The Effects of Precision Teaching with Frequency Building of Fine Motor Skills on the Performance of Functional Life Skills in Adolescents and Adults with Autism

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Background

Precision Teaching

In 1964, Ogden Lindsley outlined a set of measurement and decision-making procedures for teaching that were founded on the principles of behavior and operant learning put forth by B.F. Skinner (1938). Central to this early behavioral approach to teaching was a focus on response frequency as a primary and maximally sensitive indicator of performance proficiency and response strength. Focus on response frequency is posed in contrast to percent correct, the more traditional measure of a learner's skill proficiency in the field of education (White, 2000; Binder, 2004). Vargas (1977) summarized this way of thinking by emphasizing that a "student who does problems correctly at a higher frequency is said to know addition facts better than one who does them at a lower frequency" (p. 62, as cited in Binder, 1996).

Lindsley further developed mechanisms by which a learner's performance could be systematically measured and displayed in such a way as to provide instant feedback to teachers and students regarding progress and/or the need for program modification (Pennypacker, Koenig & Lindsley 1972). The standardized method for displaying frequency data and evaluating program progress involved the use of a "standard behavior chart" (White, 2000). In addition, the chart allows for easy, visual assessment of learning trend or changes in response frequency as measured by "celeration" (Pennypacker, Anibal & Lindsley 2003). The standard behavior chart came to be known as the "standard celeration chart." The combination of the focus on response frequency, use of the standard behavior chart, and precise measurement, display and decision-making came to be known as *Precision Teaching* (Lindsley, 1994, Lindsley, 1992, White, 1986, as cited in White 2000).

An early demonstration of the powerful impact of precision teaching in education is known as the Great Falls Precision Teaching Project, conducted in the 1970's and reviewed by Beck and Clements in 1991. Data revealed that implementation of precision teaching procedures in one elementary school resulted in an increase of 20 to 40 percentile points on the Iowa Test of Basic Skills, compared to other district elementary schools with otherwise identical curricula and instruction methods.

Although there was early excitement among educators and other professionals regarding the use of this technology, the results were not widely published initially, and subsequently, information about the impact of precision teaching was not far-reaching. Despite a number of obstacles to widespread dissemination, those practicing precision teaching amassed volumes of data to support its efficacy (Binder, 1996). More recently, the development of a specific scientific journal to publish empirical support for the application of precision teaching was instrumental in the advancement of the field. Since the foundation of *The Journal of Precision Teaching* in 1980, these data are more widely available in the educational and psychological communities.

Precision Teaching with Frequency Building Procedures

An important outgrowth of the development of precision teaching was the increased attention to measures of frequency and teaching methods designed to achieve fluent and accurate free-operant responding. Early application of precision teaching procedures in educational settings led to the discovery that specific practice to increase a learner's frequency of performance on component or tool skills consistently led to improved ability to complete more complex tasks (Haughton, 1972). For example, increasing the frequency at which a student was able to read or write digits produced an increase in that student's ability to master more complex mathematical skills. Haughton and colleagues learned that teaching component skills to specified performance rates led to more proficient, or fluent, composite skill performance. The principle of these *minimum component behavior frequencies* (Binder, 1996, p. 170; Haughton 1972) was revolutionary and served as the foundation of *fluency–based instruction*.

Haughton (1972) and later Binder (1996) and Johnson and Layng (1994) highlighted the use of the term *fluency* to refer to "that combination of accuracy plus speed of responding" which characterizes skilled performance (Binder, 1996, p. 163). These authors brought the term behavioral fluency to a broader applied behavior analysis audience, and called for a heightened awareness of the concept of fluency and greater interest in fluency-building procedures. Together, these seminal articles brought together the conceptual and measurement aspects of Precision Teaching to bear on a set of teaching procedures designed to promote fluent performance.

The development and application of these minimum component behavior frequencies (also known as *frequency aims*) generated a body of data replicating the effect documented by Haughton (1972) and his colleagues with students in academic settings (e.g. Johnson and Layng, 1992). Professionals in education and psychology began to examine this concept outside traditional academic domains. Johnson and Layng (1992) reported the success of this methodology for working with adults learning to read, and found that the results of Precision Teaching with frequency building procedures were superior to any other program funded by The Job Training Partnership Act. Binder and Bloom (1989) used Precision Teaching with frequency building procedures to train new sales representatives, who later demonstrated a stronger knowledge base than more experienced sales representatives who did not receive such training. Binder and Sweeney (2002) later applied similar procedures with newly hired customer service representatives who achieved company-defined productivity levels more rapidly than conventionally trained new hires, and surpassed those benchmarks by 60% within two weeks on the job.

The analysis of component-composite relations and establishment of frequency aims were further extended to improve gross and fine motor skills in individuals with disabilities using frequency-building procedures. Binder (1996) describes how a number of prominent Precision Teaching professionals collaborated in identifying twelve fundamental motor component skills ("Big 6 Plus 6") and associated frequency aims. (e.g. Haughton & Kovacs, 1977; Kovacs & Haughton, 1978; Desjardin & Palmer, in Binder, 1979). Haughton and his colleagues achieved meaningful and significant results by using fluency based instruction to increase these motor components in adults with severe disabilities, leading to demonstrable functional skill improvements (in Binder, 1996*).*

Ongoing empirical assessment by Precision Teachers using frequency-building procedures supported the general assumption that training component skills to certain performance frequencies ensured fluent performance of composite skills in a variety of instructional contexts and will promote ongoing skill mastery (Binder, 1996). Educators and clinicians explored this premise in attempts to establish more frequency aims by observing fluent composite performers and assessing frequencies of component skills, or, testing the composite performance of learners as their response rate of components increased. In the latter model, the intent was to identify at which point a specific learner achieved "fluency." Despite general agreement in the concept of these strategies, a universal methodology for establishing and using frequency aims was not established. (Binder, 1996). For example, some practitioners consult published or compiled aims generated by the clinical work of other Precision Teachers. Other may assess "fluent" performers in their specific settings and use the resulting frequencies as aims. Still others take a more individualized approach by not using specific aims at all, by testing the learner's performance on a variety of outcome checks as the frequency of the target skill increases, and stopping instruction at the point at which performance meets some definition of "fluency."

A consistent and empirically determined definition of "fluency" was needed in the field of Precision Teaching to address the concept of increasing response frequencies in order to achieve specified "fluent" outcomes. Over time, a number of acronyms have been developed and revised to convey the range of specific outcomes associated with fluent performance. (e.g., *R/APS*, Haughton, 1981, as cited in Binder, 1996; REAPS, Binder, 1996, RESAA/RESA/SEAR, Johnson & Layng, 1992). While a complete analysis of each acronym in not possible in the context of the current paper, each acronym primarily addressed similar outcome variables. The earlier acronyms included some measures of three variables: skill retention (maintenance of response frequency without practice), endurance (maintaining frequency over longer performance durations), and application (functionally combining component skills into composites)(Binder, 1996). Later systems expanded to include assessment of skill stability (performance in the face of distraction), which had previously been encompassed in earlier definitions of endurance (Binder, Haughton & VanEyk, 1990), and a specific form of application, contingency adduction (learning a new composite skill without explicit training) (Johnson & Layng, 1996).

Therefore, Precision Teaching with frequency building procedures was developed to increase learners' frequencies of performance of component skills, generally using an established frequency aim (typically expressed with a frequency range) as a goal, in order to achieve outcome performance characterized by fluency indicators (primarily retention, endurance, stability and application). The basic procedures to achieve these outcomes within Precision Teaching with frequency building procedures follow a typical progression. More detail on the procedural specifics and other technical terminology may be found in Johnston and Layng (1996) and Fabrizio and Moors (2003). Specific procedural variations will not be described in detail here. In general, a component skill topography is identified by specifying a stimulus and response, and the individual is taught first to perform a skill accurately through typical instruction. A frequency aim is commonly identified, a consistent timing interval is established and focus is then placed on providing daily practice opportunities to increase frequency. Conditions such as reinforcement, types of prompting or materials are developed and changed as the data indicate level of effectiveness. Often, a projected celeration line is established (see White, 2000 for a discussion of general practices in using celeration lines) to provide incremental goals for the learner to gradually approximate the desired frequency. Reinforcement in daily practice timings is contingent on meeting daily, incremental goals. A critical aspect of this process is the use of the standard celeration chart to document the learners' goals, timing lengths and performance, and to make decisions based on visual inspection of the charted data. Timed practice generally continues until the frequency aim is met, at which time fluency outcomes (e.g. RESA/SEAR) are assessed to ensure they are achieved.

While there is general consensus among Precision Teachers regarding the desired outcomes these procedures for building behavior frequency (Binder, 2001; Haughton, 1980; King, Moors, and Fabrizio, 2003; Lindsley 1995, White 2000), standard practice varies with regard to certain procedural aspects. As mentioned above, Precision Teachers may differ in how they establish frequency aims for specific skills and learners. Some clinicians utilize a predetermined frequency of celeration as a guideline for treatment modifications, while others use a learner's individual performance or a predetermined rate of celeration to guide treatment modifications (King, Moors, & Fabrizio, 2003; Moors & Fabrizio, 2002; White 2000). Other variations include: how target skills are selected, how outcome variables are measured, whether accuracy is specifically addressed before timed practice is initiated, and differences in the selection and use of materials and structure of practice sessions. Very little, if any, published comparative evidence exists to guide instructors when making such methodological decisions. While a description, analysis and comparison of all these variations in clinical practice of Precision Teaching is beyond the scope of the current paper, some attempt will be made to address a few of these procedural questions.

Application to Autism

Recent interest in Precision Teaching with frequency building procedures has led to its increased implementation in the field of applied behavior analysis for learners with autism and other developmental disabilities (Binder, 2003; Fabrizio & Schrimer, 2002; Fabrizio, Schrimer, & Vu, 2003; Zambolin, Fabrizio, & Isely, 2004). Specific research has found that Precision Teaching with frequency building procedures with this population of children has achieved powerful results in many curricular areas, including: language (preposition use), social skills (joint attention), pre-academics (picture matching and pattern imitation), and academics (sight words) (Fabrizio & Schrimer, 2002; Fabrizio, Schrimer, Vu, Diakite & Yao; 2003, Kerr, Campbell & McGrory, 2002; and King, Moors & Fabrizio, 2003). These findings have supported the need for teaching and measurement methods that ensure "true skill mastery" or "fluent performance," (measured as performance frequencies or frequency ranges with "mastery" defined by the fluency outcomes indicated by RESA/SEAR and other acronyms) in contrast to more traditional teaching methods for this population which traditionally have focused solely on accuracy and percent correct as measurement and mastery criteria (Fabrizio & Moors, 2003).

Despite the growing amount of data and body of literature demonstrating the effects achieved by Precision Teaching with frequency building procedures in children with autism, very little research is available demonstrating the application of these methods, which specifically addresses the needs of older learners with autism. Certainly, strong evidence exists to support the impact of these strategies in adults with disabilities in general (Binder, 1996). However, there are no widely available empirical reports of Precision Teaching with frequency building procedures with adolescents and adults with autism. Systematic research to document the significant benefit of this teaching strategy is needed in the broad education and applied behavior analysis literature.

The National Center on Secondary Education (2003) has reported that only 15% of persons with autism are employed in a 1-year period. Clearly, the need to determine methods of instruction that will increase the employability of this population is necessary in order to achieve more promising employment outcomes. Further, since the progress of older learners with autism relies on our ability to implement instruction in the most effective and efficient manner possible, further research to establish best practices by addressing areas of variation within Precision Teaching with frequency building procedures would also be useful.