

The Impact of Synchronized Metronome Tapping Treatments on School Achievement: A Report of Two Preliminary Investigations

Brief

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Educators have constantly searched for methods to improve the academic performance of all students. Special educators, in particular, have experimented with a wide variety of academic and non-academic intervention treatment programs, with mixed success. The most successful educational treatment programs have focused on direct instruction of academic skills. Non-academic interventions (e.g., language process and/or perceptualmotor training—psycholinguistic process training; psychomotor patterning treatment), which proliferated during the 1960's and 1970's, were found seriously wanting and failed to demonstrate replicable effects on academic achievement. As a result, the field of education has been particularly skeptical of the benefits of non-academic “processing” and “brain” based interventions, when the valued educational outcome has been school achievement.

Recently there has been a renewed interest in biologically-based conceptions of learning disorders and the potential benefits of non-academic “processing” treatments based on principles derived from contemporary cognitive psychology, brain plasticity, fMRI and genetic research studies. The cognitive “processes” hypothesized as causative factors underlying many learning disorders included phonemic awareness, speed of lexical access (rapid automatized naming), working memory, and executive functioning. These same processes have also provided the foundation for the development of new methods to improve students' academic growth.

Added to this new focus on underlying cognitive processes (in academic learning) has been mental time/interval timing research. In particular, the phenomenon of interval timing (temporal tracking) via research paradigms that require individuals to maintain synchrony with auditory tones (e.g., from a metronome) has been identified as potentially important in the diagnosis and treatment of a variety of clinical disorders. Improvements in individuals' interval timing also provided the foundation for treatment programs directed at increasing performance levels in variety of domains. Synchronized metronome tapping (SMT) treatments, designed to minimize the latency between the onset of the metronome beat and a participant's expectancy to the beat, have recently demonstrated significant treatment effects on human timing and rhythmicity. More importantly, improved timing and rhythmicity has translated into significant treatment effects in tennis and golf performance and improved behavior for children with ADHD.

As a result of the reported positive performance outcomes based on SMT treatments, two exploratory studies were conducted to examine the potential benefits of SMT on

educational achievement. SMT's impact on educational achievement was operationalized via the Interactive Metronome® treatment program in separate elementary (n = 86) and high school (n = 283) samples. Participants in both studies were randomly assigned to control and treatment groups. The IM treatment groups participated in a 3-4 week-long (15-18 sessions) intervention designed to improve their latency/onset response to a metronome beat. During the intervention period, the control subjects participated in regular classroom activities (physical education for high school students and recess for elementary students). Statistical analysis of pre- to post-test score changes, controlling for initial level of pre-test performance, focused on standardized measures of math and/or reading achievement skills and subskills (e.g., reading fluency, comprehension; math calculation and problem solving) and related cognitive abilities (e.g., phonemic awareness, RAN, attention/concentration, time estimation).

The results from both studies indicated that the IM treatment group demonstrated large significant improvements in their timing and rhythm perception and performance. On average, the IM treatment subjects demonstrated approximately 50% greater performance levels in timing and rhythm over the control subjects. More importantly, positive and statistically significant treatment effects were observed on the majority of achievement and cognitive-related dependent variables. IM treatment effect sizes (ES's) ranged from approximately .15 to .50. The ES's suggested that 3-4 weeks of IM training resulted in the IM treatment subjects demonstrating approximately 07% to 20% greater growth in reading/math achievement than the control group. The IM treatment effects were typically larger in the elementary-aged sample.

The design of the two preliminary investigations did not allow for the investigation of potential changes in underlying cognitive or brain function mechanisms. A number of preliminary hypothesis, focused primarily on cognitive/information processing causal mechanisms (e.g., improvements in working memory, executive-controlled attention, executive functions) will be presented. Implications for brain-based research (e.g., fMRI studies during and after IM treatment) will be highlighted.

In summary, this set of exploratory studies suggests that synchronized metronome tapping (SMT) treatments, which are based on contemporary research and theory from cognitive psychology, may have a positive impact on the growth of student achievement. We conclude that SMT training, operationalized in this study via the IM treatment protocol, appears to contribute to relatively faster growth in reading and math achievement, particularly for elementary school-age subjects. The underlying causal mechanisms (i.e., what is happening "under the hood") are currently unknown, but the consistently positive treatment effects observed in the current studies argue for more indepth IM investigations in educational settings.