

The brain's training in the improvement of pitch and tempo acuities*

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Boa tarde. I do want to congratulate Mrs. Diana Santiago and her committees for hosting and administering this obviously successful symposium. I am especially grateful for being invited to be a part of it. Also I appreciate the opportunity of being in Brazil again. I was fortunate to do teacher exchanges at the Federal University of Pernambuco in the years of 1975 and 1976. You do have so many exotic foods—especially ice creams!

In my talk today, I wish to not only share information about an ongoing study of mine but to elucidate a few of my thoughts about the importance, i.e., the contributions that present-day researches in brain activities can make to us in our music education and music psychology endeavors. Please follow me through a lengthy introduction in which I make the case for the importance of us music educators/music psychologists to keep abreast of what the neuroscientists are telling us about how, what, and where functions are occurring in the brain in responses to musical stimuli.

Operations of the brain and mind are increasingly being modeled as computer processes. We are more and more aware of how our musical behaviors are linked to perception, cognition, memory, learning and other acquisitions. Scientists now view mind and memory (learning) as the interactive and contributing systems of particular neuronal circuits doing specialized jobs within an integrated organ—the brain.

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The brain's enormously complicated interconnecting systems have given rise to a long list of the kinds of memory storage (learning), and neuroscientists keep finding new ways in which we process and store information. It is the human's brain in which music and all its ramifications originate. (Most often, the human's brain is hailed as the most complex object in the universe.) Recent investigations by neuroscientists have detailed how and where the process of psycho-acoustics (transforming the physical sound waves into electro-chemical stimuli) occurs and thus results in establishing particular memory systems that become localized in separate parts of the brain. The center of control for the human organism is the brain and it follows then, that music is processed by the brain and through the brain. Neuro-psychologists keep finding new ways in which the human processes and stores information, i.e., how learning takes place.

The brain is the organ of the mind. If music is in the brain and the mind is in music, then we are saying that music emanates from the functioning of the brain. Schaug (2003) has reported on how the brain's structural adaptations respond to long-term skill adaptations in response to long-term skill learning. Restak (2003) also has written and spoken about the "musical mind." Hodges (1996) elucidates further that "a Musical Mind is the birthright of all human beings.

Music, like language is a species-specific trait of human kind. All human beings—and all human beings (to the extent that we do)—have language and music." (Gaston (1968), affectionately known as the father of music therapy, has stated that "music is the essence of humanness, not only because people create music but they create their relationship to it."

Many of us have been schooled with references to the taxonomy of educational objectives as promulgated by Bloom (1963), viz., cognitive, affective, and psychomotor. In retrospect, it seems to me that, in practice, we pedagogues, have generally started with the psychomotor and have not attended to the brain—not realizing that the brain is what guides the execution of motor skills. The brain processes involved in learning are so many and so interrelated, that separating them for examination and study purposes was impossible. Now, we are beginning to understand how it is that learning represents integration of incoming new information with stored old information, and subject to recall.

Now with the technologies being utilized by neuroscientists (EEG, ERP, MRI, SQUID, and PET), it should be obvious to us where our first attention in the teaching of music should begin. This means that mental rehearsal (eupraxia) should precede psychomotor rehearsal. Coffman (1990) discusses

this as “Cognitive enhancement of psychomotor skills.” Although the acquisition of musical skills and expertise has been investigated in many domains of music, we have few reports where the concentration of music educators/music psychologists, in their classrooms have systematically sought to develop the mind a priori.

Aims/Purposes

The purpose of this research has been to investigate whether young adult musicians could significantly improve their musical skills (acuity judgments), viz., judgments of pitch and tempo accuracies as they are participating in the Musical Arts as a performer, conductor, or listener. For most of us, judgment of pitch accuracy has been a part of music training from day one. However, it has been my experience that young adult musicians are generally sorely lacking in the setting of tempi when it has finally become their responsibility. We, as pedagogues, have expected that they would “magically” learn this from having performed in many musical ensembles—by osmosis?) where tempo setting was the responsibility of someone else. I’ll take time, now, to have you in this audience check your ability to accurately name a given tempo, hopefully to make my point. Please write down your M.M. number. [96] I’m assuming that, if you’re an experienced conductor you were correct within six ticks. If not, then... moving on.

Method

Over 19 previous academic years (1987-2006) a total of 241 students enrolled in Psychology of Music classes participated in this on-going investigation. Students were instructed to use a tuning fork (A=440 Hz) several times daily over the term of the class to improve their pitch acuity judgment skills (reduce their Just Noticeable Difference [JND] scores). Also they were to use their watches daily to calculate tempi in various musical settings where they could check with the music’s indicated tempo labeling. At the beginning of each class a randomly selected tone (in the octave C4 through C5) was sounded for 8 seconds and a metronome ticking sounded for 16 seconds. The students recorded their judgments on a daily attendance slip.

Results

A comparison of first day, mid-term, and last day of the term judgments showed that there was steady improvement through the weeks, as expected.

First day comparisons to last day comparisons showed that: 1) 66% of the students showed significant improvement in their pitch identifications while the other 24% did exhibit noticeable improvement in their pitch judgments; and, 2) in tempo judgments, the students, as a whole, made a modicum of improvements in their tempo judgment accuracies.

Conclusions

The above results reflect a steady improvement in accuracies of these musical skills through each of the semester terms. The results, however, do reveal the need for more effective pedagogical techniques in teaching music skills. These would be increasingly based on understanding and employing data from the research reports from the technologies (e.g., MRI and PET) which are opening up new ideas of “training the brain.” New ways will be coming from the neurosciences merging with psychology and which then will be extended into the fields of music education and music therapy. We now know that mental rehearsal (eupraxia) activates the brain much as real physical practice does. Further, knowing that musical stimuli will execute shifts of localization of brain activities., thereby associating musical behavior with brain conditions, it will be known that there is a link between sensory processing and cognitive processes happening in the entire brain. Most of all, we need to realize that the “jargon” of the 1970' and 1980's should be discarded and replaced with teaching skills as an endeavor to educating the brain, relying on the psychological principles of how and where learning takes place in the brain—and that is the whole brain!

I do want to take an additional moment to “tack on” a major concern of which we as music educators, music therapists, and music psychologists are failing to become more active—in the mental health field. It is alarming that adults are now taking cocaine-like drugs under a different name than they took them as children (Ritalin). The fact of the matter remains that ADHA is not supported by science. No evidence has been presented of a medical condition called ADHA nor has it been validated as a disease. There is no test to diagnose ADHD. It really is referred to as a disorder. What I am saying is that ADHA is environmentally acquired. The premise is simply that, because the human cannot refuse to hear, music can reach the brain, just as can the effects of a drug... and, music doesn't poison. Any drug is a poison to the brain... in either case, behavior is altered. Music will alter it positively, while drugs will alter it detrimentally, perhaps addictively. In one

study (reported by regional newspaper) 40 percent of the children who took Ritalin developed side effects! Our daughter, a Professor of Music Therapy (and now serving as president of the American Music Therapy Association), has taught in public schools, using music therapy techniques with “Behavior Disordered” students (in the days before Ritalin became the “easy way out”). It works! We as professionals could do more, with music, to lessen dependence on poisonous drugs used to modify behaviors in both children and adults.

Thank you for listening. It has been my pleasure to speak to you and be a part of this symposium.

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