

Bicycle Riding: Pedaling Made Possible Through Positive Behavioral Interventions



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Abstract: This study demonstrated how the tenets of positive behavior support could be used to teach an educational activity. Emphasis was placed on the implementation of practical strategies to minimize errors during instruction and maximize positive outcomes. A 9-year-old boy with Asperger syndrome served as the participant, and the skill targeted for development was bicycle riding. An eight-step task analysis based on a highly individualized approach was used for instructional purposes. A changing criterion design was used to demonstrate progressively the emergence of bicycle riding over a span of 64 sessions. The implications of selecting target skills based on the criteria of social values, the employment of practical teaching strategies, and scientific deduction are discussed.

Ellis, a 9-year-old fourth grader with Asperger syndrome, was shown a rational task analysis (Resnick & Ford, 1978) that was designed to teach him to ride a bicycle. He read each line carefully, then contemptuously commented, "This is the dumbest program I've seen yet, and whoever wrote it obviously doesn't know me." He did not bother to elaborate; rather, he hitched up his pants and abruptly left the room.

Based on the behavioral educator's judgment, the plan should have been well received and successfully implemented. What, then, did the young boy see that the designer of the plan had neglected to consider?

Failure. Ellis saw failure. Ellis expected failure because he was not interested in learning how to ride a bicycle. In addition, he knew he would fail because of his own uncertainties.

While Ellis was not much of a cyclist, he was a brilliant educationalist. He made it clear that there was much more to instruction than outlining generic task sequences for him. Rather, there were multiple variables to consider, including his personal interests, his skills, his weaknesses, his aversions, and his motivators.

This case study illustrating positive behavior support and a person-centered approach was encouraged by Ellis. It focuses on a method for developing a multicomponent educational program based on the tenets of positive be-

havior support (PBS), with an emphasis on the relevance of behavioral assessment and encouraging input from Ellis and his family to drive the education process.

Alberto and Troutman (2003) suggested that task analysis instruction is a basic feature of many programs designed to teach individuals with disabilities to perform complex and sequenced behaviors. However, a task analysis should also be based on "practical" interventions, those that improve "implementation efficiency, intervention effectiveness, and the relevance of outcomes" (Sugai et al., 2000, p. 135). Although Sugai et al. used this term in reference to "strategies for preventing and reducing problem behavior" (p. 135), the concept should serve as the standard for "educational" interventions, as well.

Unquestionably, the recommendations of Sugai et al. (2000) cannot be separated from the process of developing a task analysis. Specifically, Sugai et al. suggested that behavioral educators use practical strategies that (a) involve recipients of PBS in program design, (b) consider the values of the recipients and the implementers, (c) consider the skills of the implementers, (d) secure the approval and endorsement of both recipients and implementers, (e) consider the resources and support needed to implement the strategies, and (f) provide the support needed to sustain the use of effective strategies. Finally, the desired outcomes in PBS are compelling. According to Sugai et al. (2000), be-

havior change must be comprehensive, durable, and relevant: outcomes referred to as “social values.”

Taken together, a multicomponent educational program based on practical strategies, and guided by the criteria for social values, places a behavioral educator in an optimal position to teach. However, as so clearly emphasized by Kincaid, Knoster, Harrower, Shannon, and Bustamante (2002), interventions must be a derivative of multiple assessment strategies. It is not enough to design a practical strategy in isolation, or to assume what a person might find valuable. One must conduct a thorough assessment to determine not only what strengths and preferences a person has, but also whether the skill to be learned is of value in the first place.

Along similar lines, Kincaid et al. (2002) indicated that when deciding on an educational goal, as well as strategies for achieving that goal, the practice of PBS should include a behavioral assessment process that is comprehensive, and may include person-centered planning. They further point to affecting quality of life as a major consideration, which is hardly possible unless the values of the recipients are solicited and, in fact, drive the educational process. This concept is inherent in the essential elements of wraparound, a philosophy close to the heart of PBS. Wraparound results in unique interventions, supports, and services, and some of their essential elements, as stated by Scott and Eber (2003), include community-based services, individualized plans of action, flexibility, unconditional commitment, and incorporating families as full and active partners.

In their comprehensive review of positive behavior support as an applied science, Carr et al. (2002) identified the primary goal as improvement in quality of life. However, they take it one step further in discussing people with disabilities, framed in the context of normalization; a goal of PBS is to ensure that those at risk for being devalued are helped to assume valued roles in society, increasing the likelihood that they will receive respect, and, in turn, the benefits afforded others without disabilities.

It appears that at every turn recommendations are being made for individualized teaching strategies based on the unique characteristics of the learner. In discussing systems of care, Kutash and Duchnowski (1997) included as key elements child-centered services with families as decision-making partners, as well as services that are individualized and culturally competent. They further point to considering the need for generalization across time and settings when working with children.

Within the current case study, several steps were taken to ensure that the philosophy of PBS was translated into best practices. The target behavior selected (bike riding) had been raised as an issue by Ellis’s family, to enhance his independence, quality of life, and participation in the community. The fact that this skill was of importance to the family may not have been disclosed were it not for a first, informal, and often overlooked assessment strategy:

The family was asked what they valued. Following this, additional assessments were conducted, including extensive interviews and direct observation of bicycle riding in a variety of settings, all of which stemmed from and were driven by soliciting the opinions of those close to Ellis. From these opinions, the concept of helping Ellis learn to ride a bike, a successful method of accomplishing this, and the likely benefits of doing so were forged.

Returning to our initial question, what did Ellis see that the designer of his program did not? Putting aside his assertion that he was not interested in learning to ride a bicycle, the program contained an element that made it unacceptable to him: It called for an adult to stabilize his bicycle while he attempted to pedal. The boy correctly judged that he would not have control over his balance and would be at risk of falling. The task analysis blueprint, as brilliantly designed as it first appeared, contained a conceptual flaw that was not visible until the task analysis was superimposed on the individual characteristics of the learner. In Ellis’s case, an entirely new approach needed to be adopted.

The purpose of this study was twofold. The first was to demonstrate how a task analysis (or any other behavior analytic teaching procedure) can be designed based on knowledge of relevant variables and the tenets of PBS, including considering the unique needs of the learner. The second purpose was to show how a task analysis, designed to teach bicycle riding, could be effectively implemented and evaluated against social values.

Method

PARTICIPANT

Ellis, a 9-year-old boy with a diagnosis of Asperger syndrome, who was enrolled in a fourth-grade class in a public school and performing at grade level, participated in this study. His experiences of riding a bicycle were not favorable. His parents had attempted to teach him to ride a bicycle by using a fairly common method: They held on to the seat to stabilize Ellis, ran beside the bicycle while he attempted to pedal, and let go when there was some degree of forward motion. Falling was inevitable and immediate and rendered Ellis intolerant of instruction.

SETTING AND MATERIALS

All instruction occurred in Ellis’s home and community. The following materials and supports were used: a 38.1-cm Schwinn Homegrown mountain bicycle, a Kurt Kinetic Trainer, a stopwatch, an eight-step task analysis, and a data sheet. The cost of the program included \$275 for the Kurt Kinetic Trainer, \$200 for the Schwinn bicycle (used), and \$495 for 27.5 hr of instruction from a behavioral educator who was paid \$18 per hour. The total cost of this program was \$970.

RESPONSE DEFINITIONS AND DATA COLLECTION

Bicycle riding instruction required a compilation of responses: (a) mounting the bicycle (straddling the saddle and placing the feet squarely on either side of the bicycle or on the pedals); (b) pedaling (defined by its effect, that is, maintaining the forward motion of the rear wheel); (c) dismounting (defined as getting off the bicycle saddle and assuming a standing position with feet on either side of the bicycle); (d) braking (terminating the forward motion of the wheels by pulling the brake levers on either side of the handlebars); (e) gliding (raising the feet off the ground and allowing the bicycle to roll freely); and (f) riding (maintaining the forward motion of a free-standing bicycle by pedaling). During each phase of the study, the total percentage of program steps mastered was calculated and recorded.

Data were collected on the amount of time Ellis spent pedaling. A stopwatch was started as soon as the rear wheel of the bicycle began rotating and was stopped when there was a pause in pedaling of 3 s or more. Each instance of braking and dismounting was recorded as correct or incorrect. Interobserver reliability data were collected at least once each week, with at least one observation during each of the eight task analysis steps. Both the primary observer and the individual collecting reliability data used a checklist that delineated all the component steps. In many of the recording cells, a simple binary (yes/no) system was used (e.g., did Ellis immediately stop the rear wheel after pulling the brake levers?); other cells required data on the duration of pedaling. An agreement was defined as both observers recording the occurrence or nonoccurrence of a behavior (e.g., effective braking) and recording similar pedaling durations (within 3 s). Interobserver reliability ranged from 75% to 100%, and the mean exact agreement coefficient was 85%.

EXPERIMENTAL DESIGN

A changing criterion design (Richards, Taylor, Ramasamy, & Richards, 1999) was used for this study. A unique aspect of this design with respect to this study was the fact that duration was one criterion, but duration data were not subsequently used in the display of data. Instead, achieving the required duration of pedaling across each subphase was viewed as a successful trial. This allowed duration information to be merged with the percentage of task analysis steps completed, allowing for a unified presentation of data.

PROCEDURES

Baseline

In the street in front of his house, Ellis was asked to mount his bicycle and ride without assistance. A single session

(and thus a single data point during baseline) was conducted due to Ellis's clear inability to ride a bicycle and his extreme emotional response to the demand.

Task Analysis

Following the baseline session, an assessment was completed (based on interviews and direct observation) and an eight-step task analysis program was developed. The program was reviewed with Ellis's family and approved. A behavioral educator, who worked with Ellis on community skills, and Ellis's mother conducted all training sessions. The following phases were used: In Phase 1, with the bicycle on the Kurt Kinetic Trainer, Ellis was required to mount the bicycle and pedal for 5 min (during the entire program, the bicycle remained in fifth gear). During the second phase, pedaling was increased to 8 min, and Ellis was required to brake and dismount. In Phases 3 through 5, the duration of pedaling was increased to 10, 12, and then 15 min, followed by braking and dismounting. During the sixth phase of the program, the bicycle was disengaged from the Kurt Kinetic Trainer, the pedals and pedal shafts were removed from the bicycle, and the saddle was lowered. The bicycle was brought out onto a slightly declining grassy slope. Ellis was required to mount the bicycle, lift his feet when he was ready, glide for 7 m, and then position his feet back on the ground. During Phase 7, the pedal shafts and pedals were replaced, and Ellis was required to pedal his bicycle down a slightly declining grassy slope for 14 m; he was also required to brake and dismount. The final phase required Ellis to ride his bicycle on the road in front of his house for .4 km. The criterion for advancement from one phase to another was deliberately varied according to the standards of a changing criterion design.

For every minute Ellis spent riding his bicycle (within each phase of instruction), his parents matched a minute of access to his Game Cube, Ellis's most preferred reinforcer.

Results

The abscissa of Figure 1 shows the bicycle riding sessions and the ordinate shows the percentage of mastered program phases. The filled diamonds depict the percentage of the eight-step task analysis that was completed during a session. The bicycle riding program was successfully completed within 64 sessions conducted across 105 days. Across these sessions, Ellis made only five errors.

During baseline, Ellis refused to practice bicycle riding unless he was assured that he would not fall, and in consequence the Kurt Kinetic Trainer was introduced. During the first phase of the study, Ellis met criterion performance within 9 sessions (he made one error). He mastered the second phase of the study within 14 sessions. He made two more errors at the beginning of the third phase,

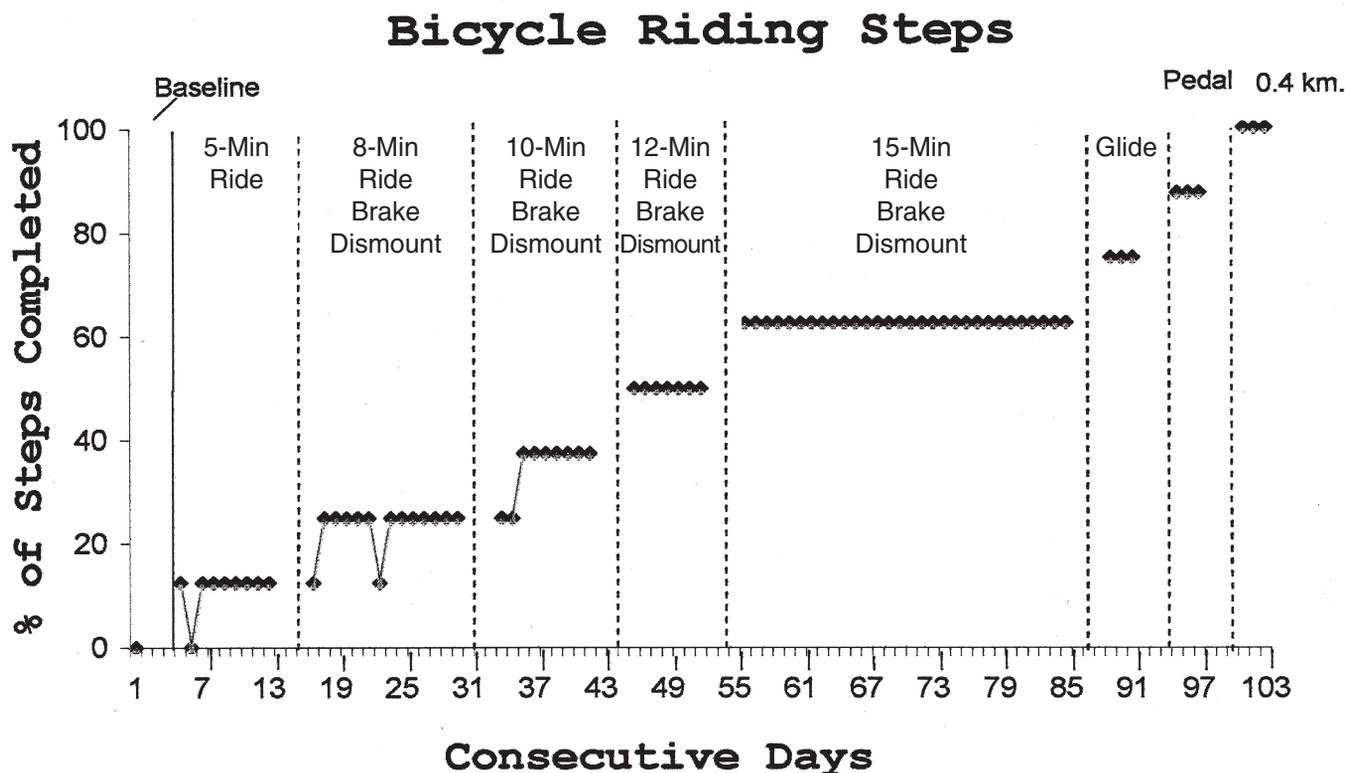


Figure 1. The filled diamonds depict the percentage of the eight-step task analysis that was completed during a session. Condition labels appear between condition lines.

and he required 9 sessions before meeting criterion performance. The balance of the bicycle riding program was errorless. Ellis advanced through the 12-min phase, the 15-min phase, and the gliding and pedaling phases without a single error. At the end of instruction, he rode his bicycle for .4 km on three occasions without falling.

Discussion

The simplicity of this study veils the exacting antecedent control technology that gave rise to the criterion performance. The initial phase of Ellis's revised task analysis was based on an important decision. The requirement that he balance on a bicycle while an adult attempted to prevent him from falling, which initially caused Ellis so much distress, was eliminated. According to Kern and Dunlap (1998), if "challenging behavior occurs immediately following task presentation, it is likely that some aspect of the task has highly aversive properties" (p. 302). This was certainly true for Ellis. His pre-program practice sessions required him to simultaneously balance, pedal, and steer. The result, even though support was provided, was that he fell—often. The introduction of the Kurt Kinetic Trainer simplified the task by removing the balancing and steering components and allowed Ellis to build on an existing be-

havioral repertoire (i.e., he was capable of pedaling a bicycle).

Ellis's mountain bicycle was deliberately used for training. While other bicycles (including a stationary bicycle) were available, Ellis's bicycle was used in an effort to program common stimuli. According to Cooper, Heron, and Heward (1987), "If physical stimuli prominent in the nontraining environments can be included in training, the probability of generalized responding increases" (p. 576). Ellis's bicycle was used to ensure that he was accustomed to the conditions under which he would ultimately ride his bicycle.

Interestingly, Petroski (1992), a structural engineer, inspired, through his writing, the design of Ellis's eight-step program: "Recognition of the potential for failure, and identification of the modes of failure that persist in the real world are absolutely essential to prediction and prevention of failure, the cornerstone objective of every designer" (p. 206). And therein lies the value of appreciating and understanding another science.

Ellis's team predicted that he would fail the undertaking of riding his bicycle unless the task of balancing and steering was within his control and temporarily separated from pedaling. In view of that, during Phase 6, the pedals and pedal shafts were removed from the bicycle and the saddle was lowered so Ellis's feet would easily reach

the ground. This modification produced clear advantages. The arrangement allowed Ellis to set his feet down and stop the bicycle any time he felt that he was losing his balance or the bicycle was moving too fast. Moreover, Ellis's ability to lower his feet and command the bicycle allowed for choice and autonomy. According to Bannerman, Sheldon, Sherman, and Harchik (1990), choice-making opportunities often lead to increased participation and a reduction in challenging behaviors. When the shafts and pedals were replaced during Phase 7, a confluence of skills allowed Ellis to ride his bicycle without assistance for the first time. The entire process of teaching Ellis to ride a bicycle exemplifies a "culturally appropriate intervention," that is, "an intervention that considers the unique and individualized learning history" of an individual (Sugai et al., 2000). By considering Ellis's learning history, and removing obvious obstacles that would probably lead to failure, mastery of a skill (including elements once considered aversive to Ellis) was obtained. By considering failure and subsequently altering components previously unacceptable to the learner, the entire task becomes agreeable; it is only then that success comes within reach.

Following Ellis's demonstration of his bicycle riding abilities, the Game Cube contingency was eliminated and the availability of natural reinforcers was described (e.g., riding to a relative's house). This change was made since behaviors reinforced by way of natural consequences are more likely to be maintained and generalized (Haring, Roger, Lee, Breen, & Gaylord-Ross, 1986; Stokes & Baer, 1977). When the natural outcomes of bicycle riding became evident to Ellis, the threads of positive behavior support were completely tightened. In short, the benefits of programming within this philosophy were made evident: By listening to Ellis, a teaching strategy acceptable to him was developed. By taking into account his preferences, the aversiveness of the learning situation was removed and replaced with not merely a neutral situation, but one that brought Ellis into contact with natural reinforcing contingencies. It was only through this shift in paradigm that the value of bicycle riding emerged for Ellis.

In terms of long-term significance, bicycle riding met Sugai et al.'s (2000) three criteria for social values: Bicycle riding was comprehensive (it occurred at all times of the day), durable (at a 1-year follow-up, Ellis was still riding his bicycle), and relevant (bicycle riding resulted in the emergence of new skills, such as street crossing).

Ellis's progress was not surprising since the task analysis was developed based on the six recommendations from Sugai et al. (2000): (a) Involve recipients of PBS in program design—Ellis played a critical role in the design of his task analysis. (b) Consider the values of the recipients and implementers—Ellis's family had identified bicycle riding as a highly valued skill, and the benefits it would afford Ellis were important to him. (c) Consider the skills of the implementers—the task analysis reflected not only

Ellis's skills but also his concerns. (d) Secure the approval and endorsement of recipients and implementers—without the approval of Ellis, implementation would not have been possible. (e) Consider the resources and supports needed to implement the strategies—soliciting the support of Ellis's family and obtaining the materials and resources to implement an effective strategy was critical. (f) Provide the supports needed to sustain the use of effective strategies—by recruiting natural reinforcers, and by demonstrating to Ellis how his newly acquired skill afforded him greater access, continued motivation for bike riding was ensured.

Perhaps most important, the bicycle riding program benefited others; 2 weeks after the conclusion of this study, Ellis, along with his family, rode his bicycle 8 km for a fundraiser.

Taken as a whole, a procedure that cost less than \$1,000 and took less than 30 hr resulted in Ellis adopting a lifestyle not previously available.

The purpose of this study was to show how the tenets of positive behavior support could be used to develop an educational program. The program described in this study was based on practical strategies and guided by social values. Moreover, the procedures were both ecologically and culturally valid. The program designers gathered inspiration from structural engineering, a discipline that creates elegant structures based on brilliant analyses, such as the Le Pont de Normandie cable-stayed bridge in France. Through positive behavior support, outcomes of analogous splendor are produced; they simply take another form—such as the image of Ellis, on his bike, chasing his dog, Tucker.

I thought of that while riding my bike.

—Albert Einstein (*on the theory of relativity*)

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