



# Why Music Education Matters in Academics:

## It May Not Be What You Think

by Gregg Goodhart

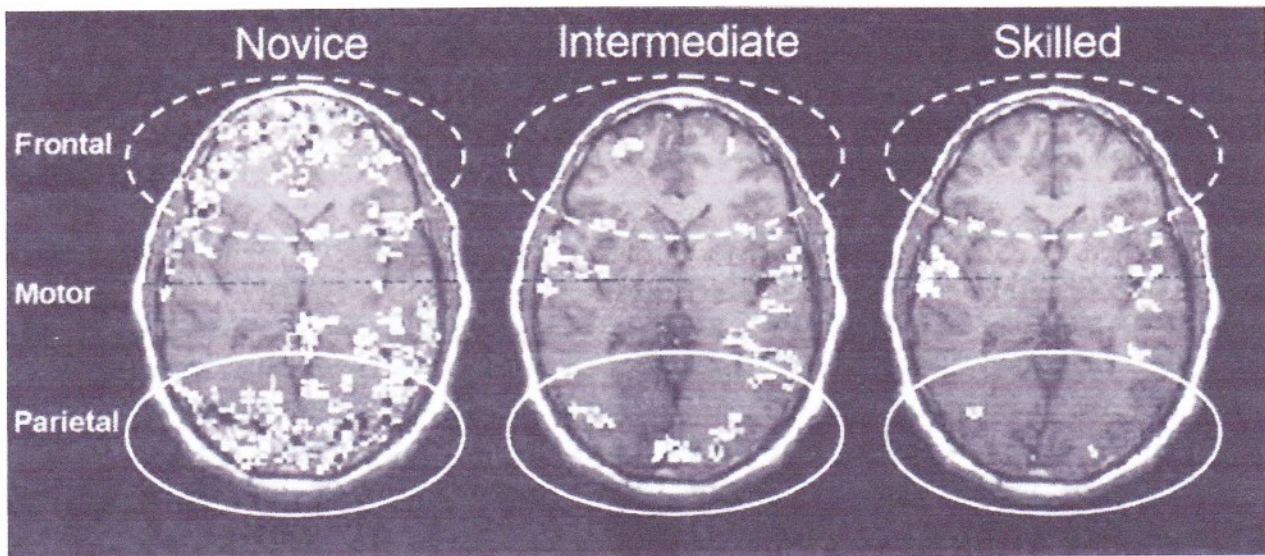
As much as I'd like to believe it, I've always been a little dubious about research citing music instruction as a causative factor of positive outcomes in other areas of life. The "Mozart Effect," ill-conceived as it was, took on a life, and an industry, of its own. I've wondered if the type of young person interested in playing the violin in orchestra is even the type of person who would ever be interested in joining a gang.

### Advances in science clarify learning

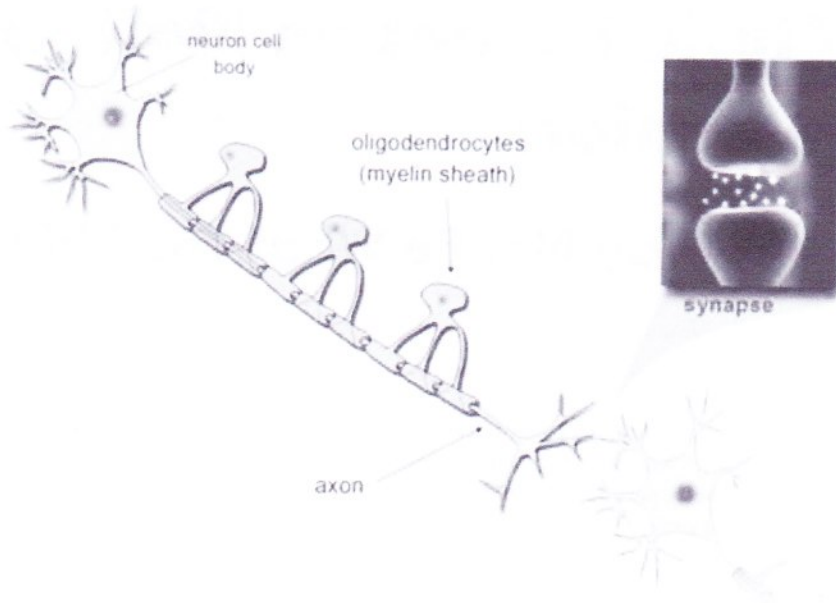
Significant advances in neuroscience are painting a pretty clear picture first brought to us by cognitive psychology educational best practices, and the answers are enlightening, unintuitive and powerful.

We may have heard that we only use 10 percent of our brain, and by inference might assume that if we used more, much more, we would be smarter, better, faster. However, when too much of the brain is active a seizure occurs. The initial, and one of the most significant parts of the learning process, involves using less of the brain.

In "Changes in the Development of Expertise: Neuroanatomical and Neurophysiological Evidence about Skill-Based Adaptations," (Hill and Schneider) researchers published functional Magnetic Resonance Imaging (fMRI) showing the brain learning a task. At first it is lit up like a Christmas tree. Most notably the pre-frontal cortex, responsible for executive function, is very involved. As the task is learned, more and more regions drop out as the brain finds the perfect efficiency point for the desired ability. This has been called a process efficiency change and a skill is learned once it is completed. This process involves difficulty and frustration as the brain is trying to figure out how to best deal with it.



But this is only the first step to becoming fluent in that skill. At this point a specific neural network has been created. Everything we do and think is represented by neurons (brain cells) connecting with other neurons and these communications are neural networks. Each time an action potential (electrochemical nerve impulse) is sent between neurons it travels down an axon then across a gap called a synapse. When that happens, specific cells attached to a part of the axon (specifically the internodal parts), called oligodendrocytes, produce an insulating sheath for the axon called myelin (Araque and Navarrete; Wake, Lee, and Fields). The more of this insulation there is, the stronger the current (action potential) remains, and the faster it travels. It takes a lot of repetition, but the more myelin that is wrapped around an axon the faster we think, play or execute any other skill we are working to learn.



What this means, in simpler terms, is one must focus and continually problem solve even when it is frustrating until the solutions to learning the skill are found (process efficiency change). This crucial step in high-efficiency learning has been called desirable difficulty by researchers (Bjork and Bjork). Then the skill needs to be repeated over and over to increase processing speed (myelination). As of this writing, researchers have not been able to find the upper limit of this speed. Take a moment and consider what that means with regard to the potential of all students.

### Moving in the right direction, and finding answers

In 2009, the Dana foundation published “How Arts Training Improves Attention and Cognition,” by the eminent education research psychologist Michael Posner and a colleague. Posner has done a significant amount of work over 50 years on the brain’s attention networks (focus). He wrote, “If there were a surefire way to improve your brain, would you try it? Judging by the abundance of products, programs and pills that claim to offer ‘cognitive enhancement,’ many people are lining up for just such quick brain fixes. Recent research offers a possibility with much better, science-based support: that focused training in any of the arts—such as music, dance or theater—strengthens the brain’s attention system, which, in turn, can improve cognition more generally. Furthermore, this strengthening likely helps explain the effects of arts training on the brain and cognitive performance that have been reported in several scientific studies, such as those presented in May 2009 at a neuroeducation summit at Johns Hopkins University (cosponsored by the Dana Foundation).”

At the time, Posner had only a hypothesis about the building of attention networks. He wrote, “Taken as a whole, the findings to date tell us that music training can indeed change brain circuitry and, in at least some circumstances, can improve general cognition. But they leave unsettled the question of under what circumstances training in one cognitive area reliably transfers to improvements in other cognitive skills.” He continued, “As we have seen, recent studies have transcended the failed paradigm of simply exposing people to the arts, and now concentrate on the effects of arts training over months and years. We need more

studies like these to determine whether, beyond strong correlation, causation occurs. Arts training may influence cognition through other brain processes as well. Because arts training strengthens the brain network related to the art being practiced, other tasks that rely on the same brain circuitry or pieces of it presumably would be affected.”

We are now getting that research. The study, “Improved Effectiveness of Performance Monitoring in Amateur Instrumental Musicians,” identified the link in 2014. Among other findings it noted, “More importantly for present purposes, higher levels of musical practice also were associated with a better engagement of cognitive control processes, as indicated by more efficient error and conflict detection... and reduced post-error interference and post-conflict processing adjustments.” To put it another way, it trains the brain to search for areas of error,

maintain focus instead of giving in to frustration, and then make adjustments based on finding those errors over and over as one works. I believe we teachers have a word for that—learning. That is how learning works for any subject, any skill, anything. The more you do of it the better, smarter and faster you get.

The study went on to say, “Here we show that already moderate levels of musical activity are associated with improved executive functioning when performing basic nonmusical cognitive tasks.” Executive function refers to the basic ability to choose “should” over “want,” a crucial skill for adult self-reliance, as well as good learning now. This is wired up in the prefrontal cortex (PFC) of the brain. The PFC is underdeveloped in the young and will not finish developing until the age of 25. Have you ever wondered why your insurance goes down, or you can’t rent a car until you are 25? Actuaries have noticed this phenomenon for a very long time; now we have insights from neuroscience to bear this out.

In the enlightening book “Willpower; Rediscovering the Greatest Human Strength,” researchers Baumeister and Tierny show, among many other amazing insights, that the PFC functions like other parts of the cortex. That is, you learn a skill (wire up a neural network) and then, through repetition, make it stronger (myelination). This is to say that focus, self-discipline, perseverance rely on strong neural networks that need to be created in the PFC. Notice I did not identify a specific skill. This is the ability to focus, push through frustration, and learn at a high level for anything. This ability to control one’s focus and behavior successfully is the essence of self-reliance, and how well students build that skill will translate directly to how successful they are as adults.

Putting all of this together we can begin to see that these networks are created and strengthened in music training, then are made available for all academic work. Why is this?

### There are no B+ averages in music

There are no B+ averages in music. Imagine a performance in which a full 11 percent of it was mistakes. Yet, many times,

students who maintain a B+ average for an academic class are considered excellent.

This is because arts teachers must teach process over content, while the general strategy usually employed elsewhere emphasizes content over process. How much did teachers teach you how to learn? And was it drilled over and over the way content was drilled? Creating the neural networks and myelinating them over and over, for years? It is that learning process that you need to become fluent in the domain while using the content during that process.

Music teachers must, as a normal part of their jobs, to be considered “good,” get all of their performing students to about 98 percent or better. The really good ones get very close to 100 percent. I taught music successfully for 13 years at the high school level. It is a common myth that music teachers at the pre-college level seek out “talented” students, or identify them in their classes, and then develop them. What we do is take anyone and everyone, and know that if they will follow our directions (the learning process in its purest form) they will get good. This develops the PFC as well.

Think of your rehearsals or performance classes, is that how math and science are taught? That is why you see such a stratification of grades in academic classes. In a competently designed curriculum there is no reason anyone should get below an A with reasonable effort. The reason this does not happen is that most students do not know how the learning process really works. They are left alone to figure it out and their grade will reflect how well they did so. An A means, at best, fluency, not mastery. That is another level. The few that can figure out the process on their own are called “gifted.”

How do we deal with gifted students? We place them in accelerated courses for focused training within the rich mental models they have already built. This fits squarely into the paradigm of skill development; work properly over time, build a mental model in order to think critically in the domain, once fluency (A's) is achieved then get intensive higher level training to progress toward mastery. This process can be taught to any healthy student, and everyone is capable of “gifted” achievements.

The gifts are already there waiting to be opened by all. They are in music. With any luck, academics will catch on to this process. Currently, there is a nascent national interest in neuroeducation.

### **The brain is designed to enjoy learning**

Making oneself do this can, at first, seem unpleasant for a young person. Many times they need to be structured into these behaviors (creating PFC neural networks). However, on the other side is a rich engagement of the brain that produces what the researcher Mihaly Csikszentmihalyi calls “flow.” This is the state the brain enters when it is fully engaged. We have experienced this as hours, seeming like minutes, when we are engrossed in a task. He argues this is the most enjoyable state for the brain to be in and makes a distinction between pleasure (lying on the beach, playing a video game) and enjoyment (when the brain is fully engaged and we are truly enjoying learning). This state can only be achieved once some fluency is acquired as it involves higher

level problem solving in the domain, and that is the difficulty (desirable difficulty) of the initial part of learning.

The good news is it appears the brain is designed to crave high level problem solving/cognition. After all, that is how humanity has advanced over the course of time. But the price of this productive state of enjoyment is persevering through the initial unpleasant stages. Most do not want to do that, thus few seem to be “gifted.”

After the initial difficulty, true fluency in a domain produces enthusiasm for learning more about that domain generating genuine and lasting learning, self-esteem and self-reliance (Zimmerman). Passion for music can be created by learning to play it well.

There also are strategies to begin gradually building positive habit patterns so that doing work properly becomes habituated (Duhigg). Starting and engaging in focused learning becomes like tying your shoes. It is neither pleasant nor unpleasant. It is just something that you do. After that, flow is not far behind.

These things are very important. But what I have written here is just the tip of the iceberg. Please research and decide for yourself. There is a bibliography included, and you can get more information and resources at my website [betterlearningthroughneuroscience.com](http://betterlearningthroughneuroscience.com).

Also, make sure students eat well and get exercise. They must nourish and take care of their bodies, for they will grow into the ones they'll need as adults. And make sure students genuinely participate in music. Like their bodies, they must nourish and take care of their brains.

### **Implications for music teachers**

I'm sure we can see the use of this information for advocacy with administrative and faculty members. There are a few other things to consider.

Every good experienced music teacher I have encountered understands the basic issues I've outlined as part of their normal teaching. What is new is the coalescing of research, first from cognitive psychology and then neurobiology, that allow us to fill in the blanks and understand how all of these things function as part of a larger model. When we come to understand that, we learn how to teach others to do what we do.

We will certainly need more than one article in a journal to get to this place. However, when we do, we can advise entire departments—all of them in fact—on to how all students can achieve that 98 percent. Any good, experienced music teacher is very close to understanding how to teach that. Teaching it should take about as long as it takes to develop students to be in your top orchestra, and the process will be the same. Depending on where a given teacher is in their own development, this could take one to four years.

I started an after-school discussion group that was well attended by faculty. The process slowly began interesting others with all of the good information available, as well as relevant contributions from the group.

If we look around, we can see a groundswell of things pushing education in this direction. There are websites that claim to train your brain; the excellent work and conventions held by The Learning and the Brain Society, The Dana Foundation; areas

such as graduate study in music cognition like the one at Eastman; a slew of books addressing myriad issues surrounding this paradigm — including the currently popular “Focus.”

I believe no other conclusion can be reached: our issues with education lies in the teaching of process, and technology can take care of most of the content.

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Gregg Goodhart has a passion for excellence in music education even though he teaches guitar! He founded and directed the internationally acclaimed Servite High School Classical Guitar Program in Anaheim, California for 13 years. In 2009, he was named the ASTA Outstanding School Music Teacher of the Year for Los Angeles and Orange Counties and received the 2011 Outstanding Contributions to Education award from the Orange County Department of Education. His writing and research in music education have been published in *Soundboard*, *The American String Teacher*, and *The Orange County Register* among others. In pursuit of excellence in teaching, he has spent years doing extensive research in cognitive and behavioral psychology and neuroscience. In 2014, he founded *Better Learning Through Neuroscience* to coach students and teachers in the foundational learning process necessary to truly master any domain, or just get as good as they would like. He travels the country doing small and large workshops for students, teachers, and administrators as well as doing distance coaching in these areas by Skype. There is more information on his website [betterlearningthroughneuroscience.com](http://betterlearningthroughneuroscience.com).

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