1996

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Original Publication Citation

Hendrickson, J. M., Gable, R. A., Novak, C. G., & Peck, S. (1996). Functional assessment as strategy assessment for teaching academics. *Education & Treatment of Children (ETC), 19*(3), 257-271.

EDUCATION AND TREATMENT OF CHILDREN Vol. 19, No.3, AUGUST 1996

Functional Assessment as Strategy Assessment for Teaching Academics

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Abstract

Functional assessment of aggressive, aberrant, and challenging behavior has dominated the literature with relatively little attention given to the potential utility of functional assessment in academics. The purpose of this article is to advocate functional strategy assessment as a procedure for acquiring data to support the formulation of intervention hypotheses by school-based personnel with the aim of improving the academic performance of students with emotional and behavioral disorders. A functional strategy assessment model is presented, and two case illustrations are employed to demonstrate the feasibility of this assessment model for use by practitioners. Examples of both an individual and small group functional strategy assessment techniques are proffered as well as tips to the teacher-diagnostician.

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Identification of possible relationships between person-environmental events and the occurrence or nonoccurrence of a target behavior is the cornerstone of functional assessment (Dunlap et al., 1993). Functional assessment requires specification of significant (i.e., variables that account for a large amount of variance in the occurrence of a behavior), controllable (i.e., variables that can be manipulated), and ideographic relationships (i.e., variables associated with an individual student) between a behavior or class of behaviors (Gresham, 1991). The usefulness of a functional assessment is linked to the notion of conditional probability--the ability to predict the likely occurrence of

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future behavior, based on knowledge of current behavior (Gresham, 1991). In their comprehensive review of the literature, Blakeslee, Sugai, and Gruba (1994) conclude that functional assessment promotes hypotheses-driven treatment, emphasizes skill-building, enhances the prospect of a positive outcome, increases the probability of maintenance and generalization of treatment effects, and contributes to advancement of science.

As an assessment technique, opinion differs as to what should constitute the process for assessing the relationship between a target behavior and maintaining variables. The literature indicates that functional assessment draws upon a variety of procedures, and researchers often recommend multiple methods of data gathering and the triangulation of data in the formulation and testing of hypotheses (Gable, Hendrickson, & Sasso, 1995). Indirect methods of functional assessment such as rating scales, checklists, and interviews are designed to identify environmental events proximal to the target behavior and can yield clues regarding the function(s) of the target behavior (Durand, 1990; Gardner, Cole, Davidson, & Karan, 1986; Lawry, Storey, & Danko, 1993). Other direct observational methodologies include the use of antecedent-response-consequence (ARC) records, ecobehavioral matrixes, scatter plots (e.g., Gable, Hendrickson, & Sasso, 1995), and lag-sequential analysis protocols (Gunter et al., 1993). A narrative, anecdotal description of the temporal distribution of events that surround a target behavior characterizes the A-R-C recording system. Scatter plots and matrices can be employed to make patterns of responses in the natural environment evident, patterns which traditional line graphs obscure (see Touchette, MacDonald, & Langer, 1985). Lag analysis typically produces data on the conditional probability of one event (e.g., teacher antecedent modeling) leading to or preceding another event (e.g., a student's correct response).

One type of functional assessment is the functional analysis of behavior which involves the experimental manipulation of person-environmental events thought to influence the behavior of interest, and the documentation of changes in that behavior under different conditions. In conducting a functional analysis of behavior, several assessment options appear to be available to the practitioner: (a) examination of person-environmental relationships in analogue settings, (b) assessment of person-environmental relationships in the natural setting, and (c) development of hypothesis-driven assumptions pertaining to a target behavior based on prebaseline data (Dunlap et al., 1993; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982; Karsh, Repp, Dahlquist, & Mank, 1994; Umbreit, 1995). Demand conditions (e.g., tasks of varying difficulty, tasks requiring different levels of effort) that are similar to those in the natural setting are created in an analogue assessment (e.g., Carr & Durand, 1985). Researchers typically have employed two or more assessment methods to arrive at an hypothesis regarding the target behavior. Although we recommend that teachers, school psychologists, and other professionals working with students with emotional and behavioral disorders practice multi-dimensional assessment, our discussion is restricted to description of two variations of a functional strategy assessment process--single student analogue and small group analogue assessments.

Hypothesis-Driven Interventions for Practitioners

To date the majority of functional assessment investigations have focused on challenging, aggressive, and aberrant behaviors. Since the early 1980s (e.g., Durand & Carr, 1985; Iwata et al., 1982) functional assessment/analysis technology has been applied primarily to topographies of aberrant behavior with relatively little attention given to cognitive and academic skills. Initial studies using functional assessment concentrated on identification of maintaining variables and/or the function (e.g., gain, escape, avoid) the target behavior serves for the individual. The typical functional assessment scenario included formulation of an hypothesis that the target behavior, for instance, might be functioning to gain positive reinforcement (such as social attention or a tangible) or to escape an aversive environment. Subsequent to hypothesis formulation, interventions are selected to match the function the behavior appears to serve for the student. As recently as 1994, Blakeslee and colleagues (1994) reported that approximately 40% of functional assessment studies focused on subsequent events and included differential reinforcement as the principal intervention.

Although the preponderance of studies using functional assessment techniques examine challenging and aberrant behavior, a number of investigations related to classroom instruction and teaching academics are found in the literature. Such studies primarily pinpoint on-task, off-task, and mildly disruptive behavior of students. In contrast to studies of the assessment of severe challenging behavior, differential reinforcement and the study of the functions of academic behavior have not emerged as primary intervention foci in the academic arena. Classroom interventions that stem from functional assessment more often incorporate manipulation of antecedent events (as well as consequent events). For example, task demand/difficulty (Cooper et al., 1992), choice-making (Dunlap et al., 1994), and student preferences or curricular appeal (Clarke et al., 1995) have emerged as variables which affect classroom performance of students with emotional and behavioral disorders.

For data from a functional assessment to be used to generate believable hypotheses, an evaluation design which demonstrates the replication of the phenomenon of interest is mandatory. The hypotheses about controlling variables are verified by the clinical teacher who systematically manipulates the variables of interest and attempts to replicate the effect. One trial is not enough; reliance on a single demonstration of effect is insufficient in a functional strategy assessment. Thus, counterbalancing assessment phases to test multiple and/or rival hypotheses (e.g., contrasting interventions) is essential when conducting a functional strategy assessment (Gable, 1995).

Although numerous questions exist regarding the technical adequacy of functional assessment, it is not our intention to discuss those here. Rather, based on the literature and our clinical experience, we advocate functional assessment as a viable and useful tool for evaluating instructional approaches used to teach academics to students with emotional and behavioral disorders (EBD). To support this claim, we offer two applications of functional assessment of academic interventions--one demonstrating functional strategy assessment with an individual student and the second a functional assessment of small groups of students. The analogue assessment strategy applied to academic content is presented to illustrate the every day utility and promise of functional assessment for school-based practitioners. Case 1 is a true-life functional assessment using an analogue procedure with an elementary-aged student who had been unable to learn simple addition facts. Case 2 demonstrates a functional strategy assessment procedure employed during small group spelling instruction. Before examining these case studies, the guidelines for conducting a functional assessment are presented, including a basic six step functional assessment/ intervention model.

Six Basic Steps of Functional Assessment Leading to Instruction

Mace, Yankanich, and West (1988) propose six steps for conducting an experimental analysis. The six steps advocated by Mace et al. are paraphrased below:

- identify the problem,
- collect descriptive data,
- formulate hypotheses,
- design analogue conditions to test the hypotheses,
- implement the analogue conditions and analyze the results, and
- develop, implement, and evaluate the treatment.

We recommend the entire sequence of steps to practitioners wishing to conduct a functional strategy assessment to determine the differential effects of various interventions on student academic skill acquisition. Unlike studies in which functional assessment is used primarily to identify the function(s) a behavior serves for an individual student, in the present functional assessment the practitioner is concerned with identifying instructional techniques to build new skills or remediate partially learned skills.

Figure 1 depicts six major steps (I-VI) and the subcomponents of our functional strategy assessment model. These steps are broader than those of Mace et al. and represent the considerations which the teacher (or child study team) must make to determine whether or not to conduct a strategy assessment and subsequently implement and evaluate the selected intervention. (Medical/sensory factors were eliminated as contributing factors in both of the following case examples (i.e., Step II).)

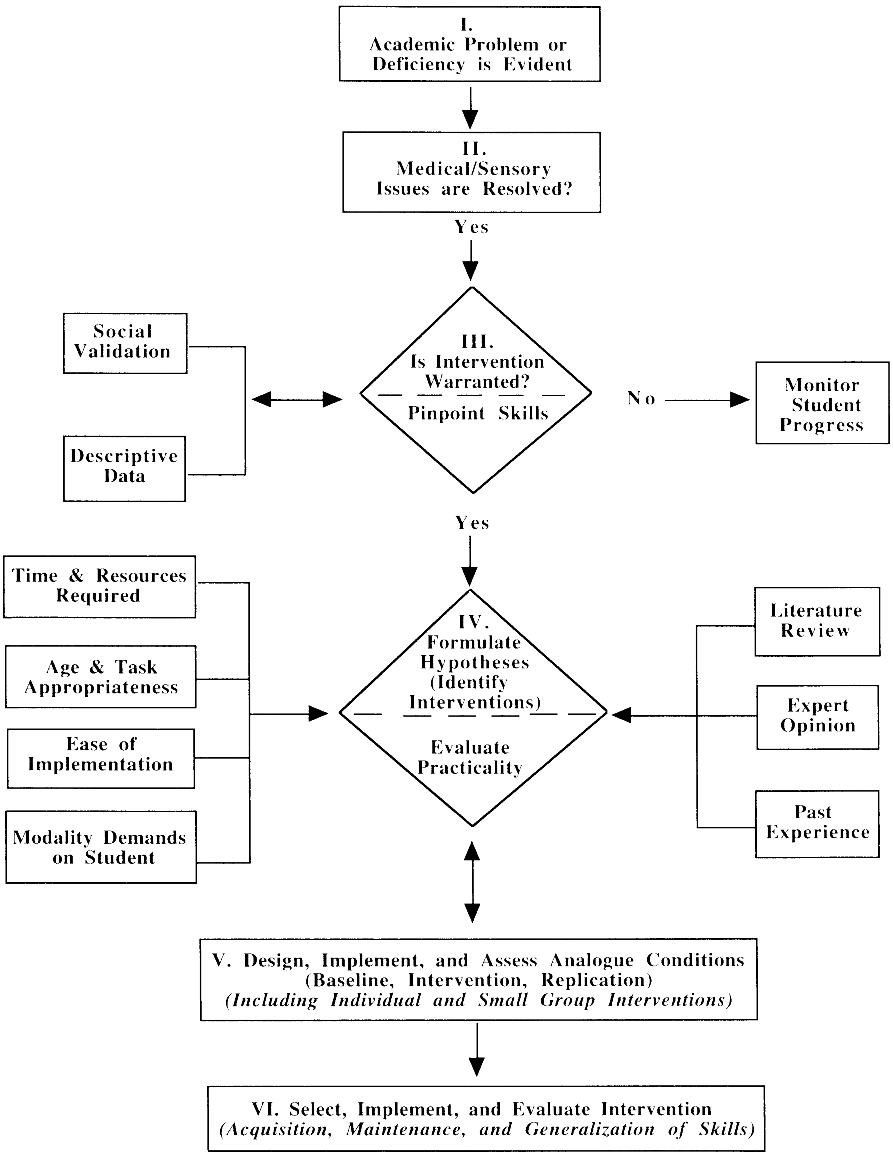
Case Study 1: Individual Student Analogue Assessment

In the present illustration, the classroom teacher identified a 4th grade, male student, Tom, with "persistent difficulty in learning addition facts" (Step I). As noted, Step II, the possibility of medical sensory problems was eliminated. Classroom work samples, parental reports, and child study team data documented incomplete mastery of basic math facts and extremely poor retention skills (Step III). The teacher/child study team hypothesized that the student's difficulty with addition was due to reasoning deficits or strategy errors (Step IV). This hypothesis was based on teacher knowledge of (a) previously attempted instructional strategies that she had used effectively with other students to teach addition facts and (b) strategies employed successfully with the target student on similar tasks. Next, several practical, age-appropriate activities for teaching the student were designed (Step IV). These were implemented and data were collected on how well the student learned to use each strategy and how well the student learned facts using the different strategies (Step V). Based on the results of the analogue strategy assessment, the teacher then selected an intervention (based on the data) which appeared to be most efficacious for the student. The teacher's next step was to develop and implement the instructional intervention in the classroom and monitor the student's initial learning (i.e., acquisition of skills), progress across time (i.e., maintenance), and performance in different situations (i.e., generalization) (Step VI).

The analogue strategy assessment itself (Step V) consists of three phases: baseline, intervention, and replication.

Baseline. To begin a strategy assessment, the teacher first tested the student for speed and accuracy on all single-digit addition facts (i.e., baseline). We recommend flash cards for use during baseline. Only math facts found to be unknown during baseline were used during the intervention and replication phases. Five unknown facts were needed for each strategy to be tested. At least 10 additional unknown facts are needed for the replication phase when two strategies are retested. If three strategies are to be compared, at least 25 problems are needed (i.e., 15 problems for the intervention phase and 10 problems for the replication phase).

Review of possible strategies: To identify addition teaching strategies the teacher consulted the literature, expert opinion, and reflected upon her



*** Adapted from Gable, Hendrickson, & Sasso, 1995.**

Figure 1. Functional strategy assessment model.

own experiences/clinical data. The teacher found antecedent strategies to facilitate arithmetic performance were replete in the literature. Various types of drill (e.g., verbal rehearsal) and fading procedures had been used extensively. Drill-type procedures included time delay (Mattingly & Bott, 1990) and cover-copy-compare (CCC) (Skinner, Turco, Beatty, & Rasavage, 1989). With the time delay procedure, the teacher provides a verbal prompt for the correct answer after a specific amount of time (e.g., 1-5 seconds) elapses without a correct solution by the student. With CCC, the student views a correctly solved problem, copies it from memory, then checks his/her accuracy by comparing his/her response to the model. The teacher noted students with good visual memories may be well suited to the CCC strategy.

Counting strategies also were discovered to be used frequently to remediate arithmetic difficulties. These strategies included the use of manipulatives, touch math, number lines, and decomposition. The use of concrete manipulatives and semi-abstract strategies were commonly paired with these strategies. Objects or drawings were used to "represent" the problem. Touch math, for example, involves counting specified "points" on each written numeral which represent the actual quantity for which the numeral stands. With number lines, the student uses a sequence of numbers (e.g., 1-20) from which to count up (or down). Decomposition is a strategy which involves transforming the original problem into a more readily known fact and adjusting the count accordingly (e.g., adding with 9 is like adding with 10, but a 1 has to be borrowed to make 9 = 10, so the second addend must be reduced by 1). Concrete objects or symbolic representations of quantities may be used with decomposition strategies. The argument for these approaches is that the students need to understand concepts before rotely learning answers or working algorithms. Armed with conceptual understanding, the student who fails to automatically recall the correct answer, presumably has a reasonable chance to figure out the answer.

Intervention (Data collection). The student was introduced to one strategy (e.g., time delay) at a time. The first strategy was time delay. In time delay, a student was given initially 3 seconds to respond or a model was provided. The teacher provided guided practice five times with each of the five problems. Afterward, the student was asked to recall the answer to those five problems. Speed and accuracy of the student's response to each fact were recorded.

Subsequent strategies were introduced one at a time (e.g., cover-copy-compare); again, the teacher provided guided practice on five new problems. The student then was asked to recall the answers to the second set of five addition problems. A third and fourth strategy may be tested. When the results suggest one strategy is more effective than another (i.e., leads to more correct and rapid recall), an attempt would be made to replicate the result.

Replication. In the replication phase, a less successful strategy was reintroduced first (using five new problems). Next, a strategy which appeared to be relatively effective was presented a second time. Ideally, results of the replication phase produce results similar to those of the intervention phase. When replication occurs, it means that one strategy is more likely to result in efficient learning in the classroom than another.

Charting and Interpreting the Results

The best way to decipher which strategy is most effective is to visually inspect data that have been depicted graphically. To illustrate, the actual data from Case Study 1 are presented in Figure 2. The initial two data points represent Tom's performance during baseline when known and unknown facts were identified. The figure shows the student's accuracy (open symbol) and recall (closed symbol) within 3 seconds of a flash-card presentation on 100 basic addition facts tested. Tom answered 82% (82 of 100 facts) of the problems correctly, but only 36% correctly within 3 seconds.

As can be seen in Figure 2, during the intervention phase, three strategies were introduced. First, a time-delay procedure was presented in which the time between the statement of the problem, and the modeled answer was increased slowly. The time-delay strategy resulted in correct recall of three of five problems, but only one of five was answered correctly within 3 seconds. Next, the use of a number line was

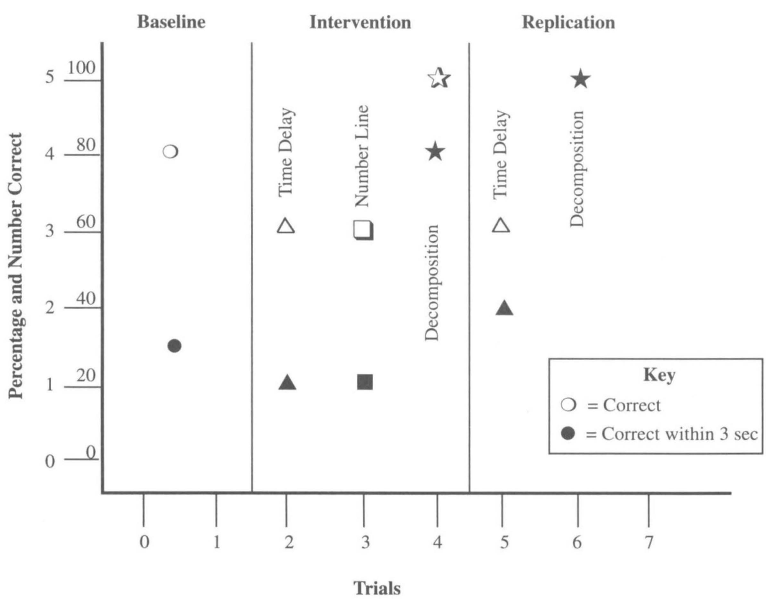


Figure 2. Assessment results of a 3rd grade LD student's basic addition facts.

taught. This resulted in three of five correct problems, but again only one of five was answered correctly within 3 seconds. Finally, a decomposition strategy was introduced. Decomposition resulted in five of five problems answered correctly, four of which were answered correctly within 3 seconds.

To ensure that these results were not a function of the specific addition problems or another confound, the replication phase was implemented. The time-delay procedure, a relatively ineffective procedure, was employed a second time with five new problems. As Figure 2 shows, the second application of time delay again resulted in three of five problems correct with only two facts recalled within 3 seconds. Next, five new problems were taught using decomposition, the strategy hypothesized to be most effective. This resulted in 5 of 5 correct, all within 3 seconds, which replicated the first results. This particular strategy assessment revealed that decomposition may be a preferable strategy for teaching Tom mathematic computations.

Case Study 2: Small Group Analogue Assessment

In this section we describe a functional strategy assessment model which can be employed with small groups of students to identify specific interventions that would best facilitate acquisition of academic skills--in this case, learning to spell. Seven 3rd and 4th grade students recommended by classroom teachers and considered by the child study team to be "at-risk" for school failure (i.e., whose group demographics included poor educational progress, low socioeconomic status, single head of household families, siblings who have been retained, and so on) participated in the program. All of the students voluntarily attended an after-school tutoring program, a joint project between a state university and a local school district. University undergraduate students majoring in elementary and secondary education served as the tutors and implemented the functional assessment strategy under the close supervision of graduate students and faculty in special education (see Hendrickson & Peck, 1993).

Prior to the functional assessment each student was given a grade-level pretest of spelling words in order to identify at least 60 words that he/she did not know how to spell. Based on the results of the pretest, an individualized list of spelling words was developed for each student. Students were grouped in teams of two and three for assessment sessions and were taught one of three spelling strategies by the tutor: CCC, Rainbow Writing, and Chaining. (See figure 3 for a description of each strategy.)

Five words were selected randomly from the student's list for each tutoring session. Sessions were conducted twice a week for approximately 15 minutes each. During each session, the tutors first demonstrated how to use one of the three strategies. Then the students

Strategy	Description
Cover, Copy, Compare	1. Provide students with model of word. 2. Students look at word for 3 seconds. 3. Teacher: "This word is cat. Cat is spelled c-a-t." 4. Teacher covers word. 5. Students write word from memory. 6. Students check word from model. 7. Repeat 3-5 times for each word.
Rainbow Writing	1. Provide students with model of word. 2. Students look at word for 3 seconds. 3. Teacher: "This word is cat. Cat is spelled c-a-t. " 4. Teacher traces word with one color crayon. 5. Students trace word with another color crayon. 6. Repeat 3-5 times for each word using a new color each time.
Chaining	1. Provide students with model of word. 2. Students look at word for 3 seconds. 3. Teacher: "This word is cat. Cat is spelled c-a-t." 4. Students copy word from model. 5. Teacher erases last sound from word. 6. Students copy word, adding the last sound from memory. 7. Repeat 3-5 times for each word until the word has been completely erased and the child must write it from memory.

Figure 3. Spelling strategy descriptions.

practiced their spelling words using that strategy. The tutors observed the students practice their words to assure that they were indeed using the learning/practice strategy as instructed. After the students had practiced all five of their words, the tutors administered a brief posttest probe to identify how many of the words the students could now spell. The number correct was divided by five to obtain a percent correct score. Unlike the individually administered assessment, student response time was not logged, only corrects and incorrects.

Strategy selection and implementation was counterbalanced across weeks to control for order effects. An alternating treatments design (Kazdin, 1994) was employed to determine if differential effects were manifested as a result of students briefly employing various strategies to learn to spell.

Figure 4 presents results of the group-format functional strategy assessment. Cover, Copy, Compare resulted in consistent scores of 100% correct for Sandy and Lilly. Rainbow Writing resulted in the highest average scores for Paul, and George and Jake performed about equally well using either Cover, Copy, Compare or Chaining. None of the strategies resulted in average scores of over 50% for Karen and Misty, although CCC was distinctly superior for Karen.

These results indicate that the strategy assessment procedure may be an effective and efficient way to identify teaching/learning strategies to optimize the academic performance of individual students. While a highly effective strategy was not identified for two of the 7 students (Karen and Misty), continued assessment of additional strategies may have yielded interventions with better outcomes for them. We were unable to implement a teaching program to demonstrate the long-term effects of these interventions because the school year ended. Effects were replicated in the alternating treatment design (not depicted here). It is important to note that the results of the strategy assessment yielded idiosyncratic results for each student. Based on these results, tentative hypotheses regarding the most promising instructional strategies in spelling could be generated for each student.

Individual Functional Strategy Assessment Recommendations

A strategy assessment is best conducted across at least two sessions to not fatigue the student. Also, a student often will perform better if the trials are separated across time (e.g., three 15-minute sessions rather than one 45-minute session). Motivation should be kept high with supportive feedback, praise, and/or other types of rewards common to classrooms.

In conducting an analogue strategy assessment, it is essential that the student use the selected strategies correctly, or the results will be uninterpretable, and valuable assessment or teaching time will be wasted. The teacher-diagnostician must correct any error in strategy usage immediately and in a positive manner. An outline of a task

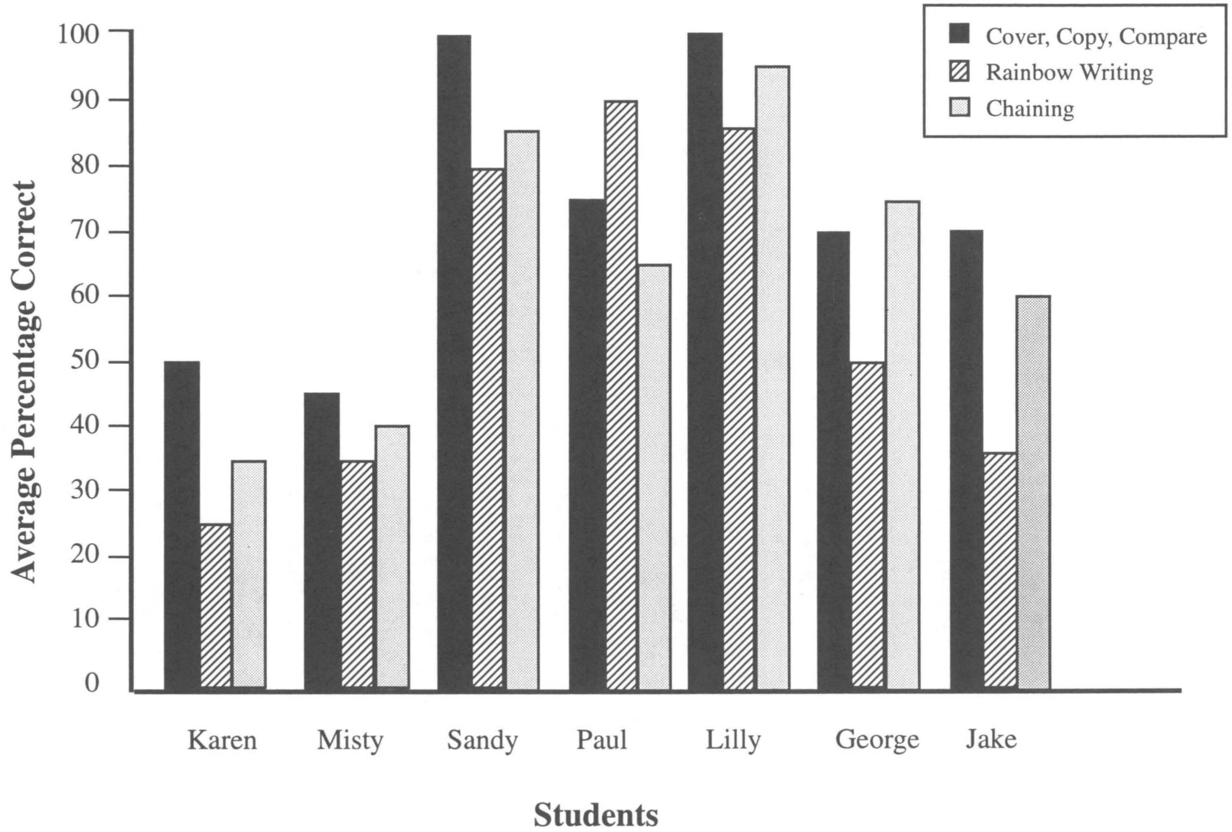


Figure 4. **Spelling strategy assessment outcomes by student.**

analysis of the steps of each strategy can be used to monitor the student's use of the strategy with each problem. Or, a simple coding system can be devised to record whether the student followed the procedure accurately and/or the amount of redirection needed.

The strategy assessment procedure can be used in other areas of arithmetic, language, arts or other academic subjects. For example, in assessing addition with regrouping, the teacher might consider comparing a self-instruction strategy versus a permanent model. Reading (decoding) might involve comparison of a sight-word drill approach versus phonics or word-family drill. In any case, three aspects of the functional assessment remain the same for the teacher who must: (a) identify the problem and a pool of unknown items, (b) select and systematically test different antecedent teaching strategies, and (c) retest the "worst" and "best" strategies to replicate the results of the intervention phase and gain confidence in the conclusions.

In addition to functional assessment of teaching/learning strategies, detailed error analyses (Gable & Hendrickson, 1990) can be conducted to determine error types and identify any error patterns which might have implications for strategy selection. In depth error analyses techniques are especially suited to assessing academic errors of students with chronic and severe academic deficits.

Functional strategy assessment as depicted here focused on identifying interventions which appear to hold the greatest efficacy for skill acquisition and initial mastery. Ultimate validation of the functional assessment of strategies for teaching academics also rests on documentation of effect on skill maintenance and generalization. Deno (1992) described curriculum based measurement (CBM) as a flexible tool which can be used to evaluate the effectiveness of changing a student's program, for instance, across settings or materials. Deno defined CBM as *the rate of change* in student performance exhibited across repeated measures on tasks of the same difficulty level. Thus, CBM may be considered a means of assessing skill maintenance as well as generalization in that measures are repeated and the skill tested is not necessarily linked to a specific curriculum.

Finally, for the data generated in a functional strategy/intervention assessment to be valid and predictive, the teacher and child study team must take precautions to insure treatment validity, that is, the consistently correct implementation of the strategies employed. Treatment integrity can be assessed readily, for example, with video and/or audio tapes, checklists marked by the teacher during implementation, and by the use of independent observers.

Summary and Conclusion

Functional assessment, including the formulation of hypotheses and the systematic introduction of different strategies in analogue assessment sessions, can produce data that are directly relevant to classroom practice and individual learner characteristics. By examining the effects of specific antecedent events as well as consequent events (not assessed in the present model), the teacher can identify those instructional elements and interventions which hold the most promise for classroom practice. Analogue strategy assessment is best used in concert with other assessment tools, including error analysis, functional assessment interview protocols, and so on. Based on our experience, functional strategy assessment appears well suited for both one-to-one and small group analogue sessions, and we recommend its use to identify effective robust instructional strategies for students who display chronic and/or perplexing error patterns in academics.

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