 1967). A plausible account can be found in the asymmetry of the horizontal field in our environment and the bilateral symmetry of our bodies (Corballis & Beale, 1971). This would also explain the difficulty children have in discriminating the directionality of oblique or diagonal lines (Rudel & Teuber, 1963) while readily discriminating vertical from horizontal lines ( vs. ). The presence of directional environmental cues in the vertical plane (an asymmetrical field) readily distinguishes it from the absence of directional cues in the horizontal plane (a symmetrical field). Gravity aligns us with the heavens above and the earth below; our feet are on the ground and our head is in the air. But what is on our left could easily be on our right; and what we see on the left side of our body is similarly seen on the right side. There are no easily identifiable, clear-cut aids to guide the child in his selection.

B. Complexity

While it is clear that training can produce improvement, it is also clear that some figures are more difficult for children to reproduce correctly than others. Children have little difficulty discriminating and producing "l" and "o" (Coleman, 1970; Lewis & Lewis, 1965) but have greater difficulty with more complex figures such as "N" and "5" (Lewis & Lewis, 1965; Moxley, 1970). In fact, even a simple directional turn may not be as difficult for children to reproduce correctly as it might first appear. For example, Moxley (1970) found that none of a class of 23 kindergarten children reversed "<", which occurred first in the forms to be

copied, although a few children reversed “>”, which followed (perhaps an overgeneralization effect), and all but 2 children reversed one or more of the digits and symbols.

It has been suggested that orientation as a visual memory form is not that difficult (Bryant, 1973; Stein & Mandler, 1974), at least under certain circumstances. This suggests that multiple alternative considerations may seriously complicate the task for the child; e.g., multiple parts to orient, multiple methods of reproduction. In general, the consideration of more alternatives implies greater uncertainty and in that sense makes the final selection more difficult. Thus, it seems reasonable to expect that a child will more easily be able to be successful when there are fewer alternatives he needs to consider.

C. Aids for Implementation

It is possible to imagine a variety of ways in which aids might be provided for the child so as to make each stage in his progress easier, aids which would help him to reduce the alternatives for consideration. The child, for example, might be given a mnemonic algorithm for the internal structure of the figure, one stroke at a time (e.g., “neck, belly, hat” for “5” [Enstrom & Enstrom, 1969; S. Smith, 1973]); or he might be given feedback from latent images (Skinner & Krakower, 1968) or tracing (Dubnoff, Chambers, & Schaefer, 1969); or a vertical line for an external environmental cue (Smith & Smith). Not all “aids,” however, may be helpful, whether writing instruments (Otto & Andersen, 1969) or cueing schemes (Moxley, 1970).

Explicit instructions on orientation (Caldwell & Hall, 1969), directional figure cues (Jeffrey, 1958), fading techniques (Bijou, 1968), and reinforcement (Tawney, 1972) have improved children’s discrimination of orientation. Fading techniques (Moxley, 1970) and reinforcement (Brigham, Finrock, Breunig, & Bushell, 1972; Hopkins, Schutte, & Garton, 1971; Sidman & Kirk, 1974) have also been used to increase the writing of figures in correct orientation.

D. Some Considerations for Application

Consider the following sequence of tasks in terms of the considerations they would provide and how they might reduce the complexity of the task for the child. The teacher models each task, then "walks" each child through it one step at a time, until the child can respond without prompting. The teacher also makes freely available the following guides: (1) oral mnemonic guides, (2) letter and numeral forms for "tracing" (or some other "instant feedback" device), and (3) letter and numeral forms for reference.

The teacher might begin with forms taped to the bottom of a flat pan that could be covered with a thin layer of salt, permitting the forms to show through. Children could then trace the forms with their finger and shake the pan to erase. Thicker layers of salt could be used until the child was ready to use a separate reference for the forms, removing the tape from the bottom of the tray but still leaving a model that the child could refer to. The child could then progress to using some writing instrument; e.g., from writing on a chalk board with a wet finger to writing with chalk (again, a similar choice of guides used previously could be made available). The child might then move to crayons or markers that could be easily erased while tracing or copying on an acetate cover. From there the child might move to paper and pencil or "magic marker." There facilitating aids might be models written on the paper, perhaps models that are gradually faded out, perhaps feedback from latent images, perhaps a marginal cueing line, perhaps folded paper.

The above serves to illustrate a variety of ways for reducing the complexity of the task for the child, ways which the child might skip or select at his own choosing. Some children may require a detailed combination of aids, some only a few to get them started. Different children bring different considerations of alternatives to the task. A verbal algorithm permits vivid imagery and internal structure to be recalled. Writing with a finger reduces the complexity of handling a writing instrument. Fading out an aid (e.g., with more and more salt or less and less cues) permits successive stages of greater independence from that aid. A feedback device permits self-checking and self-correction. A reference to an external reference point (e.g., "go toward the line") permits the left/right orientation to be anchored to a visible cue in the field.

II. Jumping-to-Conclusions or Reducing Alternatives

Simon and Simon (1973) have presented the advantages of an "indeterminate" algorithm of sound-letter lists over a "determinate" algorithm of a rule-table procedure in terms of both spelling accuracy and usefulness. They recommend a generate-and-test technique that encourages trying out alternatives rather than rules for directly arriving at the "correct" spelling.

The determinate algorithm method moves directly from identifying the occasion for its application to the "correct" answer. There is thus but one jump between initial uncertainty and the resolution of that uncertainty. The full range of alternative word forms is to be handled at one step by applying a list of rules. The problem, however, is that the "correct" answers dictated by the rules do not invariably match with reality. There are variations in the language unaccounted for and unpredicted by the rules. Multiplying the rules results in diminishing returns. Spellings still exist outside the rules, for the exactness and determination of the rule system is too restrictive for what actually indeed exists. For example, "i" before "e" except after "c" does not account for "seize."

In contrast, the indeterminate algorithm does not move in one jump from initial uncertainty to resolution but in successive stages which progressively reduce the variety of alternative considerations. The aids recommended are not ones immediately resulting in answers but ones which help reduce the alternative considerations. It is one step to generate a list of alternative written representations for representations in sound (perhaps with the help of a dictionary-type key). It is another step to write down some of those alternatives for comparison; e.g., "sieze," "seize," "secze." And it is another step to make a final choice after visual inspection.

The contrast between these two concepts is a powerful one. On the one hand, the child is given a set of rules which do not consider some of the correct alternatives and which necessarily produce incorrect answers because of this. On the other hand, the child is given an aid for reducing alternative incorrect considerations, permitting the possible correct answers to remain among the alternatives.

Generally, overly restrictive and deterministic approaches that

try to simplify the movement from the full range of alternatives to the final answer in one step are often neither efficient nor effective. They often place children in artificially difficult situations, increasing rather than decreasing task difficulty, with error built into the answers. Such examples include requiring every child to begin handwriting with an exact replication of a particular model (e.g., touching particular lines at particular places, using a particular writing instrument, a particular posture, a particular sequencing of strokes, etc.); to begin expressive writing with thorough proof-read perfection using a particular dialect, style, and vocabulary; and to begin reading only in a manner suited to a particular oral reading model which requires vocalization of an unfamiliar text. As with spelling, these are examples of applying inflexible rules to produce correct results quickly in one step. As with spelling, these rules are notorious for producing "bad" results. Colleges are filled with students who lack flexibility in adapting reading to a purpose and who can read silently little faster than they can read aloud. Many of the "rules of grammar" that have been taught have strongly been repudiated by linguists. And it is commonplace to observe how badly the supposedly well-educated can write.

Where applicable, the jumping-to-conclusions model seems to have its best fit for low level factual recall skills and concrete rote learning. The more such algorithms are applied to higher level skills, to more abstract skills, and to more complex problem solving skills, the worse they seem to fit. In practice, much of traditional classroom "teaching" tasks are more "tests" that force children to "conclusions" for which they are not well prepared (Moxley, 1974c; D. Smith, 1974). Some of the relationships of indicators for concrete and abstract thinking have been examined in the classroom by Harvey (1970); Harvey, Prather, White, and Hoffmeister (1968); Harvey, White, Prather, Alter, and Hoffmeister (1966); and Soar & Soar (1972).

It should be pointed out, however, that what may be a complex problem at one level (e.g., drawing a letter for a three-year-old who has only been able to scribble) may be a simple concrete skill at another level (e.g., drawing a letter for an experienced layout artist). The response considerations may move from the active

consciousness to unconscious automaticity, from relatively “free” information to relatively “bound” information (Bakan, 1974). Those who have already acquired and assumed behaviors, taking for granted what they once struggled to learn, may also assume that a simple jump to a conclusion is all that the learner needs.

A reduction-of-alternatives approach does not attempt to resolve problems by putting all the considerations into foregone conclusions. Instead, this approach seeks to exhaust the full range of alternatives in a systematic fashion. A reduction-of-alternatives approach may begin with the full range of alternatives and seek to eliminate a large number of alternatives at each step. In the game of twenty questions, for example, questions can be asked to identify a specific animal, vegetable, or mineral which can only be answered by a “yes” or “no” response. Here, asking if something is bigger than a breadbox is more likely to eliminate substantial alternative considerations in the beginning than asking if something is a diamond ring. In this game, of course, the optimal strategy is to halve the alternative considerations at each step rather than to seek the final answer with every question. Jumping to conclusions is the wrong strategy for this game.

A reduction-of-alternatives approach, however, may also begin with only a few of the alternatives. The child makes a selection from those, and is then exposed to a few more alternatives. He makes a selection from those, and so on, until the child is exposed to the full range of alternatives. Fading out cues and prompts can serve this purpose. The child may be selecting the “final” answer at each step, but he is progressively expanding his ability to handle more and more alternative considerations. This may mean moving from the easy considerations to the more difficult ones after the child has mastered the earlier alternatives. The child, for example, may begin by writing “I,” discriminating the vertical from the horizontal, and then write “L,” adding a left-right discrimination from the earlier alternatives of vertical and horizontal. Or the child may move from the multiple visible differences between a simple “l” and “o” to the more subtle difference between the more complex figures of “b” and “d.”

Any time inappropriate alternatives are eliminated from consideration or any time an equally likely alternative becomes more

likely or less likely than the other alternatives, then there has been an information gain, and the final answer is closer than before. For example, knowing that the answer is "b" or "d" is a gain in information from previously knowing that the answer was "b," "d," "p," or "q." In principle, the magnitude and rate of information gain can be adjusted to the capacity of each child so that it can be challenging without being either intimidating (too much) or boring (too little). Even though we may be unable to determine what the child's actual considerations are, we are able to increase or decrease the considerations involved in the task.

If the child is successful, we know we did not present too many alternatives. If the child shows motivated interest, by a high frequency rate of response or sustained attention, we have an indication we did not present too few alternatives. When the range of alternative considerations is manipulated and varied, information on response rate and specific improvement in performance provides empirical evidence as to which alternatives were most effectively adapted to a particular child.

The teacher may be the sole manager of alternatives presented to the child's consideration, deciding what alternatives to reduce, in what sequence, and what the final product will be. The child himself, however, may also be extensively involved in the management of alternative considerations. He may decide for himself which sequence of steps to move through. He may observe the results of his performances, monitor his own progress, and use empirical criteria of improvement for evaluating his own decision-making and self-selection.

Clearly, the decision-making needn't be a mutually exclusive, either/or involvement. Both teacher and child can participate to varying degrees in a reduction of alternatives approach. Although it may well be advantageous to have the child assume more and more decision-making responsibility, any additional consideration involved in additional decision-making adds to the total of considerations facing the child. And this too must be considered in a reduction of alternatives approach.

Because a reduction of alternatives model moves through progressive stages and seeks only the optimal amount of information for any particular child moving through any particular stage, the

total range of alternative considerations that are eventually processed may be indefinitely large. There is little need to permanently leave out any relevant alternative from consideration merely in order to simplify the task. Anything of relevance can be considered, which increases the likelihood that any useful alternative can be identified and can contribute to the solution. In contrast, since the jumping-to-conclusions model must process all the information at one hurdle, many relevant alternatives may be permanently excluded simply in order to simplify the task and make it more manageable. Reduction of alternatives simplifies by adjusting the alternatives to be considered at each stage. Jumping to conclusions simplifies by refusing to consider some alternatives, even if relevant, and by accepting “wrong” answers because they fit the rule. Reduction of alternatives does not need to ignore any problem or any consideration. Jumping to conclusions must ignore many problems and many considerations.

III. Levels of Writing

A reduction-of-alternatives approach could be applied to all levels of writing for all the components of a meaningful expression, from writing parts of letters and numerals to writing whole letters and numerals, from writing parts of words to writing whole words, from writing parts of complete expressions to writing complete expressions. Components of different levels can be learned separately or simultaneously. Analytic and holistic aspects may be combined. For instance, meaningful expression may be formed solely by a phrase, a word, a letter, or even a basic stroke of letter-numeral forms (i.e., “I”), given the appropriate context.

Variety is intrinsic to this approach: a variety of alternatives, a variety of guides, and a variety of activities. And all of this is subject to evaluation and comparison in terms of effectiveness and efficiency in generating a full and complete range of relevant considerations, reducing uncertainty, and producing a desirable outcome.

A. Writing Parts of Letters and Numerals

Even at the earliest levels, a reduction-of-alternatives approach would be consistent with the encouragement of problem solving,

creativity, and simply “playing” with visible language skills. Even scribbling can be colored and decorated, much like a stained glass mosaic, and it can serve as a kind of primordial “stream” of behavior from which increasingly specialized forms can arise.

Rhythmic scribbling exercises could serve to uncover natural basic patterns.

The most important element in this pattern is the angle, or the different angles, or movements; . . . we should not teach basic symbols of the alphabet in a specific traditional form, but only basic form-characteristics. . . . The idea is not to show a specific “a,” but to show the *characteristics* of the symbol “a,” etc. . . . This general approach to handwriting will be much freer and entail fewer frustrations. Its advantages will be greater sensitivity in recognizing patterns, and greater sensitivity towards the basic rules of form and shape. (Crowel, 1974, p. 264)

Rather than insisting that strokes only be performed in one direction, for example, the child could be permitted alternative ways of writing “N,” “M,” “5,” etc. For attempts to establish a consistent preference in movements may come at a cost. Consistent downstroking, for instance, requires a child to lift a writing instrument from the page when making an “N.” Permitting a child to begin an “N” with an upstroke permits the child to keep his writing instrument on the paper and is a remedy for reducing the reversal of “N” (Enstrom & Enstrom, 1969). A similar problem exists with the numeral “5.” Is progress of the child facilitated more by putting a priority on strokes which do not have to be made by lifting pencil from paper or is the priority to be placed on stroking in one direction only? Or should a choice be permitted?

Different ways of combining frontward and backward “c” with a line can form “b,” “d,” “p,” “q,” and other symbols, depending on the particular letterform model (Enstrom & Enstrom, 1969). Children can thus build the appropriate form from a limited set of component forms which have multiple correspondencies to different letters and numerals. This “set of diversity” in which a component form can be used for many symbols (Barganz, 1974) stands in contrast to advocacy of an invariant one-to-one correspondence approach.

Additional buildings of all letter and numeral forms can come from selections and combinations of straight and curved strokes in vertical, horizontal, and diagonal orientation, in which the turnings and connections are decisive. A picture of a house, roof, and sun can provide the basic strokes, as can a drawing of a ball, bird, and stick (Fuller, 1974). Even a picture of round clouds and slanting rain can provide basic strokes (Wright & Allen, 1975). Thus, children could learn to form letters and numerals in a stage by stage selection from a limited set of alternatives rather than being left to follow a particular algorithm for each separate letter and numeral. For a particular algorithm may be rather complex and may still leave aspects like reversals unaccounted for, especially when an explicit environmental cueing reference is not available.

It is also easy to imagine sensible alternatives to invariant rules for writing instruments (Anderson, 1966; Wiles, 1943) or grip (Otto & Anderson, 1969), as well as posture, slanting of strokes, and touching ruled lines on paper at particular points or avoiding them at particular distances. For with a monolithic approach that insists on only one way for all children to move to the "correct" answer in one jump, the child is lost if the correct answer does not result. He has no other means to find his way. A reduction-of-alternatives approach permits the child to select from among alternatives in successive stages to the correct answer. If the result is not satisfactory, the child has other alternatives to choose from.

B. Writing Parts of Words

Similarly, children can learn to spell in parts and thereby learn the beginning, middle, and end forms for words and their sounds. For example, if " _op" were already written for children as a guide, the child could then be asked to fill in "m" or "t" depending upon whether he heard the word "mop" or "top." Successive stages might move from " _op" to "to _" to "t_p" to "t _" to " _ _ ." By arranging the guides so that they would permit limited ranges of alternatives in progressive stages of difficulty (i.e., in general, expanding the range of allowable alternatives), clearly defined alternative choices could be made available for the child at whatever level desirable.

Among these guides could be keys to sound and letter correspondence, much as the key at the bottom of a dictionary page. Following Simon & Simon (1973), children could be permitted to generate lists of feasible alternatives, exercise a decision procedure in their selection (from visible inputs of the morphology or "form" of the words), and check the result (e.g., against a glossary or dictionary).

There are several advantages to an approach like this over the memorization of word lists for "spelling." (1) It would be a practical skill useful for looking up words in a dictionary. It would even be easy to make up a pronunciation key just like dictionaries do, using key known words as examples with marks over the vowels; e.g., "ā" as in "bāke." (2) It provides some information about print to sound as well as exact information about sound to print. Known words and sentences can be pronounced so that it can always be meaningful, at least more so than trying to analyze unfamiliar words from print to sound. (3) It is less complex and less of an information load than a whole word would be. It can be used for a minimally meaningful discrimination (e.g., "bit/bet") where the choices for the child to consider can be so few that if he does make a mistake he knows what the right way must be (e.g., telling the child to point to "i" or "e" when you say "bet"). It may thus be self-correcting in a way that handling all the sounds all at once in a whole word could never be (when there are too many other possible wrong ways for the child to select a "correct" way). This also makes it easier to reinforce and shape the child for small steps of progress. (4) It lends itself to games and peer tutoring cooperative relationships (e.g., bingo games where key letters for vowels could be printed on bingo cards, a word called, a letter covered; nonsense word games; flash card games; and situations where it would be easy for one child to share his little "bit" of knowledge by teaching or testing another child). (5) It lends itself to precise measurement of progress and research since exact records of the child's performance can be kept, and these records can reveal exactly where the child's difficulty is and what he has learned. (6) When a child writes in his own letters, even if only inserting a simple "i," he is expressing himself in print. Self-expression in visible language is open to considerable feed-

back. The expression is visible. It endures. It can receive feedback over time quite easily.

C. Writing Words and Parts of Phrases, Sentences, Paragraphs, Stories

At this level, the child could write words to form meaningful expressions, beginning at the one word level and expanding with the aid of guides that control the range of alternatives. At the one word level, for example, the child could make lists of things that make him happy, sad, or mad. Or he could make a book of wishes, or words he knows, or would like to know, or any collection he desires, in a kind of paradigmatic listing. Or the child could be given prompting guides that would narrow the alternatives that could be considered to completing an idea, in a kind of syntagmatic fashion: e.g., "My favorite food is . . . ; The scariest thing that ever happened to me was . . . ; If I were the teacher, I would . . . ; If I were president of the U.S., I would" (Variable numbers of word forms or word cards may also be used in the substitution and sequencing of expressions.)

D. Writing Complete Expressions

Children can write their own stories, newspapers (which permit an indefinite variety and frequency of written expression), reports, books, novels, etc. Children, for example, can write a story, make a table of contents, title, author, vocabulary list, thought questions, and illustrations, with a check out card at the back to become part of the classroom's resources. Or the writings and illustrations of every child on a particular theme may be compiled as an anthology and pasted in a scrapbook for future reading in the class "library." Writings, stories, collections, or books can be long or short and accumulated in individuals folders for an exceptionally accurate and detailed account of a child's progress in writing. One of the strongest assets of written performance is its permanence and ease of collection, which make refinements and the slightest progress easily accessible and detectable. Any written document can be progressively modified in terms of alternatives for spelling, punctuation, descriptive words, expression, and sequencing of ideas which can be considered and reconsidered for children individually or as a group, as in a group project or play.

Labeling the contents of the classroom, notewriting, letters, and book reviews can all be considered and designed with aids for a convenient limiting of alternatives. The child can determine whether to work on the formation of letters, words, or meaningful expressions, or all three. Permitting the child self-selection in the aids and levels of effort can be a self-diagnostic device in itself. The child can reduce alternatives at his own pace, in the direction of his own interests. The child may choose his own writing tasks, or tasks may be provided for him with an opportunity for a considerable range of interests from which to select. Consider the alternatives and the selections that might be considered in the following example from Lamberg (1974, pp. 10-11); whatever the level of the child:

Step One: The purpose of this step is to write down a lot of different memories. These memories will be used as the subjects of your narratives.

Directions:

- a. You will be writing as much as you can in fifteen minutes.
- b. Before you start writing, look around the room until you see something that reminds you of something that happened to you, some memory.
- c. When that memory comes to mind, write it down.
- d. Then ask yourself what else you are reminded of and write down whatever comes to your mind.
- e. Once you get started, let your mind go from one memory to another and put down everything that comes to mind.
- f. Start your list of memories on the opposite page.

Step Two: The purpose of this step is to choose one of the memories in your list as a subject for a narrative.

Directions:

- a. Read over your list of memories and
- b. Ask yourself—which memory would I like to write about?
- c. Choose the memory and circle it.

Step Three: The purpose of this step is to write as many details as you can about the memory. The details will be the material for your narrative.

Directions:

- a. Under the question (on the next page) "What Was It About?" write the words you circled in Step Two.
- b. Think about this memory and get ready to write down everything that comes to mind.
- c. Write down the details under the question "What Happened?"
- d. Write as much as you can in fifteen minutes.

IV. Holistic Approaches

Holistic approaches have been advocated in reading (Douglas, 1973) and language arts (Moffett, 1973). The language arts or the language experience approach are exemplifications of this (Durkin, 1972, 1974; Lee & Allen, 1963; Moss, 1975; Pflaum, 1974; Stauffer, 1970). An advantage of a holistic or systems approach is that the complexity of the entire task can be reduced significantly when it is approached as a whole rather than as a collection of independent components (Laszlo, 1972). Some things are just more important than others. Function has priority over structure (e.g., when the structure exists to serve the function or realize a consequence). Effective communication as demonstrated by a reader's response to writing has priority over the particular form of the expression. And attention to every single structural component is typically an unnecessary and overdetermined constraint if it has to be done all at once. For example, it would be impossible for a reader to attend to every structural detail of print and still be an efficient reader (F. Smith, 1971).

Making books (Moffett, 1973; Moss, 1975), comics and myths (Kohl, 1974), and producing plays (Moffett, 1973) are examples of holistic approaches. All aspects of language can be brought to bear in these productions. All the parts can exist in functional relationship to the whole. In such a context, meaningful consequences exist in a far fuller and richer connection than they are likely to exist in any one part independently. Furthermore, the complete context provides aids for selection which can facilitate the functional and structural choice of any one component. The selection of alternatives is reduced by context determination. Overdetermined aids for making a selection thus become in-

creasingly less appropriate for the more organized and more meaningful expressions, particularly as the more essential structural-functional features become increasingly visible and distinguishable from the more irrelevant and unnecessary (F. Smith, 1971).

To the extent that any complex system is organized, interdependency among its parts would be a feature distinguishing it from mere collections of chaotic aggregates. There is convincing rationale and evidence for a substantial relationship between motor and verbal development (Wolff, 1974; Wolff & Wolff, 1972; Zaslow, 1966) as well as between language variables in children (Early, 1960; Winter, 1957), especially between reading and writing. A constructive view of perception (Neisser, 1966), for example, argues that what we see is determined to some extent by how we put it together. This would seem to be supportive of the view and evidence that early writing leads to early reading (Durkin, 1966, 1972, 1974; Hildreth, 1963; Torrey, 1973). In addition, there is the rather convincing evidence from studies indicating that manuscript writing is more effective in teaching children to read print than cursive writing (Long & Mayer, 1931) and that it facilitates the development of spelling and the number of different words written as well as reading, in comparison to cursive writing (Cutright, 1936). It seems clear then that there are conditions in which early writing can facilitate early reading. And certain kinds of writing skills are more facilitative than other kinds.

As with oral language acquisition, visible language may develop best as an interacting whole in relationship to all language skills and all human skills. In contrast to the Great Debate of order over which comes first, the whole or the part (Carroll, 1972), it may be more proper to see the issue as not an either/or but as providing the child with whichever alternative moves him in the fastest progress, moving him wherever and whenever he is ready to move, writing stories whenever the child is ready and going into spelling whenever the child is ready for that, giving him the opportunity to choose that alternative, on all levels. The question then becomes: What is the measure of progress? What is the scale of values? Which ones have precedence in terms of value of importance rather than learnability?

Generally, a holistic competence would have more value than any of its component competencies since a holistic attainment can be assumed to contain multiple component competencies within it. This does not mean that all learning should occur first and exclusively on that level. Rather, the argument is for making a holistic alternative available to the child whenever it also results in progress (preferably at that level also). If the child is writing better and better stories or essays, more and more easily readable (according to acceptable criteria), let him continue. However, if, for example, he always misspells certain words without making improvement and progress in general has leveled off, a procedure that focuses on that problem can appropriately be implemented. It may also well be that some children do better by moving analytically and serially, step by step, while other children do better by concentrating on a holistic approach (Daniel, 1973). And different children may have their own optimal combination of the two if they have that choice to select from.

In brief, the argument is that the choice between part or whole be included in the consideration of alternatives from which the child can select. If the child prefers to generate a list of different ways for writing a letter, if he wishes to see how the varieties "look" before making his choice in regular writing, he should have this opportunity. Likewise, if he wishes to write a story, even though he is unable to spell any word in standardized form, he should have this opportunity also. Obviously, his choice cannot be independent of the context in which he is in, which includes the desirable goals of the teacher also. But that context, whatever it is, can permit an accommodation that at some time allows him some choice between the whole and a component. And that choice need not necessarily be a mutually exclusive one.

V. Research

Information on effective and efficient improvement of children's writing is obtainable from individual-centered (intensive individual) designs (Risley & Wolf, 1973; Shapiro, 1966; Sidman, 1960). Unfortunately, individual-centered designs applied to language-type skills such as Bijou (1968), Gardner (1969), Moxley (1970), Premack (1970), and Sidman (1974) are all too rare

(Editors, 1974), even though they are eminently applicable to teachers in the field (Hall, Cristler, Cranston, & Tucker, 1970). It is a very straightforward procedure in fact for each child to chart his own progress (Bates & Bates, 1974).

Researchers in education, however, have generally preferred to follow a highly overdetermined monolithic algorithm for research and persevere (or persevere) with aggregate-centered designs (e.g., so-called "classical" experiments of a hypothetico-deductive null hypothesis test of significance model with one-shot cross-sectional samplings requiring statistical manipulation to tease out aggregate tendencies). The effect has been more to the cultivation and preservation of theories than to effective improvement of individual performances (Bakan, 1967; Moxley, 1974a).

The external validity of individual-centered designs rests on replication and obviously does not preclude using several individuals simultaneously or in any appropriate sequence. The essential feature is for individual data to be collected over time on one or more individuals, reflecting progressive within-individual changes. In contrast to the meager information available from typical tests of significance (Bakan, 1967; Meehl, 1967), such designs can provide a wealth of information on performances and the conditions of those performances in which complex individual organisms (as opposed to chaotic aggregates) engage as well as an opportunity to detect significant patterns (Simon, 1973).

Summary

In the view of writing as uncertainty reduction and information processing, it is critical for the child to be able to make selections from considerations of alternatives. The advocacy here is to provide the child with aids for writing that simplify the selection process at whatever level he is interested in, allowing the reduction of alternatives to proceed in stages. Children should also be encouraged to overtly express their alternatives and not merely their final conclusions. In contrast, over-determined algorithms and rules that jump to conclusions leave the child with either no help or more than he needs. They typically result in (1) inaccuracies without provision for remediating these deficiencies, (2) an atomistic bits and pieces approach without a way for coherently

putting the parts together, and (3) an absence of individualization, ignoring any differences between children.

REFERENCES

- Andersen, D. W. Handwriting research: movement and quality. In T. D. Horn (ed.), *Research on handwriting and spelling*. Champaign, Ill.: National Council of Teachers of English, 1966, 9-17.
- Bakan, D. *On method: toward a reconstruction of psychological investigation*. San Francisco: Jossey-Bass, 1967.
- Bakan, D. Mind, matter and the separate reality of information. *Philosophy of the Social Sciences*, March 1974, 4(1), 1-15.
- Barganz, R. A. Phonological and orthographic relationships of reading performance. *Visible Language*, Spring 1974, 8(2), 101-122.
- Bates, S., & Bates, D. F. ". . . and a child shall lead them:" Stephanie's chart story. In R. Ulrich, T. Stachnik, & J. Mabry (eds.), *Control of human behavior: behavior modification in education*. Vol. 3. Glenview, Ill.: Scott, Foresman & Co., 1974, 384-387.
- Bijou, S. J. Studies in the experimental development of left-right concepts in retarded children using fading techniques. In N. Ellis (ed.), *International review of research in mental retardation*. Vol. 3. N.Y.: Academic, 1968.
- Brigham, T. A., Finfrock, S. R., Breunig, M. K., & Bushell, D., Jr. The use of programmed materials in the analysis of academic contingencies. *Journal of Applied Behavior Analysis*, Summer 1972, 5(2), 177-182.
- Bryant, P. E. Discrimination of mirror images by young children. *Journal of Comparative and Physiological Psychology*, 1973, 82, 415-425.
- Caldwell, E. C., & Hall, V. C. The influence of concept training on letter discrimination. *Child Development*, March 1969, 40(1), 63-71.
- Carroll, J. B. The nature of the reading process. In L. A. Harris & C. B. Smith (eds.), *Individualizing reading instruction*. N.Y.: Holt, Rinehart & Winston, 1972, 40-49.
- Coleman, E. B. Collecting a data base for a reading technology. *Journal of Educational Psychology Monograph*, August 1970, 61(4, Pt. 2).
- Corballis, M. C., & Beale, I. L. On telling left from right. *Scientific American*, March 1971, 224(3), 96-104.
- Crouwel, W. A proposition for education in letterforms and handwriting. *Visible Language*, Summer 1974, 8(3), 261-264.
- Cutright, P. Script-print and beginning reading and spelling. *Elementary English*, April 1936, 13(4), 139-141, 160.
- Daniel, J. S. Serialists and holists. *ERM*, October 1973, 6(1), 24-25.
- Davidson, H. A study of the confusing letters: b, d, p and q. *Journal of Genetic Psychology*, December 1935, 47(2), 458-468.
- Douglas, M. P. Reading between and beyond the lines. *Visible Language*, Summer 1973, 7(3), 225-234.
- Dubnoff, B., Chambers, I., & Schaefer, F. *Dubnoff School Program I*. Boston: Teaching Resources, 1969.
- Durkin, D. *Children who read early*. N.Y.: Teachers College Press, 1966.

- Durkin, D. *Teaching young children to read*. Boston: Allyn & Bacon, 1972.
- Durkin, D. A six-year study of children who learned to read in school at the age of four. *Reading Research Quarterly*, 1974-1975, 10(1), 9-61.
- Early, M. J. Communication arts. In W. Harris (ed.), *Encyclopedia of educational research* (3rd ed.). N.Y.: Macmillan, 1960, 306-312.
- Editors. The summary: views on a statistically significant trend. *Reading Research Quarterly*, 1973-1974, 9(3).
- Enstrom, E. A., & Enstrom, D. C. In print handwriting: preventing and solving reversal problems. *Elementary English*, October 1969, 46(6), 759-764.
- Fuller, R. Breaking down the IQ walls: severely retarded people can learn to read. *Psychology Today*, October 1974, 8(5), 96-102.
- Gardner, R. A., & Gardner, B. T. Teaching sign language to a chimpanzee. *Science*, 15 August 1969, 165(3894), 664-672.
- Hall, R. V., Cristler, C., Cranston, S. S., & Tucker, B. Teachers and parents as researchers using multiple baseline designs. *Journal of Applied Behavior Analysis*, Winter 1970, 3(4), 247-255.
- Harvey, O. J. Belief systems and education: some implications for change. In *The affective domain: a resource book for media specialists*. Washington, D.C.: Communication Service Corporation, 1970, 65-96.
- Harvey, O. J., Prather, M., White, B. J., & Hoffmeister, J. K. Teachers' beliefs, classroom atmosphere and student behavior. *American Educational Research Journal*, March 1968, 5(2), 151-166.
- Harvey, O. J., White, B. J., Prather, M., Alter, R., & Hoffmeister, J. K. Teachers' belief systems and preschool atmospheres. *Journal of Educational Psychology*, December 1966, 57(6), 373-381.
- Hildreth, G. The success of young children in number and letter construction. *Child Development*, March 1932, 3(1), 1-14.
- Hildreth, G. Early writing as an aid to reading. *Elementary English*, January 1963, 40(1), 15-20.
- Hopkins, B. L., Schutte, R. C., & Garton, K. L. The effects of access to a playroom on the rate and quality of printing and writing of first- and second-grade students. *Journal of Applied Behavior Analysis*, Winter 1971, 4(2), 77-87.
- Huttenlocher, J. Children's ability to order and orient objects. *Child Development*, December 1967, 38(4), 1169-1176.
- Jeffrey, W. E. Variables in early discrimination learning. *Child Development*, June 1958, 29(2), 269-275.
- Kohl, H. Comics and myths. *Teacher*, November 1974, 92(3), 6-12.
- Lamberg, W. J. Design and validation of instruction in question-directed narrative writing. *The Reading Specialist*, Fall 1974, 11(1), 3-12.
- Laszlo, E. *The systems view of the world*. N.Y.: George Braziller, 1972.
- Lee, D. M., & Allen, R. V. *Learning to read through experience* (2nd ed.), N.Y.: Appleton-Century-Crofts, 1963.
- Lewis, E. R., & Lewis, H. P. An analysis of errors in the formation of manuscript letters by first-grade children. *American Educational Research Journal*, January 1965, 2(1), 25-35.
- Long, Howard H., & Mayer, W. C. Printing versus cursive writing in beginning reading instruction. *Journal of Educational Research*, December 1931, 24(5), 350-355.

- Meehl, P. E. Theory-testing in psychology and physics: a methodological paradox. *Philosophy of Science*, June 1967, 34(2), 103-115.
- Moffett, J. *A student-centered language arts curriculum, grades K-13: a handbook for teachers*. Boston: Houghton Mifflin, 1973.
- Moss, J. A general language arts program in an informal classroom. *The Elementary School Journal*, January 1975, 75(4), 238-250.
- Moxley, R. A., Jr. A program for reducing reversals of digits and symbols produced by kindergarten children (doctoral dissertation, University of Michigan, 1970). *Dissertation Abstracts International*, 1970, 31(5), 2192A-2193A. (University Microfilms No. 70-21741)
- Moxley, R. A., Jr. Formative and non-formative evaluation. *Instructional Science*, October 1974, 3(3), 243-283. (a)
- Moxley, R. A., Jr. Reduction of uncertainty. *International Journal of General Systems*, 1974, 1(3), 175-182. (b)
- Moxley, R. A., Jr. The world's worst reading objective. *Educational Technology*, August 1974, 14(8), 20-26. (c)
- Neisser, U. *Cognitive psychology*. N.Y.: Appleton-Century-Crofts, 1966.
- Otto, W. & Andersen, D. W. Handwriting. In R. L. Ebel (ed.), *Encyclopedia of educational research* (4th ed.). N.Y.: Macmillan, 1969, 570-579.
- Pflaum, S. W. *The development of language and reading in the young child*. Columbus, Ohio: Charles E. Merrill, 1974.
- Premack, D. The education of S*A*R*A*H: a chimpanzee learns the language. *Psychology Today*, September 1970, 4(4), 55-58.
- Risley, T. R., & Wolf, M. M. Strategies for analyzing behavioral change over time. In J. R. Nesselroade & H. W. Reese (eds.), *Life-span developmental psychology: methodological issues*. N.Y.: Academic, 1973.
- Rudel, R. G., & Teuber, H. Discrimination of line in children. *Journal of Comparative and Physiological Psychology*, October 1963, 56(5), 892-898.
- Sekuler, R. W., & Houlihan, K. Discrimination of mirror-images: choice time analysis of human adult performance. *Quarterly Journal of Experimental Psychology*, May 1968, 20(2), 204-207.
- Shapiro, M. B. The single case in clinical-psychological research. *Journal of General Psychology*, January 1966, 74(1), 3-23.
- Sidman, M. *Tactics of scientific research: evaluating experimental data in psychology*. N.Y.: Basic Books, 1960.
- Sidman, M., & Kirk, B. Letter reversals in naming, writing, and matching to sample. *Child Development*, September 1974, 45(3), 616-625.
- Simon, D. P., & Simon, H. A. Alternative uses of phonemic information in spelling. *Review of Educational Research*, Winter 1973, 43(1), 115-137.
- Simon, H. A. Does scientific discovery have a logic? *Philosophy of Science*, December 1973, 40(4), 471-480.
- Skinner, B. F., & Krakower, S. *Handwriting with write and see* (teacher's edition). Chicago: Lyons & Carnahan, 1968.
- Smith, D. E. P. On characteristics of learning tasks. *The Reading Specialist*, Fall 1974, 11(1), 1-2.
- Smith, D. E. P., & Smith, J. M. *Michigan language program*. N.Y.: Random House.
- Smith, F. *Understanding reading: a psycholinguistic analysis of reading and learning to read*. N.Y.: Holt, Rinehart & Winston, 1971.

- Smith, S. A. *Creative teaching of the language arts in the elementary school* (2nd ed.). Boston: Allyn & Bacon, 1973.
- Soar, R. S., & Soar, R. M. An empirical analysis of selected follow-through programs: an example of a process approach to evaluation. In I. J. Gordon (ed.), *Early childhood education: the seventy-first yearbook of the national society for the study of education, part II*. Chicago: U. of Chicago Press, 1972, 229-259.
- Stauffer, R. G. *The language-experience approach to the teaching of reading*. N.Y.: Harper & Row, 1970.
- Stein, N. L., & Mandler, J. M. Children's recognition of reversals of geometric figures. *Child Development*, September 1974, *45*(3), 604-615.
- Tawney, J. W. Training letter discrimination in four-year-old children. *Journal of Applied Behavior Analysis*, Winter 1972, *5*(4), 455-465.
- Torrey, J. W. Learning to read without a teacher: a case study. In F. Smith (ed.), *Psycholinguistics and reading*. N.Y.: Holt, Rinehart & Winston, 1973, 147-157.
- Wiles, M. E. Effects of different size of tools on the handwriting of beginners. *Elementary School Journal*, March 1943, *43*(7), 412-413.
- Wilson, F. T., & Flemming, C. W. Reversals in reading and writing made by pupils in the kindergarten and primary grades. *Journal of Genetic Psychology*, 1938, *53*, 3-31.
- Winter, C. Interrelationships among language variables in children of the first and second grades. *Elementary English*, February 1957, *34*(2), 108-113.
- Wolff, P. Mirror-image confusability in adults. *Journal of Experimental Psychology*, December 1971, *91*(2), 268-272.
- Wolff, P. Autonomous systems in human behavior and development. *Human Development*, 1974, *17*(4), 281-291.
- Wolff, P., & Wolff, E. A. Correlational analysis of motor and verbal activity in young children. *Child Development*, December 1972, *43*(4), 1407-1411.
- Wright, J. P., & Allen, E. G. Ready to write! *The Elementary School Journal*, April 1975, *75*(7), 430-435.
- Zaslow, R. W. Reversals in children as a function of midline body orientation. *Journal of Educational Psychology*, June 1966, *57*(3), 133-139.

The author wishes to thank Stephanie Wilson of First Ward Elementary School for her comments and suggestions.