

Applied Behavior Analysis in Education

Ronnie began instructing students in reading. She sat behind a worktable and called up one, two, or three students in turn. Quiet sounds were coming continually from the classroom—a sixth grade student tutoring a young child, the hum of a Language Master, and the teacher's words: "Bill and Mary are working so well." "Jim, I liked the way you answered my question." "Thank you for waiting your turn." "Super!" "Wonderful!"

One wall of the classroom is crowded with graphs of students' performance in reading and arithmetic. One student in the reading group leaves the worktable to add a data point on her graph.

Ronnie is a teacher of 15 elementary-aged students with learning disabilities. Ronnie is also a behavior analyst.

Applied behavior analysis in education is expanding rapidly. Most departments of special education have at least one faculty member who teaches basic courses in this area. Increasing numbers of classroom teachers refer to themselves as behavior analysts. Major journals frequently publish research and discussion articles on applied behavior analysis. Approximately 25 journals are devoted almost exclusively to applied behavior analysis. However, even with such activity, many educators have misconceptions concerning what applied behavior analysis has offered education. This paper describes the dimensions of applied behavior analysis and the contributions this technology offers

teachers in the area of systematic applications, direct and daily measurement, and experimental methodology.

Applied Behavior Analysis

Applied behavior analysis is derived from basic laboratory research known as the experimental analysis of behavior. The practice of applied behavior analysis is evident in the *Journal of Applied Behavior Analysis* (1968-1981). Baer et al. (1968) defined the dimensions of this applied science. They said "... the study must be applied, behavioral, and analytic; in addition, it should be technological, conceptually systematic, and effective, and it should display some generality" (p. 92). For clarity, these terms are described briefly within the dimensions proposed by Baer et al.

Applied is sometimes defined by the research procedures used in a study. However, the term applied in this context is used to describe research involved with behaviors and/or stimuli which are immediately important to individuals and society (e.g., retardation, crime, behavioral disorders, education).

Applied *behavioral* research is concerned with the manipulation of environmental stimuli to help individuals efficiently and effectively emit specific responses that are important to clients or society. This implies that the applied behavioral research is interested in what people do rather than what they say, unless a verbal response were under analysis. Precise measurement and reliable quantification of physical events are important aspects of applied behavioral analysis.

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Essentially, the definition of *analytic* requires a demonstration that the applied researcher can accelerate or decelerate a specific behavior at will. Both applied and non-applied behavioral research are involved with the control of behavior. "The analysis of a behavior, as the term is used here, requires a believable demonstration of the events that can be responsible for the occurrence or non-occurrence of that behavior" (Baer et al., 1968, pp. 93-94). In applied behavior analysis, single case experimental designs such as the reversal, multiple-baseline, changing criterion, and alternating conditions are used commonly to demonstrate analytic control of a behavior (Cooper, 1981).

Technological is a term used to describe procedures for behavioral applications that have been completely identified and described. For example, the term social reinforcement is not a technological description. Also, it is not sufficient to say the stimuli will be "teacher praise." For *social reinforcement* to qualify as a technological description all components of social reinforcement must be defined (e.g., stimuli, contingency, schedule of reinforcement) and the exact verbal responses that will be given must be stated (e.g., "Good!" "Look how well Bill is working." "Wonderful!"). Basically, for procedures to qualify as technological, a reader should be able to replicate the stated procedures with only a reading of the description.

Effective means that a change in client behavior is large enough for practical value. The essential criterion of effectiveness is: has the behavior changed enough to be socially important?

Generality of a behavioral change encompasses changes that occur in a wide variety of settings (e.g., home, classroom, playground), in related behaviors (e.g., spelling, reading comprehension, reading fluency), in different clients (e.g., John, Mary, Bill), and has durability over time (Stokes and Baer, 1977).

Applied researchers, employing the dimensions of applied behavior analysis as defined above, have reported data relevant to classroom teachers since approximately 1965. Currently, these applied researchers have made at least three important contributions for classroom teachers. The three contributions include: a) a research foundation for the systematic application of environmental manipulations to increase, decrease, maintain, or develop academic and social behaviors, b) an emphasis on direct and daily measurement of academic and social

behaviors, and c) the development of single case experimental methodology that enables classroom teachers to be practitioners of applied research.

Systematic Applications

Classroom teachers enrolled in an introductory study of the principles of behavior often claim that the principles (e.g., reinforcement, stimulus control) are not new. To support this contention they give widely practiced techniques as illustrations. Then they will state, "I just did not know the technical term for what I was doing." Possibly, these classroom teachers are correct in their observations. Each generation of teachers rediscovers these principles through their trial and error experiences, through verbal reports of master teachers, or through direct observations of other teachers. In education, teachers reinforce academic skills of students with privileges, praise, encouragements, grades, and point systems. Teachers often punish inappropriate academic and social behaviors of students with verbal reprimands, removal from the classroom, or physical disciplines. These teachers use the principles of behavior as demonstrated in applied behavior analysis because they have been effective in improving academic and social growth of students. However, most often teachers are unaware of their applications. For instance, many successful classroom teachers are uncomfortable philosophically with "behavior modification" or "operant conditioning." Yet, in practice they may be masters in applying the principles of behavior even without realizing it. What then can applied behavior analysis offer teachers concerning the application of principles of behavior?

First, applied behavior analysis offers a foundation for the systematic application of environmental manipulations. For example, when a behaviorally oriented teacher employs reinforcement, several considerations are clearly determined. The academic or social behavior followed by reinforcement is defined carefully. The reinforcer is applied consistently toward a specific student outcome. Conversely, consequences as typically used by teachers are not characterized often as systematic and consistent applications.

Second, applied behavior analysis decreases the need for each generation of teachers to rediscover the principles through trial and error learning, verbal reports, and observations. The foundation from applied research sets the occasion for pre-service teachers to acquire skills in the application of principles of behavior before their first teaching

position. These skills may have the potential to make the transition from preservice teaching to professional teaching less frustrating. Beginning teachers may be more proficient and content in early teaching assignments with improved instruction for academic and social skills. If so, in place of instructional time for treating many problem behaviors, teachers may prevent entirely their occurrence. Also, beginning teachers may not have had the opportunity to practice other less precise techniques.

Third, as already stated, general knowledge and application of principles of behavior is not new information for many teachers. However, the new information from applied behavior analysis for teachers is the experimental demonstration of the effectiveness of these principles and the generality of effects. Numerous experimental demonstrations have established generality of effects across clients (e.g., retarded students, regular students, gifted students), across settings (e.g., clinics, homes, laboratory schools, special classrooms, regular elementary and secondary schools, university classrooms) and across teachers (e.g., parents, paraprofessionals, student teachers, teachers, and self applications) (Sulzer-Azaroff and Mayer, 1977).

Direct and Daily Measurement

Teachers are subject to passing fads in instruction as a result of basing many changes in education on historical accidents, untested theories, and the opinions of influential individuals. Applied behavior analysis has elucidated classroom procedures of measurement that may help teachers demonstrate their effectiveness in teaching (Hall et al., 1975). By using direct and daily measurement of student academic and social behaviors, teachers may be in a position to defend themselves against educational fads and other pressures for unproven educational change.

Direct measurement is concerned with measurement of the specific behavior to be taught. For example, direct measurement must provide data on student response to the actual materials used during the instructional setting. Student responses to items on a formal achievement test would not be considered direct measurement. Indirect measurement often does not provide sufficient information for planning individual programs of instruction.

Daily measurement means the measurement of student responses is continual. That is, frequent samples of student performance are obtained. To illustrate, if the instructional behavior is spelling a

given set of words, the student has the opportunity to perform that skill over a number of days. During this time, daily measurements are taken to evaluate the student's performance and the appropriateness of the instructional procedure.

With an emphasis on direct and daily measurement the teacher can graph and analyze trends in performance. Therefore, the probabilities of obtaining erroneous student data because of an unusual day are decreased. Components of measurement techniques used by classroom teachers on a daily basis without recourse to outside observers are: measurement of permanent products and observational recording procedures which include event recording, duration recording, interval recording, and momentary time sampling. For a discussion of these procedures, the reader is referred to Cooper (1981), Eaton (1978) and Hall et al. (1975).

Experimental Methodology

The majority of models for experimentation in education are not appropriate for classroom teachers. These models most often involve between-group comparisons which are beyond the resources of teachers. For instance, to test experimentally the effect of an intervention on the isolate behavior of a student in the classroom, the experimenter must find several isolate children to receive the intervention and additional isolate children to serve as the control group. Obviously, teachers do not have the time or resources to do this type of applied research.

Historically, education has not demonstrated a cumulative development of instructional approaches. This development can occur when classroom teachers apply research for examining instructional practices.

Applied behavior analysis is characterized by defining independent variables and systematically manipulating those variables with single students (Hersen and Barlow, 1976). It, therefore, provides classroom teachers with the methodology of a "true" experimental approach to the analysis of instructional technique. For this reason, the single case experimental methodology developed rapidly since the early 1960s.

The work of applied researchers such as Hart et al. (1964) and Wolf et al. (1964) demonstrated the appropriateness of the single case experimental methodology for teachers. During the early 1960s applied researchers faced many problems. Most experimentation had to be conducted in laboratory

schools or institutions without access to public schools. These research procedures were just beginning to develop. Problems were evident in the experimental designs that were available and employed (e.g., the reversal design) and in other conditions such as the absence of interobserver agreement on the occurrence or non-occurrence of the dependent variables. In addition, these early applied researchers experienced problems in publishing their results. Most journals in education and psychology were reluctant to publish experiments in single subject applied research.

Three significant events in applied behavior analysis occurred in 1968. Perhaps most important was the publication of the *Journal of Applied Behavior Analysis (JABA)*. With the advent of *JABA*, the first behavioral journal dealing with applied problems in the United States, applied researchers utilizing single case experimental methodology had an outlet for publishing their findings. Since the late 1960s, as a result of *JABA's* influence in the social sciences, most journals are now receptive to publication of single case experimental analysis. Barlow (1981), commenting on this point, stated: "In 1977, the *American Psychologist* reported that *JABA* ranked third out of 57 social science journals on mean citations per published article, topped only by the *American Psychologist* and the *Journal of Verbal Learning and Verbal Behavior*. Subscriptions outnumber all but the largest journals, and are distributed worldwide. Major advances in our science and our profession, first reported in *JABA*, have affected every aspect of our functioning" (p.1).

The second event in 1968 which influenced applied research in education was again an outcome of the publication of *JABA*. Articles appearing in *JABA* became model demonstrations of how to apply and interpret single case experimental methodology. This in turn led to improved application and experimental design (e.g., measurement, interobserver agreement measures).

Also in 1968, Baer et al. (1968) gave the first published description of using the multiple baseline design for applied research. This design was an important development because classroom teachers were more receptive to a multiple baseline design for the analysis of problems in academic behaviors. (It did not require a reversal of behaviors to demonstrate a cause and effect relationship among independent and dependent variables.)

The methodology of single case analysis continued developing during the decade of the 1970s. Table 1 illustrates some selected methodological

developments of the 1970s as they occurred in chronological order.

As a result of the development of single case experimental designs throughout the 1960s and 1970s, teachers are now in a position to use analysis techniques in their classrooms. Currently, opinions vary widely on how much use teachers should make of analysis techniques. One position does not encourage using analysis but rather emphasizes direct and daily measurement of student behaviors for guiding program decisions. Another position maintains that in addition to measuring and graphing behaviors, teachers should analyze the effects of all direct instruction. Regardless of which position teachers accept, they should conduct applied research not just for themselves or for their students but for future generations of teachers and students. Unlike outside researchers, classroom teachers are uniquely positioned to perform analysis that can lead to significant advances in instruction. With an increasing application of behavior analysis in education, teachers will be able to incorporate a scientific approach into their classroom instruction.

Table 1
Selected Methodological Developments
in Single Case Experimental
Designs during the Decade
of 1970-1980

Methodological Developments	Source
Multielement baseline design	Ulman and Sulzer-Azaroff (1975)
Changing criterion design	Hartmann and Hall (1976)
First major text devoted entirely to single case experimental designs	Hersen and Barlow (1976)
Reliability of measurement	Kazdin (1977)
Multiple probe baseline design	Horner and Baer (1978)
Delayed multiple baseline design	Heward (1978)
Social validity	Wolf (1978)
Behavioral assessment	<i>JABA</i> (1979)

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