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Facing the Risks of the "Mozart Effect"

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FACING THE RISKS OF THE “MOZART EFFECT”

Bennett Reimer argues that music educators must protect the integrity of music education from alternative, nonmusic agendas.

BY BENNETT REIMER

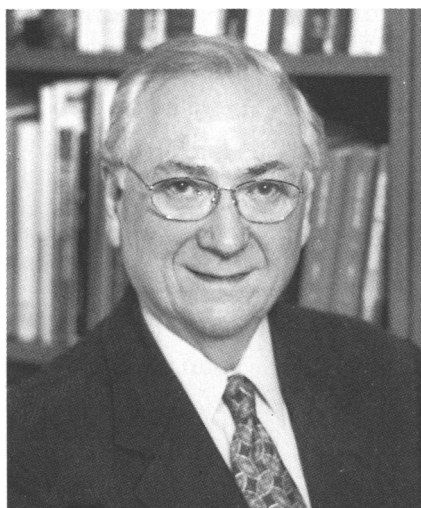
The spirit of music education can be found in the day-to-day actions of every music teacher. Frequently, however, the development of this spirit can be traced to the influence of recognized authorities in our profession. These authorities have guided our profession with distinction through their words and actions.

The purpose of this series is to offer distinguished senior members of our profession, the “Grand Masters,” the opportunity to write about some aspect of music education based on their perspective as lifelong leaders in the field. The ultimate intent is to provide the entire readership with an encounter with those who have been and, we hope, will continue to be an integral part of our profession.

The second article in this series is written by Bennett Reimer, the John W. Beattie Professor of Music Emeritus at Northwestern University in Evanston, Illinois, where formerly he was chair of the Department of Music Education

and founder and director of the Center for the Study of Education and the Musical Experience. He has been the author or editor of twelve books (with several more on the way) and more than one hundred articles, chapters, and reviews. His writing, teaching, and lecturing have addressed a variety of topics, including philosophy of music education, curriculum theory, research theory, multicultural issues, musical intelligences, interdisciplinary arts principles, teacher education, international music education issues, and applications of cognitive psychology to music learning. Reimer, who first entered music education as a band director, has participated in many national and international initiatives, including the MENC Goals and Objectives project, the MENC task force that wrote the National Standards for Music Education, and MENC’s ongoing Vision 20/20 project. He has lectured and presented keynote addresses all over the world.—Mark Fonder, series editor

Throughout its history in the United States, and in most countries and cultures around the world, the teaching and learning of music has been recognized as serving a variety of human needs. Some of these needs can be met only through music—that is, through the kinds of meanings and satisfactions that only musical sounds, defined and structured according to cultural expecta-



Bennett Reimer

Photo by Jerry Sharff

tions, traditions, and identity traits, can provide. Involvement with culturally significant musical events, through composing, improvising, performing, listening, or any other musical opportunities a culture provides, has been considered fulfilling to varying degrees, from the lightly entertaining to the profoundly spiritual. Teaching and learning music, then, have been understood to be valuable because they improve people’s abilities to gain meaningful, gratifying musical experiences. Other needs served by studying music can also be valuable but can be fulfilled in a variety of ways not involving music or its study.

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Sometimes these other needs come into conflict with the musical ones. A glance backward in history will illustrate how this can happen.

Musical and Other Purposes of Music Education

Singing schools were established in the United States in the early eighteenth century to fulfill a need to improve the quality of singing as part of worship services—an important societal activity that depended on a higher level of musicality than that achieved by most members of the congregation. But in addition to fulfilling a musical need, these instructional sessions were socially enjoyable for the people attending them. No doubt, some single individuals attended in the hope of meeting suitable partners (some things don't change over time). Also, the singing masters—the first professional music educators in the United States—were able, if they were successful, to make a decent living from the activity.

Singing schools, then, had the primary purpose of teaching music skills, while naturally and comfortably serving a variety of associated purposes. There were, of course, many other ways to enjoy companionship, to meet eligible partners, and to make a living. There was only one way, however, to satisfy the need for better singing—to learn how to sing better. The conflict occurred when several people who regularly attended a particular singing school began to complain that too much time and effort were being spent on singing instruction and that more time was needed for socializing—perhaps for potluck suppers, games, and so forth.

For the singing master—the music educator—this presented a dilemma. He (this was, then, a male role) was devoted to the musical task for which he was responsible and for which he had developed the necessary musical and pedagogical expertise. He had a course of study to deliver, including skills to develop, a musical repertoire to be studied, understandings to be nurtured, and learning assessments to be made; in short, he had a curriculum. But when he heard his students' complaints, he wondered if he was

being too hard a taskmaster and needed to provide a bit more time for those other needs to be met. Or, perhaps, he should take the cue from his students' requests and make singing instruction secondary, devoting the most time and effort to the other, more social activities. Maybe he should go even farther, advertising his school as being focused on social and singles activities, thereby appealing to a wider constituency than those interested in learning to sing.



The argument based on the “Mozart effect” proposes that spatial-temporal reasoning development should be the point and purpose of music teaching in the schools.



At what point would he be allowing the purpose of musical learning to become so altered by other purposes as to lose its centrality and veracity? At what point would the tail start wagging the dog? If he allowed this to happen, he might get more students in his classes and make more money. But what would that do to his professionalism, his musical self-respect, and his belief that musical values deserve a secure place in education, not to be displaced by other purposes that could be served just as well in other ways? Surely a wagging tail is a sign of a happy dog, so why not include appropriate attention to other values that add to the happiness of learning

music? And why not even mention such values when justifying the need for and importance of his instruction? But how could he do so without weakening, or even sacrificing, the significant values that only music can impart? How could he protect the primacy of his music education curriculum?

The singing school master's dilemma has persisted over the centuries. If we fast-forward now to the MENC National Biennial Conference in Phoenix, Arizona, in April 1998, we can hear Frances Rauscher, an experimental psychologist from the University of Wisconsin—Oshkosh, explaining her findings about the effects of music training on spatial-temporal reasoning. I, along with several hundred other music educators in a large room, listen intently. I am filled with mixed, conflicting thoughts and feelings.

On the one hand, my interests in musical intelligence, musical cognition, musical perceptual processing, musical learning mechanisms, and the like lead me to be extremely curious about how our brains process various stimuli, musical and otherwise, in ways we are only now beginning to investigate. A host of issues related to Rauscher's research arise in my mind, such as *reversibility*—whether direct training in spatial-temporal reasoning would positively affect musical perceptual responses; *experimental selectivity*—whether a variety of training regimens other than in music would produce even stronger effects than music did; *interaction effects*—what, precisely, in the experimental treatment actually caused the effects measured; *measurement*—how the measurement methodologies themselves influenced the findings, with other possible effects from a variety of interactions in musical learning going unnoticed; and *external validity*—whether professional performers, especially those steeped in the Western classical tradition, have notably higher spatial-temporal reasoning levels or mathematical/scientific abilities than most other people. I find her work provocative as research, but I also see that it leads to important unanswered questions.

But it is another part of my response that ties me to my precursor colleague conducting a singing school. Over the centuries, from his time to ours, a great variety of human needs have aligned themselves with music teaching, usually quite compatibly and nonthreateningly. In most cases, music educators, despite their fears, have not been confronted with demands to so dilute their obligations to musical learning as to compromise their professional integrity. The troublesome scenario I envisioned for the singing master is unlikely to have occurred. Music educators generally have been able to attend to their primary purpose and be pleased that associated purposes are also served. But there has been a state of anxiety about the possibility that someday they might be pushed too far—that at some time, purposes other than musical ones might start to dominate, and, as individuals or collectively as a profession, they might have to stand up and be counted as supporters of the primary value of music.

As I sit there listening to Rauscher's presentation, I wonder, "Is this the time?" The unprecedented publicity given to her research and that of others on the effects of music on spatial-temporal mental functions, dubbed the "Mozart effect," has, ironically, placed the music education profession in a vulnerable position, perhaps more so than in any other such situation in its history. Spatial-temporal reasoning is thought to be foundational for success in higher mathematics, proportional reasoning (such as that used in engineering, structural design, architecture, and so forth), and other activities that require high mental ability (such as chess). These are high-stakes benefits, making others, such as opportunities to socialize and to meet partners, pale by comparison. Will music educators be placed in the position of having to justify music education on this new basis? If so, would they be held accountable to deliver the claimed spatial-temporal improvements? Would they, then, have to alter their curriculum of musical learnings in the direction of learnings most beneficial for developing spatial-temporal abilities? What would such a curriculum look like?



By focusing on musical learning goals as stipulated in the Standards and graciously including a variety of purposes reflecting other interests, the profession can both protect the integrity of its musical responsibilities and comfortably serve a variety of associated values.



All these thoughts stream through my mind as Rauscher talks and as I recall listening to her on other occasions. At just about this point in my ruminations, I hear her say, "But I want to make something clear about the work I'm telling you about. It would be a terrible shame for music education to have to be justified on the basis of the kind of research I do and the kinds of findings I'm reporting." The entire audience bursts into spontaneous, enthusiastic applause. I am stunned by the intensity of feeling being expressed and am deeply moved by the message being given so powerfully—that music educators are devoted to music education and that they passionately and correctly insist that the tail, no matter how much clout it happens to have, must not wag the dog—the musical values and learnings to which they are dedicated.

The Vulnerability of Musical Values

The elation of that moment has passed, and I, along with many other music educators accustomed to being slightly paranoid, have reverted to my doubting ways. Sadly, these doubts have been fueled by an article in the *Arts Education Policy Review*: "Spatial-Temporal versus Language-Analytic Reasoning: The Role of Music Training" by Temple Grandin, Matthew Peterson, and Gordon L. Shaw.¹ This article, I am sorry to report, takes music educators perilously close to, if not over the edge of, the precipice they have long feared. Rauscher's comforting remark at the convention (noticeably absent from her articles) has been replaced (in this article co-authored by her frequent collaborator Gordon Shaw) by the clear, straightforward assertion that music's positive influence on spatial-temporal reasoning should be the purpose for music education.

The article begins with the claim that "recent experiments demonstrate that music can enhance reasoning ... that specific music could enhance how we think, reason, and create."² Notice the assumption embedded in this claim—thinking, reasoning, and creating are mental functions absent in music, but they can be influenced by music. In an interview reported in the *Chicago Tribune*, Gordon Shaw states the following: "We're aware of the emotional impact of music. But we're saying it goes way beyond that. It has an effect on the reasoning and thinking part of the brain too."³

This assumption that music deals with emotion, which is separate and different from reasoning and thinking, is the legacy of the philosopher and mathematician René Descartes (1596–1650), whose enormously influential argument stated that mathematical thinking, conceived as being separate from involvement of the body and its unreliable senses and emotions, is the model for reasoning and for achieving pure intellect, which is reliable to the extent that it is abstract, free from the body and its emotions. This dualism separating mind and body has pervaded Western beliefs and education. It has led to the assump-

tion that there are “intellectual” or “cognitive” subjects such as math, science, and languages that require intelligence and are therefore “basic” and that other subjects such as the arts, being rooted in the bodily senses and attendant emotions, are decidedly not “intellectual” or “cognitive,” do not require intelligence, and are therefore not to be considered “basic.” Spatial-temporal reasoning is a foundational component for certain of these “basic” subjects. If particular kinds of music and particular kinds of musical training improve such reasoning, then the case can be made that music should be included in education because of its positive effects on math, science, and other such learning, rather than because of its own worth.

Over time, Descartes’s ideas have been seriously questioned and in recent years have been directly contradicted. For example, in his book *Descartes’ Error: Emotion, Reason, and the Human Brain*, neurologist Antonio Damasio asserts, “Contrary to traditional scientific opinion, feelings are just as cognitive as other percepts.”⁴ We have learned through recent scholarship that reasoning, thinking, creating, and “being cognitive” are not only deeply and necessarily pervaded with feeling, but that different domains of human endeavor require distinctive modes of reasoning, thinking, and creating—that these cognitive operations are manifested in domain-specific ways.⁵ We are now beginning to understand that there is not a singular way to demonstrate intelligence but many ways in which humans are intelligent. Similarly, there is not a singular manifestation of creativity but many diverse ways of exhibiting it. Also, intelligence and creativity do not transfer automatically or readily from one area of knowledge to another: transfer is an arduous, uncertain task. Musical involvements *require* reasoning, thinking, creating, and cognizing—they require intelligences of the sort that various musical roles distinctively and characteristically enable humans to exhibit.

In the Grandin article, the authors report on several experiments designed to explore whether the pattern-recognition abilities necessary for musical



We have learned that musical doing, thinking, and feeling are essential ways in which humans make contact with, internalize, express, critique, and influence their cultural contexts.



processing would enhance these abilities for spatial-temporal reasoning. They explain why they chose the music of Mozart for the experiments: “We expected that Mozart ... was exploiting the inherent repertoire of spatial-temporal firing patterns in the cortex in the ultimate manner. The particular sonata [K. 448] was carefully selected for its incredible use of the features of symmetry and natural sequences of patterns.”⁶ They report that a “causal link” was found between this music and spatial-temporal reasoning. Other kinds of music did not produce significant effects on spatial-temporal reasoning, but “future EEG [electroencephalograph] experiments might help predict which among different types of music would also produce the Mozart effect.”⁷ Private keyboard lessons produced highly significant improvement in a puzzle assembly task, but “no significant improvement was found on tests of spatial-recognition reasoning (such as matching, classifying, and recognizing similarities among objects).”⁸ Astonishingly, this finding is completely ignored in the subsequent discussion.

The research studies reported in the Grandin article, and other studies

related to them, require careful, exacting analysis because they raise a host of questions about their validity and credibility. Here, I want to deal with the conclusion that the article presents and its implications for music education. The article ends as follows:

We strongly suggest that music education be present in our schools, preferably starting in preschool, to develop “hardware” for ST [spatial-temporal] reasoning in the child’s brain. The absolutely crucial (but now neglected) role of spatial-temporal reasoning in learning different math and science concepts must be explored and exploited.⁹

I am going to take this conclusion directly and fully at its word. It says quite clearly that since spatial-temporal reasoning is crucial for math and science learning and since music has a positive effect on such reasoning, music education should be present in schools for the purpose of developing spatial-temporal “hardware” in students’ brains. This perspective gives clear direction as to what an appropriate, relevant, valid, and successful program of musical studies should cover. To the degree that such a program enhances spatial-temporal reasoning, it will have both fulfilled the purpose of music education and have established its value in our schools.

Music educators are given an excellent opportunity here to explore the consequences of this popularly compelling and widely publicized rationale for music education, which is based on a distinctly different purpose than the development of people’s abilities to gain significant, fulfilling experiences from music. The spatial-temporal rationale for music education is not simply another happy effect that happens to occur from a curriculum focused on musical learning. The argument based on the “Mozart effect” proposes that spatial-temporal reasoning development should be the point and purpose of music teaching in the schools. What, exactly, would this mean for music education?

The Implications

I want to suggest that the music education profession in the United

States now has a practical and pertinent basis for answering the question of how the spatial-temporal rationale would alter music programs devoted to musical learning—the National Standards for Music Education.¹⁰ To a very high degree, music educators have agreed that the nine content areas in the Standards should be the basis for all curricula in music, balanced to reflect various program emphases but with due attention to all of them. The profession has generally agreed that these nine content areas represent the fundamental ways in which music should be encountered and understood if it is to be incorporated into people's lives as comprehensively and meaningfully as possible. These areas constitute the knowledge base necessary for optimal musical experiencing.

Let's examine the Standards, reshaping them to fulfill the objective of music education as the spatial-temporal rationale conceives it.

The first two, dealing with singing and performing on instruments, are given clear direction from a spatial-temporal perspective. In one of the experiments, singing instruction was used as one of the controls, and it produced no improvements in spatial-temporal reasoning. This was disconcertingly camouflaged in the article in the observation: "There were three control groups of children, including a group receiving computer lessons.... The control groups did not improve significantly in any of the tests."¹¹ To the degree that this finding holds up in subsequent studies, singing could be safely eliminated from the music program. It would simply be irrelevant to spatial-temporal learning. If further research reverses this finding, we could reconsider it, but it is likely that a choice will have to be made between singing and performing on instruments, depending on which produces the stronger spatial-temporal effect.

As to performing on instruments, piano keyboard instruction, while producing mixed results as reported above, should be included because it does seem to affect spatial-temporal reasoning, at least as measured by puzzle manipulation. The piano instruction was in private lessons, so the "in

groups" part of the standard ("alone and with others") is of doubtful utility and might have to be eliminated. And we are not at all certain about what, exactly, the children did that caused the one positive finding.¹² We know that the key elements related to spatial-temporal reasoning are "symmetry" and "natural sequences of patterns." Apparently Mozart's music from the Western classical period (roughly 1750–1820) demonstrates this inherent "naturalness." This implies that music from different periods and from other world cultures represents "unnatural" symmetries and sequences of patterns. So we would need to devise a regimen of symmetrical, sequentially patterned material in Western classical style, which would be the basis for instruction. If future experiments did uncover other types of musical materials that would also produce the desired effect, then we could add them. The "varied repertoire of music" clause in the Standards clearly must be dropped because our program would include only those musical styles and types discovered to cause spatial-temporal improvement.



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The question of which musical instruments to include is raised by the keyboard finding. It is likely that the spatial arrangement of keyboards is influential in effecting the results we seek. We would have to replicate the

experiments to discover which other instruments, if any, produce similar improvements. We could then include instruction in any that produced the desired results. Further, it is not at all clear that musically expressive playing, as determined by each style of music being studied, has anything whatsoever to do with spatial-temporal reasoning. Nothing in the spatial-temporal research bears on this. Considering the enormous amount of time and effort that performance instruction spends on appropriate creative interpretation, including elements such as phrasing, balance, blend, dynamics, articulation, rhythmic fluency, melodic nuance, and so forth, we would be well served to eliminate as much of this as possible because most or all of it is likely to be irrelevant to the improvement of spatial-temporal reasoning.

Standard 3, dealing with improvisation, and Standard 4, dealing with composition, require experimental verification that they, in fact, improve spatial-temporal reasoning. At the moment, we know nothing about their efficacy for this purpose. Because they deal with musical materials in significantly different ways than performing composed music, students involved in improvising and composing are likely to demonstrate significantly different results on spatial-temporal reasoning measures. Computer composition is unlikely to be beneficial, given the negative results of the computer control group. It is possible that improvising on the keyboard with symmetrical patterns would be useful, but it is unlikely that composing at a keyboard will be fruitful for the purpose being pursued. For the moment, in the absence of evidence, it would be safe to hold improvisation and composition instruction in abeyance, awaiting research demonstrating that the musical intelligence and creativity that they call upon have significant effects on spatial-temporal functioning, as required for improved math and science learning.

Standard 5, dealing with reading and notating music, serves as an interesting case. Staff notation used for composing and performing Western music is highly spatial in orientation, including both vertical and horizontal

spatial dimensions. Perhaps this accounted for at least some of the (partial) gains obtained. If so, we would need to intensify notation study, devising a variety of exercises exploiting the spatial framework in which staff notation operates. It may well be the case that notated, symmetrical, classical-style (“natural”) pattern exercises, played on the piano keyboard, will be the key to the result being sought, producing the optimal spatial-temporal benefits from music education. Such exercises, indeed, may well prove to be more efficacious than Mozart’s music itself, given the many nonsymmetrical, nonpatternlike aspects of his music, especially in his more expansive works such as the *Requiem Mass* and the operas, not to mention his later symphonies and chamber works. It is likely that we can eliminate all the nonessential musical material by depending on exercises based on the patterns and symmetries in the particular piano sonata that was used in this research as the stimulus, rather than actual pieces of music, thereby maximizing the desired effect on spatial-temporal reasoning.

This effect can be enhanced by Standard 6, which deals with listening to music. “Persistence of the EEG coherence patterns after listening to the Mozart sonata was observed for over twelve minutes.”¹³ Notice that this positive effect was produced with no musical instruction; subjects simply listened. Instruction about music for listening would perhaps be effective for spatial-temporal purposes if it were closely linked to playing and using notation as discussed above, but any other kind of listening-focused involvements, such as composing, improvising, analyzing, describing, and learning material for Standards 7, 8, and 9, (to be discussed shortly) would be highly questionable if not completely irrelevant.

In the *Chicago Tribune* interview to which I referred previously, Shaw was asked, “Have your findings changed your listening habits?” He replied, “Surely. I listen to a lot more Mozart.”¹⁴ He did not reply that he spent more time analyzing and describing Mozart’s music or learning more about Mozart’s life, the histori-

cal-cultural milieu from which he came, the musical heritage he built upon, the aesthetic posture he both adopted and expanded, his influences on music of his time and afterwards, the growth he exhibited as a musician and the inner and outer forces influential on it, or any other learning that is likely to provide the human context within which Mozart’s music takes on dimensions of meaning that an intelligent listener both brings to and gains from the creative act of listening.



The spatial-temporal argument for the value of music study is perhaps the most extreme that the music education profession has ever faced.



All that one needs to do to gain the desired effects, apparently, is listen. So, if we provided schools with a set of the appropriate recordings and asked that they be played at all possible times (especially immediately preceding math and science instruction), we would have fulfilled our obligation and would be relieved of any duties other than those requiring the playing/notation instruction so far discussed.

Standard 7 (having to do with evaluating music and music performance), Standard 8 (developing understandings about relationships between music, other arts, and other disciplines), and Standard 9 (understanding music in relation to history and culture) are all based on “language-

analytic” reasoning. This kind of reasoning, according to Grandin, Peterson, and Shaw, is less desirable than spatial-temporal reasoning for learning math and proportional thinking; therefore, we cannot afford to waste precious time on it. Music educators are relieved of having to both learn such material themselves and teach it to their students, simplifying their work and their lives immensely. The new spatial-temporal reasoning justification would leave music educators with little to do as compared to the many challenges of the National Standards. But music educators would have the satisfaction of knowing that their radically redefined profession would be finally contributing to something “really useful,” as compared to the trivial goal to which they have long been dedicated—enhancing musical experiences through more highly developed musical intelligences.

Reconciling Musical and Other Purposes

The spatial-temporal argument for the value of music study is perhaps the most extreme that the music education profession has ever faced. My analysis of this argument’s logical consequences responds directly to its challenge. This forthright response is necessary, given the enormous promotion that the “Mozart effect” has received and its imminent potential to force music education over the line that separates its devotion to musical learning, which the National Standards exemplify, and associated learning, which, rather than being comfortably assimilated within the Standards, becomes a replacement for them. It is very tempting for music educators, constantly in the position of having to justify the need for their subject in the schools, to regard a rationale such as improved spatial-temporal reasoning as a gift handed to them on a silver platter. But such a gift, as I have tried to demonstrate, is intended to serve only the purpose of the giver, not the receiver. There will be potentially destructive effects if the gift is accepted without a thorough examination of the consequences of accepting it.¹⁵

How can this unexpected, widely acclaimed benefit of music study be

accepted without having it overwhelm musical values? Since the days of the singing school, the music education profession has managed to protect the primary purpose of music study from undue dominance by associated purposes. I would suggest that it can continue to achieve a proper balance through the following two responses.

First of all, music educators must not be rigid about their primary purpose of helping students better create and share the meanings and feelings that only music provides; they need not fear that this purpose is in danger of breaking apart when other interests are also accommodated. A purist, formalistic stance is not possible or desirable in the complex world in which music and music education exist. Music educators can recognize and even call attention to the many diverse benefits that music study offers without giving the impression, by their arguments or educational practices, that such benefits should ever threaten to replace their fundamental mission. By focusing on musical learning goals as stipulated in the Standards and graciously including a variety of purposes reflecting other interests, the profession can both protect the integrity of its musical responsibilities and comfortably serve a variety of associated values.

The key factor in maintaining an acceptable balance is the degree to which the program of musical learning is altered in order to serve other purposes, as my scenario in regard to the Standards in service of spatial-temporal reasoning illustrates. This kind of dangerous capitulation to other demands can best be deflected by agreeing that music study, such as we music education professionals are obliged to offer, can indeed make such contributions. We are happy that it has such positive effects, and as we go about fulfilling our musical teaching responsibilities, we will be sensitive to and supportive of all the many positive ways in which music study and experience can enhance people's lives.

Second, music educators must continue to learn about, apply, and conscientiously promote the benefits of involvements that are particular to music. As mentioned previously, work

in cognitive science has clarified the fact that human knowing and intelligence are multifaceted and that various musical involvements provide opportunities to operate at the highest levels of cognition that humans are capable of—to understand, to create, and to share meanings as only music allows people to do and to exercise the intelligence particular to and dependent on each musical role. We have learned that musical doing, thinking, and feeling are essential ways in which humans make contact with, internalize, express, critique, and influence their cultural contexts. We know that musical teachings such as those that the Standards delineate are necessary if humans are to fully benefit from the opportunities and challenges their innate human capacities and their culture afford them. Such realizations deepen and strengthen the basis for musical learning as an essential component of education more securely, more convincingly, and more realistically than any others. Our expanding understandings of human knowledge, emotion, expression, and intelligence have solidified the essentiality of music to the human condition. The dog is very healthy. The obligation of the music education profession remains now, as in the past, to keep it so and to be pleased that it wags its tail, as well.

Notes

1. Temple Grandin, Matthew Peterson, and Gordon L. Shaw, "Spatial-Temporal versus Language-Analytic Reasoning: The Role of Music Training," *Arts Education Policy Review* 99, no. 6 (July/August 1998): 11–14.

2. Ibid., 11.

3. Ronald Kotulak, "Q & A with Gordon L. Shaw," *Chicago Tribune*, May 24, 1998, sec. 2, p. 1.

4. Antonio Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: G. P. Putnam & Sons, 1994), xv.

5. The most influential argument of the domain specificity of intelligence is Howard Gardner, *Frames of Mind: A Theory of Multiple Intelligences* (New York: Basic Books, 1983).

6. Grandin, Peterson, and Shaw, "Spatial-Temporal versus Language-Analytic Reasoning," 12.

7. Ibid., 12.

8. Ibid., 13.

9. Ibid., 13.

10. MENC, *National Standards for Arts Education* (Reston, VA: MENC, 1994).

11. Frances H. Rauscher et al., "Music Training Causes Long-Term Enhancement of Preschool Children's Reasoning," *Neurological Research* 19, no. 2 (1997): 3.

12. Ibid. The piano lessons were "traditional," including "pitch intervals, fine motor coordination, fingering techniques, sight-reading, music notation, and playing from memory."

13. Grandin, Peterson, and Shaw, "Spatial-Temporal versus Language-Analytic Reasoning," 12.

14. Kotulak, "Q & A with Gordon L. Shaw," 3.

15. For a parallel discussion of threats to arts education from claims of effects on improved performance in the "academic" subjects, see Elliott Eisner, "Does Experience in the Arts Boost Academic Achievement?" *Art Education* 51, no. 1 (January 1998): 32–38. ■

Call for Nominees

The "Grand Masters" series welcomes suggestions for featured writers. If you have a nominee who you feel should be recognized by this series, please contact Mark Fonder, Music Education Department, School of Music, Ithaca College, Ithaca, NY 14850. E-mail: fonder@ithaca.edu. Nominees need to have a distinguished record in publication, leadership, and teaching in the music or music education field.