Music and Music Technology in College Teaching: Classical to Hip Hop across the Curriculum

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How can music technology be used to improve learning in college courses? To answer this question, a review of (a) the theoretical and research evidence on music and the brain and (b) the effects of music on learning is presented. Those reviews revealed a glaring scarcity of solid evidence on the effectiveness of music clips. However, despite this lack of evidence, potentially, music and the related technology provide a best fit to the characteristics of this *Net Generation* of students and a valid approach to tap their multiple intelligences and learning styles. Concrete guidelines are given for using available music technology in the classroom, selecting appropriate music clips for any class, and applying those clips as a systematic teaching tool. The use of clips can also attain 20 specific learning outcomes. Toward that end, 12 generic techniques with examples to integrate music technology into teaching across the college curriculum were described.

Keywords: music**,** music technology**,** music and learning, music and the brain, multiple intelligence theory, Net Generation, Mozart effect, technology in the classroom, theatrical techniques

INTRODUCTION

Using music in teaching is not new. What is new are offshoots of the burgeoning technology. They are manifested in four areas: (a) the variety of music types, (b) the ease with which the technology can facilitate their application in the classroom, (c) the use of music as a teaching tool in nonmusic courses across the college curriculum, and (d) the number of music techniques an instructor can implement to improve learning. An iPod, MP3 player, or PC/Mac with a portable speaker system reproduces music easily and with amazingly high quality.

This article examines what we know and don't know about music technology and learning. Detailed reviews of the theory and research on music and the brain and the extensive literature on the effects of music on learning over the past three decades are

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presented. These reviews provide the springboard for attaining specific learning outcomes and suggesting a dozen generic techniques to integrate music clips into teaching across the college curriculum. The article focuses on four areas: (a) why use music in teaching? (b) technology tools in the classroom, (c) selecting appropriate music, and (d) 12 generic techniques for using music technology in teaching.

WHY USE MUSIC IN TEACHING?

When you watch a TV program or movie, your feelings and emotions, such as excitement, anger, laughter, relaxation, love, whimsy, or even boredom, are often triggered or heightened by the music playing behind the action. You are responding to the mood created by the music and the scene. The music has a strong effect on how you react. The soundtrack is so powerful that you may download it off the Internet or order the CD from Amazon so you can listen again and relive the experience. This attraction to soundtracks extends to Broadway musicals and classical, jazz, rhythm and blues, rock, pop, and new age music concerts as well. So how can faculty in all courses use music as an instructional tool so students will want a CD soundtrack of their classes?

LEARNING OUTCOMES

The entertainment value of music has been demonstrated. The key question here is: What is the learning value of music in the classroom? Here are 20 potential outcomes to ponder:
1. Grab students' attention;
2. Focus students' concentration;
3. Generate interest in class;
4. Create a sense of anticipation;
5. Establish a positive atmosphere/environment;
6. Energize or relax students for learning exercise;
7. Draw on students' imagination;
8. Build rapport among students;
9. Improve attitudes toward content and learning;
10. Build a connection with other students and instructor;
11. Increase memory of content;
12. Facilitate the completion of monotonous, repetitive tasks;
13. Increase understanding;
14. Foster creativity;
15. Improve performance on tests and other measures;
16. Inspire and motivate students;
17. Make learning fun;
18. Augment celebration of successes;
19. Set an appropriate mood or tone; and
20. Decrease anxiety and tension on scary topics.

After you have finished pondering, consider the theoretical and research evidence related to these outcomes, which is reviewed and critiqued in the following two sections: (a) music and the brain, and (b) the effects of music on learning. This evidence furnishes the foundation for how music can be used as an effective teaching tool and, more important, its potential as a legitimate, systematic teaching method for college instructors.

MUSIC AND THE BRAIN

There are hundreds of volumes on the topic of the brain, especially the ones that begin with *This Is Your Brain on…* Specifically, the primary interest here is only on how music is processed in students' brains to facilitate learning. This review covers: (1) core intelligences of musical/rhythmic and emotional, (2) left and right hemispheres, (3) triune brain, (4) brain wave frequencies, and (5) music-brain conclusions.

Core intelligences. Among Gardner's (Gardner, 1983, 1993, 1999, 2005; Gardner & Hatch, 1989; Marks-Tarlow, 1995; Williams, Blythe, White, Li, Sternberg, & Gardner, 1996) 8.5 multiple intelligences, musical/rhythmic is one of the core intelligences in every student's brain. It involves appreciating and recognizing music, composing, keeping time, performing, recognizing rhythm, and singing. It is just part of that unique profile of strong and weak intelligences that every student possesses. Neuroscience research has confirmed the physical difference in the neuronal networks of each student's brain (Zull, 2002). Instructors can only work with what each student brings to the classroom.

This "pluralistic view of the mind" permits faculty to think of exposing their students to a wide range of learning strategies. Drawing on from four to six intelligences allows virtually every student to use their strength intelligences as well as to strengthen their weaker ones. Music should be one of those six.

Goleman's (1998) emotional intelligence is also tied to music. (*Note*: Gardner's intrapersonal and interpersonal intelligences are similar to Goleman's emotional intelligence.) Music elicits emotional reactions of liking or disliking and excitement or arousal (North & Hargreaves, 1997; Robazza, Macaluso, & D'Urso, 1994). It can be used to communicate with learners at a deeper level of understanding by touching their emotions.

Left and right hemispheres. There are separate hemispheres of the brain that relate to two ways of thinking: verbal and nonverbal (Gazzaniga, 1992; Sperry, 1973). The left hemisphere is predominately the logical and analytical side that processes information sequentially as in mathematics, logic, and language. It is also the verbal side that is structured, factual, controlled, rational, organized, planned, and objective (Miller, 1997). In contrast, the right hemisphere is the nonverbal, creative side which is spontaneous, emotional, disorganized, experimental, empathetic, subjective, intuitive, and seeking relationships. It focuses on art, color, pictures, and music (Jourdain, 1997; Polk & Kertesz, 1993).

The best news is that music taps both hemispheres. The left side processes rhythm and lyrics; the right side listens for melodies, sounds, and harmonic relationships over time (Bever & Chiarello, 1974; Hébert & Peretz, 1997; Schlaug, Jancke, Haung, Staiger, & Steinmetz, 1995). As children study music, the connections between the two hemispheres increase as they age (Schlaug et al., 1995). Clearly, music can be an effective tool for engaging both hemispheres.

Triune brain. A cross section of the brain would reveal that it has three layers: (1) the stem or *reptilian* brain (5%), which performs basic tasks, such as breathing, pulse, and heart rate, determines the nature of sound–its direction, volume, and potential threat, (2) the inner layer or *limbic* brain (10%), which is the center of our emotions, reacts to music with appropriate emotions and long-term memory, and (3) the outer layer wrapper "bark" called the *neocortex* or cerebral cortex brain (85%), which controls hearing, vision, language, and higher-level functioning and responds to music intellectually (MacLean, 1990). The latter "thinking brain" absorbs the sounds of the reptilian brain and feelings of the limbic system and organizes them into music. This triune concept facilitates our understanding and creation of music.

Brain wave frequencies. Another aspect of brain functioning is brain wave frequencies. Among the four types of waves—Delta, Theta, Alpha, and Beta—that relate to various levels of consciousness, the Alpha and Beta waves have particular implications for music. Delta deep sleep or Theta shallow sleep, deep contemplation and free-flowing creativity may be characteristic of students in classes where the instructor just lectures. Alpha waves occur when students are in a relaxed state of awareness, such as after they wake up in class. The right hemisphere is primarily engaged in Alpha when they're reading, studying, or reflecting. The emotions are dominant and the left hemisphere's rationality drops out of sight temporarily. Slow, minor-key produces Alpha waves. It relaxes the brain, which can be useful when reviewing content so it passes into long-term memory (Millbower, 2000).

Beta waves are the patterns of a fully awake mind, when the left hemisphere kicks into action. This is multitasking mode for the *Net Generation* of students. They are functioning at optimum speed. Fast, up-tempo, major-key music can snap students to attention who are in a drifting Alpha or meditative Theta state. They are now super-alert, ready for whatever activities the instructor has planned (Millbower, 2000).

Music-brain conclusions. The value of music as a teaching tool lies in its potential to do the following: (1) tap the core intelligences of musical/rhythmic and emotional (interpersonal and intrapersonal), (2) engage both the left and right hemispheres, (3) appeal to the reptilian, limbic, and neocortex layers of the brain to sense the nature of sounds, react to music emotionally, and appreciate it intellectually, and (4) manipulate students' Alpha and Beta brain waves to relax or alert them for learning when they're not sleeping in Delta or Theta waveland. It would be a shame not to stir up these intelligences, hemispheres, layers, and waves in the classroom to promote learning. For an opposing perspective on the inadequacy of the preceding cognitive neuroscience findings and their implications for educational practice, see Waterhouse's (2006a, 2006b) critical review of the evidence.

EFFECTS OF MUSIC ON LEARNING

Beyond what is known about how our brain functions, what research has been conducted specifically to determine whether music has any positive effect on learning, especially with regard to the outcomes listed at the beginning of this article? This section reviews the evidence on the following: (1) *Sesame Street*, (2) "Mozart Effect" or not, (3) "active" and "passive" concerts, and (4) music and learning by subject area.

Sesame Street. The Emmy-award winning *Sesame Street* is the most effective educational children's program in history. For nearly 40 years and more than 4100 episodes broadcast in 120 countries, *Sesame Street* has used music almost nonstop throughout the programs with live people, muppets, animation, video clips with people and animals, and even in the extremely popular "Elmo's World" segment. It is a key tool for teaching children basic academic and life skills. The lyrics are chock full of content to help kids remember numbers, arithmetic, geometric forms, letters, words, cognitive processes, and classification. Catchy melody, upbeat tempos excite children and keep their attention, while slipping the content into long-term memory. Researchers found that when the music and action was stopped, such as on Sesame Street during dialogue between adults, the children stopped watching (Fisch & Truglio, 2001).

This music-action formula to learning deserves serious consideration by all faculty. It is especially apropos for this *Net Generation* of students. They have minimal patience with course requirements and a limited attention span (Berk, 2008a, 2008b). They want everything "now." These behaviors, however, are by choice. They can spend hours playing video games or other activities in which they are interested (Prensky, 2006); they

just find most courses boring. Nearly 50% of college freshman reported they are "frequently bored in class" (Pryor, Hurtado, Saenz, Korn, Santos, & Korn, 2006). Unless the content is on their radar screen, it's likely to be rated "boring."

Instructors could create adult student versions of *Sesame Street* in their live face-to-face classrooms. The application of music technology will be a start to break the mold of traditional teaching practices. (*Note*: Instructors at not-for-profit teaching institutions are permitted to use music in their classrooms under the "Fair Use" doctrine of the U. S. Copyright Law. However, online use would violate the law.)

"Mozart Effect"or not. There have been several studies on the effects of listening to instrumental music on spatial-temporal reasoning. Couched within the context of neurophysiological theory (Leng & Shaw, 1991), the first study by Rauscher, Shaw, and Ky (1993) found that listening to music and executing spatial tasks share neural pathways in the brain's cortex. The music serves to prime or warm-up these neural transmitters for the subsequent execution of spatial reasoning tasks. This finding was referred to as the "Mozart Effect." College students listening to the first movement of Mozart's "Sonata for Two Pianos" (K. 448) had a significant, but short-lived (10–15 minutes), improvement in spatial reasoning. This study was followed by another one by the same researchers (Rauscher, Shaw, & Ky, 1995) that produced similar results.

Rauscher, Shaw, Levine, Wright, Dennis, and Newcomb (1997) then investigated preschoolers who studied piano. They found that those children performed significantly better in spatial and temporal reasoning ability than those who spent the same amount of time learning to use computers. This work was extended by Graziano, Peterson, and Shaw (1999) with 237 second-graders who had both piano keyboard training and innovative math software. Those children scored significantly higher on proportional math and fractions than the piano-less control. These results suggest that the spatial-temporal approach can be generalized to teach other math and science concepts.

Three other investigations by Rideout and Laubach (1996), Rideout and Taylor (1997), and Sarnthein, Stein, Rappelsberger, Petsche, Rauscher, and Shaw (1997) confirmed the Mozart effect findings. The second study replicated the original Rauscher et al. (1993) study using two different spatial reasoning tasks. The other two were EEG coherence studies which found that the presence of right frontal and left temporo-parietal activity induced by listening to Mozart carried over into two spatial-temporal tasks.

Others have attempted to replicate the effect with musical pieces from Yanni, whose music has similar properties to Mozart, minimalist music by Philip Glass, the dance group Aqua, and pieces by Albinoni and Schubert. To date, however, there is no published research on the effect using any non-classical musical selections. The most recent two-part study of the Mozart effect used both Mozart and a slow piece by Albinoni (Schellenberg, Nakata, Hunter, & Tamoto, 2007). This research found that Canadian undergraduates performed better on the Symbol Search subtest after listening to up-tempo Mozart compared to slow Albinoni, and Japanese five-year olds produced drawings that were more creative, energetic, and technically proficient after singing or hearing familiar children's songs than after hearing Mozart or Albinoni.

Despite many of the above results in support of the Mozart effect, another series of studies by Stough, Kerkin, Bates, and Mangan (1994), Kenealy and Monseth (1994), Newman, Rosenbach, Burns, Latimer, Matocha, and Vogt (1995), and McKelvie and Low (2002) found no Mozart effect. The first three studies concluded that a brief listening to classical music does not enhance the spatial problem-solving of college students; the last cited study found no effect for children with an average age of 12. In fact, it has been difficult to reproduce the effect experimentally (Rauscher & Hinton, 2006; Steele, Ball, & Runk, 1997; Steele, Bass, & Crook, 1999). No other researchers have been able to replicate the effect in a rigorous control-group study. Further, other

researchers have argued that the spatial intelligence increase is nothing more than a shift in the participants' arousal (Steele, 2000; Thompson, Schellenberg, & Husain, 2001) or their preference for the music (Nantais & Schellenberg, 1999).

In order to make sense out of all of this confusion over whether a definitive Mozart effect exists, Chabris (1999) conducted a meta-analysis of 16 studies on the effect based on 714 subjects. He found a trivial increase of 1.4 general IQ points for all studies and 2.1 for those that only used spatial intelligence, compared to Rauscher et al's. (1993) first study which produced an increase of 8–9 points in spatial intelligence. Hetland (2000) then reviewed every Mozart study to date with a combined total of 1014 subjects. She concluded that Mozart listeners outperformed the comparison groups more often than would be expected by chance, but with small effects, which could be attributed to gender, ethnicity, musical preference, training, and spatial ability. Most recently, Waterhouse (2006a, 2006b) argued that the use of music in instruction should not be based on the inadequate empirical support from the Mozart effect studies.

Overall, the research reviews and the bulk of evidence from the foregoing studies attempting to search for a Mozart effect to boost spatial intelligence indicate *trivial, nonsignificant, and nonreplicable findings* compared to Rauscher et al's. original study 15 years ago. What's even more discouraging is the quality of research being conducted. Most of the investigations cited previously by Rauscher, Rideout, and Steele lack an independent control group, which precludes a comparison of scores between listening to Mozart and attempting spatial problems, measured only by the Stanford-Binet spatial subtest. Further, many of the sample sizes were inadequate and no demographic descriptors of the children or college student participants in the research were provided, which could be correlates or explanations of IQ score increases.

"Active" and "passive" concerts. In the 1960s, Lozanov, a Bulgarian psychiatrist, explored techniques to use music to increase learning and memory. The theories, research, and strategies he developed emerged into what is now known as "Accelerated Learning" (Lozanov, 1978). The use of background music lies at the foundation of his techniques. Lozanov created two methods that were very different, but equally effective, learning environments called concerts: active and passive.

An *active concert* activates the learning process mentally, physically, and/or emotionally by playing an up-tempo piece of music and reading or reciting language phrases in time with the music. This has been found to produce high memory retention. An active concert during movement activities can increase productivity, energize students, grab students' attention, and make learning fun.

A *passive concert* involves slower, Baroque-type music to relax the students' Alpha brain wave state and stabilize the students' mental, physical, and/or emotional rhythms to increase information absorption. Students enter into a relaxed state of awareness, opening their minds to incoming information. The music helps them maintain focus and concentration. By tapping into the pleasant emotions of the limbic system, information passes into long-term memory. Lozanov found that students could learn language skills at least four times faster via this approach compared with traditional methods; hence, the term "accelerated learning." Brewer (1995) has recommended that background "passive" music can be played while students study, read, or write to increase attention levels, improve retention and memory, extend focused learning time, and expand thinking skills. This music can also be effective during reviews and tests.

Lozanov's techniques also included other ways to promote a positive learning environment, such as playing music as students enter and leave the classroom for a break, during a three-hour class or workshop, and during break times. That music can set the tone or mood for the class (Sousou, 1997; Stratton & Zalanowski, 1994).

Music and learning by subject area. Since Lozanov's work, there has been a growing number of studies related to using music across the curriculum K–college to increase learning. Based on Lozanov's research, several studies have examined the effects of background music on writing tasks (Hallam & Godwin, 2000), behavior and mathematics performance (Hallam & Price, 1998), reading (Brown, 1986), memory and reading comprehension (Furnham & Bradley, 1997; Mullikin & Henk, 1985), and science (Davidson & Powell, 1986).

Others have explored how music affects reading and mathematics performance (Gardiner, Fox, Jeffrey, & Knowles, 1996), mathematics skills (Graziano et al., 1999; Vaughn, 2000), reading and verbal skills (Douglas & Willatts,1994; Ho, Cheung, & Chan, 2003; Lamb & Gregory, 1993), reading speed (Miller & Schyb, 1989), spelling and phonological skills (Overy, 2003), and creativity (Adaman & Blaney, 1995; Mohanty & Hejmadi, 1992). Butzlaff (2000) conducted a meta-analysis of 24 studies of music and reading and concluded that a strong association exists between music and performance on reading/verbal tests.

To date, there is a scarcity of research in all subjects, especially at the middle-, high-school, and college levels. The evidence accumulated at the preschool and elementary school grades suggests that music used as a systematic teaching tool can have a positive effect on learning reading and mathematics. Further controlled, well-executed studies with adequate sample sizes are still necessary to confirm that "suggestion" and furnish a body of evidence at the college level to justify the pedagogical value of music in a variety of courses.

TECHNOLOGY TOOLS IN THE CLASSROOM

Our culture has been flooded with the burgeoning technology. It is almost impossible to keep up with all of the amazing products that keep hitting the streets. Among all of the tools currently available, which ones do students use and which ones have potential for classroom use? The answers to those questions are examined in the following two sections: (1) tools of the trade for students, and (2) tools for the classroom.

TOOLS OF THE TRADE FOR STUDENTS

Today's *Net Generation* of students is so sophisticated with technology that they have been branded as *digital natives* (Prensky, 2001, 2006). "Digital" is their native language. They are "native speakers" of the language of computers, video games, and the Internet. As you observe these students, you will notice wires coming out of every part of their body. Attached to those wires are MP3 players, iPods, iPhones or smart phones, PCs, and all the other tools of the digital age (Berk, 2008a; McGee & Diaz, 2007).

That brings us to our first multiple-choice question:
What are they doing with all of this equipment?
1. Listening to music.
2. Playing PC/video games.
3. Talking on iPhone.
4. Sending e-mails or text messages (TMs).
5. Watching videos and/or TV.
6. Multitasking on at least 3 of the above.
7. Multitasking on all of the above.

Recent estimates indicate these students spend from 6.5 to 11 hours per day multitasking on the above activities (Salaway, Katz, Caruso, Kvavik, & Nelson, 2006). They live in a complicated remixed, mashed-up, digital, mobile, always-on media

environment (Jenkins, 2006; Oblinger & Oblinger, 2006; Tapscott, 1998). The students function at "twitch speed," thanks to their exposure to video games and MTV. They listen to music on their PCs, Macs, iPods, Zunes, Zens, iPhones, RAZRs, and Blackberrys. Their experience with the technology has enabled them to master complex tasks and make decisions rapidly (Prensky, 2006). Classroom exercises need to extend these capabilities they already possess.

TOOLS FOR THE CLASSROOM

This topic is almost a no-brainer given what students can do with the technology. For small group or class-size activities, music can be played on a CD player or boom box or PC with portable speakers, or an iPod or MP3 player can be inserted into a speaker system. On a more sophisticated level, music clips can be inserted into PowerPoint® slides on a PC or Mac with audio output from the sound system in the room. There are a variety of configurations. If a teacher runs into difficulty, his or her students will be able to assist and find a way to play the music.

SELECTING APPROPRIATE MUSIC

Choosing music for classroom use involves several issues. This section provides guidelines for faculty in the following forms: (1) criteria for selection, (2) types of music, and (3) sources for selecting music. After this section, it will finally be time to consider 12 techniques for integrating music into teaching.

CRITERIA FOR.SELECTION

The lyrics of some of the pop music to which college students are listening, especially hip-hop and rap, are out of control in terms of inappropriate language and offensive content. If music is going to be used as a teaching tool, criteria must be established for what is appropriate and acceptable music in a teaching-learning context. Each instructor should set his or her own standards for music, just as standards may have already been set for other types of classroom behaviors, such as offensive humor (Berk, 2002, 2003), inappropriate or disparaging comments, and issues of civility (Forni, 2002).

There are two sets of criteria that must be considered: (1) the students' characteristics, and (2) the offensiveness of the lyrics. The first set of criteria relate to salient socio-demographic characteristics: age or grade level, gender, ethnicity, and language-dominance. Instructors know their students and these characteristics are a *must* consideration in choosing the right music. The second set of criteria concerns the possible offensiveness of the lyrics: profanity; obscenity; put-downs or ridicule of females, racial and ethnic groups, professions, politicians, and celebrities; and other offensive content.

Clear standards for "acceptable" music should be delineated. The music is being used to facilitate learning, not impede it. A student who is offended by a music clip will withdraw, turn off, and harbor anger, which are emotions hardly appropriate for learning. What is interpreted as offensive is a very personal decision by each student based on his or her own values, beliefs, and principles. The instructor should make every effort to reject any lyrics that are even borderline or potentially offensive. The pool of available music is so large that picking the right stuff should not be a problem. If it is a problem, the instructor should seek counsel from colleagues who would be sensitive to such issues.

TYPES OF MUSIC

There are a variety of music types that can be used in the classroom. The actual choice will depend on the characteristics of the students and their interests. The sources identified in the next section will suggest methods to obtain that information. In the mean time, here is a shopping list to keep in mind: (1) classical, (2) early romantic, (3) late romantic, (4) 20th century, (5) TV, movie, and Broadway soundtracks, (6) pop (e.g., top 40, country, easy listening, rap, hip-hop, rock, rhythm and blues), (7) jazz , and (8) new age (Millbower, 2000). Other factors to consider, such as emotional effects, visual imagery, and instrumental versus lyrics, are briefly discussed next.

Emotional effects. All of these types of music can evoke or induce anger, excitement, activity, motivation, love, laughter, whimsy, tears, dreams, calmness, relaxation, sleep, and a coma. Music can have powerful emotional effects. Instructors need to decide the effect they want to produce in a given learning situation. Applied inappropriately, the music can distract and decrease learning; even incite students to riot. Unless rioting is a specific learning outcome, instructors should be very discerning in their choices.

Visual imagery. The emotional arousal evoked by music may also be accompanied by visual imagery. There is an individualized jukebox full of memories inside every one of us. Hearing a piece of music automatically brings those special memories into focus like a photograph (digital, of course). Hearing the music alone triggers a response similar to what has been called a "flashbulb memory" (Brown & Kulik, 1977; Sierra & Berrios, 1999; Winograd & Neisser, 1992).

Music serves as a retrieval cue for those personal memories. When the instructor presses the play button, the students' mental picture buttons are pressed into action. Snapshot images suddenly pop into their minds. These images may provide recollections of any of the following: (a) the person performing the song or composition, (b) the person with whom the student associates a scene from a particular TV program, movie, or musical, (c) the person with whom the student heard it, or (d) the time and place where the student heard it. Other details may be recalled as well. All of this occurs in a nanosecond. This image creates feelings, emotions, and moods related to that previous experience. They may be positive (joyous, romantic, humorous) or negative (anxious, discomforting, very painful). Instructors need to be sensitive to the possible negative effects of music that some students might exhibit and handle them appropriately. This is essentially music-induced nostalgia, for better or worse.

Instrumental vs. lyrics. The form of music used in the studies cited previously was predominately classical. It served as the background to reading, mathematics, and other activities. The slow-tempo selections set a classroom mood and tone that transcended cognitive learning blocks that students' may have experienced. It reached into deeper Alpha wave states to relax them and create a nonthreatening, safe environment to absorb information into long-term memory and foster creativity (Millbower, 2000). The fast-tempo pieces snapped their minds to attention and maintained it in Betaland. In all of these applications of music, it is the right hemisphere that is called into action. The instrumental selections can be played before class and throughout class to systematically orchestrate learning activities. The specific techniques will be described shortly.

When music with lyrics is introduced, both hemispheres and the interaction between them are engaged with even greater learning potential than instrumental alone. The lyrics add to the familiarity of the music, meaning and depth, and overall impact. They can increase memory by association with the content or they can be rewritten to become the content itself. Words synchronized with music are easier to learn than words by themselves. Have you ever sung songs in school to help remember material you were taught?

When choosing music for class, the specific outcome to be achieved should guide that choice. There are 20 listed at the beginning of this article. For each outcome and technique for using the music, two key questions must be addressed: (1) Do the students' need to identify the title of the song for it to work? and, (2) How do the lyrics match the content? For some outcomes, the title of an instrumental selection may not be pertinent, such as in the classical pieces referred to in the research. In others cases, it is essential for its value to be realized. All students must recognize the song title to make the intended connection with the context.

When lyrics are included, they must relate to the content and context within which they are played; otherwise, they may come across as pointless. An instructor may observe a lot of puzzled looks on the students' faces. Songs with lyrics are obviously more restrictive than instrumental music. The lyrics must have an instructional point. The alternative method noted previously is to write new lyrics derived from the actual content. That strategy can be a powerful learning tool. The title of a song with or without lyrics can also be changed to put a relevant spin on the song. The new title alone can have a significant impact on learning and memory.

SOURCES FOR SELECTING MUSIC

Music selected for courses across the college curriculum is not the same as music that is chosen for a music appreciation course or any other music course. The purposes are very different. Music for the former consists of clips with which most if not all students in the class should be familiar; in the case of the latter, the intent is usually to acquaint students with music forms with which they are probably unfamiliar. The sections that follow cover published sources and Websites, identification of music in the students' world, formal student survey, and CD versus Internet.

Published sources and Websites. There are several music sources that provide inventories of various types of music for instructors at every level. These sources include books by Anderson, Marsh, and Harvey (1999), Brewer (1995, 2007), Brewer and Campbell (1992), Campbell (1992, 1997, 2000), and Millbower (2000). The Brewer and Millbower books even match the musical selections to the recommended methods for using them. Further, there is a Website called "Songs for Teaching: Using Music to Promote Learning" (http://www.songsforteaching.com), which contains thousands of pages of lyrics, sound clips, CDs, and downloads of music catalogued by educational subject and grade level, along with teaching tips, songbooks, and sheet music. Also, see Berk (2002) for other Internet sources.

Identification of music in the students' world. Despite all of these available sources, the primary underpinning for the music techniques that follow shortly is to *pick music the students recognize*, with which they are familiar and in which they have an interest. Therein lies the connection between their world and the content instructors need to cover. They are not teaching them *new* music. The aforementioned books do not consider that criterion for the music that is included.

Where does one find music in the students' world? The answer to that question leads us to our second multiple-choice item:

What is the most appropriate source from which to select music for class?
1. *TV program theme* music based on Nielsen Media Research survey results for the
2. college age group
3. *Movie* music based on cult classics, Oscar winners, and most recent and
4. popular flicks
5. *Pop* music based on Top 40, including hip-hop, rap (Be Careful!), and R & B
6. *Broadway* music based on shows performed in schools and on Broadway

7. Informal and formal student surveys of what music students prefer
8. All of the above

Formal student survey. Let's examine choice E further. This choice means faculty should ask their students. Instructors should talk to them at every casual opportunity to find out the latest and most popular music to which they are listening. Beyond that, however, instructors should conduct a formal survey of their students at the beginning of their first class of the semester which will furnish a wealth of music information. It can be completed in less than 10 minutes in class or online. Here are eight steps to follow for the in-class survey:

1. Pass out two 3 X 5 cards to each student
2. Ask the students to number each side of each card in the upper right corner with 1, 2, 3, and 4
3. On side 1, ask them to list their *3 favorite TV programs*
4. On side 2, list their *3 favorite movies* seen over the past 3–6 months
5. On side 3, list their *3 favorite Broadway shows*
6. On side 4, list their *3 favorite pop songs*
7. Ask students to pass the 1–2 card to the right and 3–4 card to left
8. Collect all of the cards (Of course, they may be all mixed up in the wrong pile.)

Now the instructor can collate and compute the results and identify the music to which his or her students are listening. He or she should take side one and create a frequency distribution of the top 10 TV programs the students are watching. A distribution should then be computed for each of the other three sides. Those distributions will yield four top-10 lists that can serve as the pool of music from which clips can be extracted for the entire course. That pool provides sources from which the instructor can draw TV music themes, hit music from movies and Broadway shows, and pop music with which most of the students will be familiar. That's more than 40 different music sources. This is probably the *most accurate inventory of musical selections* an instructor can use.

CD vs. Internet. There are two principal sources from which to obtain the music: original CD or the Internet. There are several factors to consider in using these sources. If the music needs to be extracted and converted to a format compatible with Microsoft's PowerPoint[®] (PP) for PCs, the Internet may already have the converted version; otherwise, the instructor will have to do the extracting and conversion with specific software, such as Sony *Sound Forge Audio Studio 8* or *9,* unless he or she has a Mac . Other factors include the following:

Factor	CD	Internet
Cost	Expensive	Free or cheap
Quality	High	Good—High
Format	Not PP compatible	Some PP compatible
Most recent music avail-ability	Very good	Very good
Related music	Excellent	Not available

TWELVE GENERIC TECHNIQUES
FOR USING MUSIC TECHNOLOGY IN TEACHING

There are several resources to consider for specific methods of using music in the classroom and examples of music for those methods. Books by Brewer (1995, 2007), Brewer and Campbell (1992), Campbell (1992), and Millbower (2000) are very useful starting points. These volumes were mentioned previously as sources of music. The music lists are extremely helpful to guide the choice of appropriate music for the method and intended outcome.

Since an instructor's choice of music and music techniques are contingent on the students' characteristics, music interests, and content to which they are applied, the methods described here are somewhat different than those in the references cited above. The history for the development of those techniques is also very different. Over the past decade, this author developed several methods to incorporate music into one of the most universally hated courses on this planet: statistics. Just saying the name of the subject conjures up the sound of the "Shower" music from *Psycho* along with mental images of the butcher knife and curtain. On the first class of the semester, my students are usually thinking, "Why don't you just kill me now?"

The 12 generic strategies described next are derived from 10 years of practice and research on their effectiveness (Berk, 2001, 2002). Two self-report studies were conducted: (1) a survey of 385 students in two undergraduate and five graduate statistics courses over two and a half years was administered to evaluate 40 musical selections, and (2) a survey of 232 students in one undergraduate and three graduate courses was distributed to determine whether 12 music pieces in combination with class demonstrations helped them learn the material.

The first survey requested the students to rate the effectiveness of the music for four outcomes: (1) to grab your attention and focus, (2) to increase your interest in the topic, (3) to relax or reduce your anxiety/stress on the topic, and (4) to make learning the topic fun. The median ratings for the music were "Extremely Effective" or "Very Effective" for all four outcomes. According to the students, the music significantly increased their levels of engagement, helped them relax or reduce anxiety, and made learning fun.

The second survey asked students how much they learned from the music-demonstrations in terms of three outcomes: (1) facilitate your understanding of the statistic, (2) help you remember the statistical concept or process, and (3) help you learn the statistic when you applied it. The research reviewed in earlier sections also examined understanding and memory, although this design was a self-report, rather than experimental. Here the students' median ratings for all 12 selections were "Very Effective." Overall, 86% or more of each class felt the music-demos improved their understanding, memory, and learning of the statistics.

Based on these studies, the 12 highest-rated strategies for using music in college teaching were identified. They are applicable to any course content and level—undergraduate and graduate. Hopefully, further research on their effectiveness will furnish more substantial evidence of their usefulness as teaching tools.

ONE. PRELUDE TO CLASS

As students are settling in with their backpacks, coats, and snowshoes and the instructor is preparing for class, *background music* can be played to set the tone and mood for the class. It can be up- or slow-tempo, depending on the class time, day, and the desired effect. It should be played for 1.5–5 minutes. For example, a 9am Monday class might suggest an upbeat tone to charge up the students' engines, whereas a 1pm class on

Thursday or Friday may be a slower tempo to relax the students or, possibly, an up-tempo jolt if they need a boost.

The music can provide a break in the typical "chatter" noise that occurs as students settle down. It also permits them to check their mental baggage at the door, unwind, relax, or get an emotional boost before class begins. When the music stops, class begins. Students should be told that is the cue to end talking and shift gears into learning mode.

TWO. CLASS OPENING TUNE-UPS

Once students are ready, different music may be used to begin the day. For example, the recording of the first violin revving up an orchestra to open a show or concert can be played. This can be followed by a PowerPoint® slide of a curtain being raised (transition "uncover up") to the up-tempo "Everything's Coming Up Roses," "That's Entertainment," or a similar song, which will engage all of the hemispheres in the room.

THREE. SPECIAL OCCASION BLOCKBUSTERS

At the beginning of the semester, after a long holiday break, or for another special occasion (e.g., the instructor's sabbatical), a blockbuster production should be prepared. The first class, in particular, is critical. From a student's perspective, it can be the forecast of a smash hit or a flop course. It is their first face-to-face impression of the instructor, the content, how he or she teaches, course requirements, expectations, and clothing styles, which are frequently highly predictive of the rest of the course. Since the students do not expect any fireworks, any effort to jumpstart their minds and hearts for learning will be appreciated. The blockbuster is also an effective strategy to reduce anxiety, stress, and tension in "required courses" that some students absolutely dread.

One type of blockbuster is a parody of a popular TV program, movie, or Broadway show with which all of the students are familiar. A parody has both music and humor to which the students can relate. If the parody can be linked to the course content in some way, it will be even more meaningful. A well-written and executed parody is a powerful method to kickoff anything. Although it may require only a minute of class time to present, the impact can be memorable and, maybe, unforgettable. Here are a few thoughts:

> *Gourd of the Dance: A Halloween Treat*
> *Harry Potter Gets Lasik®*
> *Indiana Jones and His Angioplasty*
> *Meal or No Meal*
> *Mission: Improbable*
> *Phantom of the Opera Meets Jack Bauer*
> *Card Bored: The Net Generation*

Students watch parodies regularly on TV, YouTube, MySpace, and in the movies. Faculty should make every effort to involve students in the planning and execution of the production. It is limited only by the instructor's imagination and creativity. The instructor is the writer, director, choreographer, and scenic, lighting, sound, and costume designer (Berk, 2002). It's all in the preparation. The TV programs, movies, and Broadway shows from an instructor's top10 student survey are fair game for class parodies. Instructors can get ideas from the following lists of parodies. Most of the TV programs are on *Comedy Central* and many of the movies are cult classics.

TV Programs	Movies	Broadway Musicals
The Daily Show	*Scary Movie I–IV*	*The Producers*
Colbert Report	*Austin Powers*	*Young Frankenstein*
Reno 911!	*Airplane!*	*Spamalot*
MAD TV	*Scream I–IV*	*Avenue Q*
SNL	*Fatal Instinct*	*Forbidden Broadway*
Chappelle's Show	*Not Another Teen Movie*	
Mind of Mensia	*Young Frankenstein*	
South Park	*The Producers*	
Scrubs	*Blazing Saddles*	
YouTube.com	*Monty Python and the Holy Grail*	

FOUR. TOPIC INTRODUCTIONS

One of the most attention-grabbing, tone-setting, anxiety-reducing strategies to segue from one topic to the next is to play music with a topic slide. The music can be instrumental or with lyrics, but must be related to the content of the topic. Here are a few instrumental examples from our world:

Topic	*Music*
*Math*terpiece Theatre: Quadratic Equations	Theme from *Masterpiece Theatre*
Law 101: "Make My Day!"	Theme from *Law & Order*
Korean War	Theme from *M*A*S*H*
Writing an Essay: Just when you thought it was safe to go to English!	Theme from *Jaws*

Music with a topic slide is the simplest method to incorporate music for a topic introduction. Costumes and props can also be added, such as a smoking jacket and calabash pipe for *Masterpiece Theatre*, to exaggerate the effect as the music is playing. Four other strategies are the parody mentioned above and content grabbers, the class demonstration, and the collaborative learning exercise, which are described in techniques 5, 6, and 7, respectively. These theatrical alternatives draw on at least four intelligences, plus musical/rhythmic, and can serve as the anchor for how the topic is subsequently covered. The next three sections will suggest a few ideas with examples on how they can be executed.

FIVE. CONTENT GRABBERS

Carrying the preceding technique one step further, music can be integrated into the content material being covered. It will be totally unexpected. The right music can pump life into the most boring content. Instructors should not stop with the topic introduction. They can build on that music by adding other selections as the content is being revealed. They should search for every content nook and cranny to insert up-tempo music. Costumes and props can also accompany this music to provide a visual treat to dramatize the effect. That will keep the students' attention, interest, motivation, engagement,

concentration, and emotions in the content, not drifting elsewhere. Here are a few suggestions with music from our world:

Content	*Music*
Correlation: Relationship Between 2 Things	Theme from *The Odd Couple*
Building a Support Network	"You've Gotta Have Friends"
Classroom "Survivor": The Good, The Bad, and It Could Get Ugly!	Theme from *The Good, The Bad, and The Ugly*

SIX. INTRODUCTIONS TO CLASS DEMONSTRATIONS

A visual demonstration of a concept, theory, or process can be a powerful vehicle for learning. It requires students to *see* the process, *solve* the problem, or *critique* the encounter. They use higher-order thinking skills plus verbal, quantitative, visual/spatial, bodily/kinesthetic, intrapersonal, and interpersonal intelligences, depending on the demonstration. When the "Not-Ready-for-Classtime Players" are called into duty, the demonstration becomes instructional CPR or a defibrillator to resuscitate a dead topic or pump life into boring content.

The demonstration involves transforming a verbal or quantitative concept or process into a visual image. The techniques an instructor can use borrow heavily from the experience and craft of theatre (Diamond & Christensen, 2005; Millbower, 2003; Patterson, McKenna-Cook, & Swick, 2006; Spolin, 1986; Timpson, Burgoyne, Jones, & Jones, 1997). Imagine what it would be like to sit in the students' seats and see through their eyeballs how their classmates act out an equation, a poem, or a chemical reaction.

The effectiveness of the demonstration hinges on the students' level of engagement. There are four stages to maximize that engagement: (1) pre-demo set-up, (2) grabbing the students' attention, (3) seeing or walking through the demo, and (4) post-demo Q & A follow-up. Let's focus on stage 2. The other stages with examples are described elsewhere (Berk, 2001, 2002).

Stage 2 involves the music, which serves as the hook to grab the students' attention and prime their minds, cognitively and emotionally, for the demonstration. Both hemispheres are engaged. When the music stops playing, the students should be on the edges of their seats in anticipation of the demo. Here is the procedure:

1. Preselect one or two groups of 4–6 students each by gender a couple of classes before demo is scheduled. The groups should be equal in size.
2. Tell the students exactly what will happen: the women will be asked to line up in the back of the room and start walking to the front when the music begins; they will line up across the front; then the men will do the same. That's it.
3. On the day of the demo, the class is given a serious set-up for the demo (stage 1).
4. The first group of students is asked to "Get ready." The women go to the back and line up. The music begins and they walk to the front.
5. Say: "Where are my guys? Get ready." The music begins and they walk to the front.

So what is the big deal? The MUSIC!! Here are a few music choices:

MEN	WOMEN
"Bad Boys" (Theme from *Cops*)	"What a Feeling" (*Flashdance*)
"Gonna Fly Now" (Theme from *Rocky*)	"She's a Lady" (Tom Jones)
"Bad" (Michael Jackson)	"I'm Every Women" (Whitney Houston)
"Born to Be Wild" (Steppenwolf)	"Friends" (Bette Midler)
"Law & Order" (Theme)	"All That Jazz" (*Chicago*)
"Stayin' Alive" (*Saturday Night Fever*)	"Dreamgirls" (*Dreamgirls*)

Think about those songs for a moment, which are played with lyrics except "Gonna Fly Now" and "Law & Order." Remember, this musical event occurs in English literature, World History, Statistics, Chemistry, and in every other course where it *doesn't* belong. What happens is totally unpredictable. As the students walk to the front, they may dance, box, use hand and arm gestures, or mimic the lyrics. Anything's possible. Sometimes costumes, such as hooded sweatshirts for Rocky or white gloves for "All That Jazz," or props may also be used, similar to the preceding techniques, to exaggerate the effect.

The music and the students' antics become the punchline. It is unexpected by the rest of the class. The students erupt with laughter. It takes ~15 seconds for each group to get to the front of the room. Sometimes they'll end with a hilarious group pose. Those 30 seconds create an amazing effect, one which the class will long remember.

When the music stops and everyone settles down, the attention of the class is riveted on the visual demo. What a powerful supercharged opening this music can create, instead of students just walking to the front of the room.

Despite the preparation involved behind the scenes to create the demonstration, the execution by the instructor consists of just pressing the play and stop buttons on whatever player is being used or the remote button for PowerPoint®. The element of surprise is also an essential ingredient in the success of the demonstration. The class never knows when the next one will occur. The students involved in the demonstration are sworn to secrecy. Five demos sprinkled throughout an entire semester can usually ensure high attendance at every class. Intermittent reinforcement does work. If a student misses a demo on an important concept or process, there will be no repeat performance.

SEVEN. COLLABORATIVE LEARNING PRODUCTIONS

Once the instructor presents a parody or demonstration that involves groups of students, it's time for him or her to take one step back and assign students to create the production. Based on a basic *theatre model* applied to collaborative learning, groups of five students can be given different concepts or processes to role-play the following:
1. *Director:* guides everyone to focus on a content topic, concept, or process to develop a skit/parody/demonstration with/without script
2. *Designer:* creates scenery, costumes, props, lighting, sound, music, videos, and games
3. *Technician:* determines equipment, tools, and resources to execute skit/parody/demo
4. *Writer:* prepares script, if required, and sequence of steps to execute skit/parody/demo
5. *Actor(s):* performs skit/parody/demo

This production team will flesh out the visual image they want to create using the following teaching tools: music, videos, sound effects, games, props, costumes, lighting, sets, and movement. The demonstration can be scripted or unscripted following the rules of improvisation (Berk & Trieber, in press; James & Williams, 1981; Newton, 1998). A maximum time limit should be imposed. A 10-minute block is usually adequate. When the final product is performed to illustrate a concept, principle, or process, it will be an unforgettable experience for the team, performers, and entire class.

This collaborative learning activity matches the technology savvy, kinesthetic, experiential, participatory, team-oriented characteristics of the *Net Geners* and their cultural world (Berk, 2008a; Prensky, 2006; Salaway et al., 2006). Moreover, instructionally it draws on at least five of their multiple intelligences; leadership, artistic, technical, and musical gifts; and learning styles; plus it fosters deep learning.

The instructor should meet with each group to monitor the ideas and progress. Most of the work should be done outside of class. He or she can also make suggestions or assist with technical support, such as the music and videos, or the students can produce their own. Similar to the class demonstration directed by the instructor, this student production engages everyone in the preparation and possibly everyone in the live performance. Here the music is only one requirement.

EIGHT. CLASS ACTIVITY INTERLUDES

Anytime the students are requested to type an assignment on their laptops in class requiring 30 seconds to three minutes, that timeframe presents another opportunity for music. What happens when students are writing answers to one or two questions, writing a minute paper on the three most important points just covered, or solving a problem or case? What do you hear? NOTHING!! Dead silence.

Background music can be played to help students relax and drift into Alphaland or to produce a chuckle or two in Betaworld. The music chosen is critical. The goal is not to distract, but to facilitate the activity so the students are more insightful, reflective, accurate, and creative in their responses than without the music. Low-tempo selections might include classical music or "The Rainbow Connection" (*The Muppet Movie*); up-tempo, chuckle-inducing music could be themes from *Jeopardy!*, *Seinfeld*, and other favorite TV shows. The music should be related to the activity and timed with the length of the activity. When the three-minute music piece is over, the work stops and assignments are printed or submitted. This use of music should be planned carefully and implemented occasionally with the element of surprise, similar to all of the preceding techniques.

NINE. CLASS BREAKERS

In lengthy classes of three hours or more, it is wise to take at least one break, or else the students could revolt or whip you with their laptop cables. Near the end of a 10–15 minute break, about one minute before you want everyone back and in their seats, ready to resume class, play some music. It's time to put the brake on the break. This music is the cue to head back into the room and start sitting down.

What type of music would fit this application? Try catchy music from TV programs that air on that day of class or even in real time during the class, if it's taught in the evening. TV themes can serve as an up-tempo, yet relaxing attention getter. You can even mention, after the theme plays, that you didn't want them to miss their favorite program. Students usually get a kick out of hearing those familiar themes at the break.

Since these themes typically run only ~30 seconds, you need to have a couple of them prepared to play in sequence or on click. Use different themes for each class. You might also consider music from commercials with which the students are familiar.

TEN. TEST REVIEWS WITH GAMES

There are so many games, so little time. Students love games, especially video games. Not all instructors can produce video games in class, although some students probably can (see Prensky, 2006). Popular TV games, however, are a real possibility. The games can be used to teach material and to review content for a test. The music theme and game background slides available on the Internet make it even more authentic and exciting to play than a board game.

The most widely used games adapted to teaching are *Jeopardy!*, *Who Wants to Be a Millionaire*, *Hollywood Squares*, and *Deal or No Deal*. The template slides allow teachers to supply their own content (see http://qbx6.ltu.edu/natsci/games.shtml). Other games can also be used, but the identifiable theme music is a must to provide an instant connection with the students.

ELEVEN. POSTREVIEW PEP RALLY

After conducting a test review, the instructor should hold a pep rally in or out of the classroom to get students pumped up and motivated to do their best on the test, just like it was the day before the football or basketball game. Why let sports events get all of the attention and hype? Why shouldn't academic events like tests and projects be given their time in the limelight?

Once the review is completed and before the students leave, the instructor should ask if there are any remaining questions. He or she should then offer a few words of encouragement, make the expectations clear for the test performance, and tell the class that "We Are the Champions" (Queen), "We Will Rock You" (Queen), "Hakuna Matata" (*Lion King*), the college's football fight song, or some other up-tempo, appropriate title with accompanying music. Students should depart with the proper supportive tone and the feeling that the instructor really cares about their performance. In this application, the instructor creates the context; the music sets the tone.

TWELVE. POSTTEST PICK-ME-UPS

After test or project results have been posted on the course Website, the instructor should comment on the class' performance online and in class, placing that score or grade in the context of the rest of the assessments. If some of the students are disappointed with their performance, the instructor should tell them: "Think about the words to this song." (press play) Here are a few suggestions:

"Tomorrow" (*Annie*)
"Don't Worry, Be Happy" (Bobby McFerrin)
"What a Wonderful World" (Louis Armstrong)
"Happiness" (*You're a Good Man, Charlie Brown*)

These selections always produce at least a few smiles. The music says something positive to all students and, especially, to those who didn't do as well as they expected. It can change the tone and attitude of students faster than anything the instructor could possibly say, except maybe "That 'F' doesn't count."

FINALE

This article was designed to acquaint you with the potential value and uses of music in the college classroom. Music is a virtually untapped resource for teaching the *Net Generation* and for drawing on their multiple intelligences to increase the success of every student. Its learning potential was expressed as 20 instructional outcomes at the outset and 12 specific techniques at the end. The material in between those anchors was mostly research. The theory and research on the brain and music and learning were reviewed and critiqued. The research on music and learning was more encouraging than informative. The results accumulated so far are merely suggestive rather than conclusive. The body of evidence is inadequate to argue wholeheartedly for the positive instructional effects of music, Mozart or otherwise, but maybe halfheartedly. A considerable amount of research evidence needs to be collected in all disciplines at the college level before all 20 outcomes may be supported.

The technology requirements and the sources for selecting appropriate music were also described. However, when applying the Olympic judging criteria of "technical merit" and "artistic impression" to the instructional uses of music technology, it seemed that the technical aspects were the easiest to implement. It's the artistic side that is the most challenging—the effectiveness of the music depends on the instructor's creativity, imagination, and artistic gifts that will inevitably make the greatest difference in the classroom. Those gifts, moreover, must be accompanied by systematic planning and preparation, which is very time-consuming.

I challenge all instructors to seriously consider the ideas presented in the foregoing pages along with the lists of available resources for music to add a dimension to their teaching that will change how they teach forever. Once they incorporate music into all that they do, their view of teaching and their students will never be the same. In the years to come, maybe students will request CD soundtracks of their classes to download onto their iPods, iPhones, and MP3 players, rather than the current rap and hip-hop music. Then they can play and relive those magical teaching moments with music.

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