SEVENTH EDITION

Integrating Educational Technology into Teaching

M. D. Roblyer
Nova Southeastern University

PEARSON

Boston Columbus Indianapolis New York San Francisco Upper Saddle River
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montréal Toronto
Delhi Mexico City São Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

13

By Jay Dorfman and M. D. Roblyer

Teaching and Learning with Technology in Music and Art

Learning Outcomes

After reading this chapter and completing the learning activities, you should be able to:

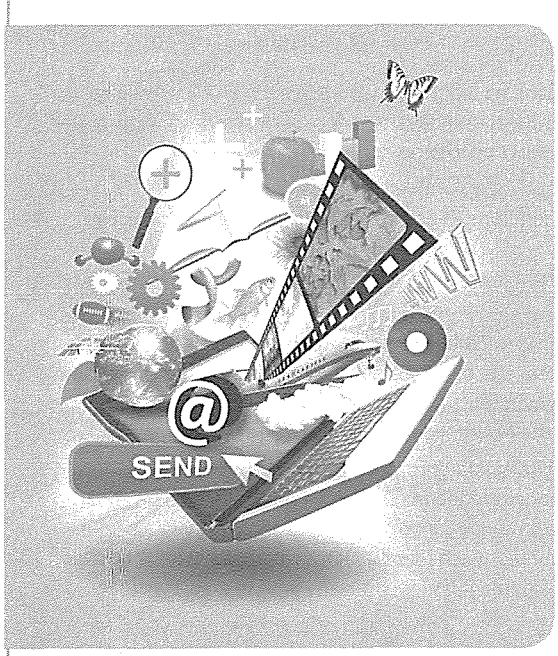
1. Articulate a rationale for including technology in curriculum for arts education. (ISTE Standards•T 1, 5)
2. Identify implications for technology integration for each current issue that music teachers face. (ISTE Standards•T 4, 5)
3. Select technology integration strategies that can meet various needs for instruction in music curricula. (ISTE Standards•T 2, 5)
4. Identify implications for technology integration for each current issue that art teachers face. (ISTE Standards•T 4, 5)
5. Select technology integration strategies that can meet various needs for instruction in art curricula. (ISTE Standards•T 2, 5)
6. Design a strategy for how to build teacher knowledge and skills in technology integration for music or art instruction. (ISTE Standards•T 5)

Vladgrin/Shutterstock

TECHNOLOGY INTEGRATION IN ACTION
THE FINE ART OF ELECTRONIC PORTFOLIOS

GRADE LEVELS: Middle to high school • **CONTENT AREA/TOPIC:** Music and art composition, technology • **LENGTH OF TIME:** Ongoing

PHASE 1 ANALYSIS OF LEARNING AND TEACHING NEEDS



Angela Waye/Shutterstock

Step 1: Determine relative advantage.

The music, arts, and technology resource teachers at Eureka High School were discussing the new block scheduling plan in which music, art, and technology credits would share one of the four 90-minute units students would attend each day. The teachers realized that a logical thread among these three curricula would be to have students develop a Web-based portfolio of their musical and artistic work. They felt this would meet several needs. First, it would be a way of working with each student at individual levels of musical and artistic expertise. This was important because students in their classes would range from beginners at musical composition or art skills to advanced musicians or artists. Second, it had always been difficult to find an audience for student work; the teachers knew that having others listen to or view their work was motivating and provided helpful feedback to students at all levels. A Web-based format would make it easier to share students' works. Third, it would be easy to create projects that linked skills across the disciplines—for example, having students use a **Musical Instrument Digital Interface (MIDI)** keyboard and music editor to prepare a musical composition expressing the feeling or mood of a painting. (MIDI refers to a protocol that has been adopted by the electronic music industry for communication between devices, such as synthesizers and sound cards.) Finally, the teachers realized that an electronic portfolio could serve as a valuable, ongoing assessment tool for students' art, music, technology, and language development, and would help students develop skills in using technology to present their work and to communicate and share information with others.

Step 2: Assess required skills and resources.

The teachers explored the available Web-based tools for constructing portfolios. They each examined several online platforms ranging from free or low-cost to pay-per-use; they also tried using portfolio systems that ranged from prescriptive to extremely flexible. They eventually settled on a Web-based tool that was flexible in that it allowed for many types of media to be displayed, but it was limited in that the overall design of each student portfolio would be the same. However, since the tool fit within their budget and would be easier to implement across classes, they decided it was the best choice. The technology teacher prepared a handout on how to use it and shortcuts for performing each required operation; this would be useful for both teachers and their students.

PHASE 2 PLANNING FOR INTEGRATION

Step 3: Decide on objectives and assessments.

The teachers decided they each would use a component of the portfolio as the basis of student assessment for each grading period. The art and music teachers would assign each student individual benchmarks to achieve in their composition and skill development, and the technology teacher would use the electronic portfolios the students produced to assess their production skills. Students' grades would be a combination of the three assessments, with each content area weighted according to which one was being emphasized during the grading period. They decided on the following outcomes, objectives, and assessment strategies:

Outcome: Progress in art.
Objective: Students will meet their assigned benchmark for progress in art skills.
Assessment: Rubric to assess this portfolio component.

Outcome: Progress in music.
Objective: Students will meet their assigned benchmark for progress in music skills.
Assessment: Rubric to assess this portfolio component.

Outcome: Progress in language expression.
Objective: Students will meet their assigned benchmark for development in written expression.
Assessment: Rubric to assess this portfolio component.

Outcome: Technology skills.
Objective: Students will demonstrate competence in each required Web page development skill by completing assigned tasks.
Assessment: Web production checklist.

Step 4: Design integration strategies.

The teachers decided they would follow the same sequence of activities for each grading period:

Review skill levels and set benchmarks. The art and music teachers meet with each student, review accomplishments to date, and set benchmarks for individual skill development. Some students with lower skill levels are placed in small groups so that teachers can spend more time working with them.

Review portfolio requirements. The technology teacher meets with each student, reviews the requirements for the portfolio, and sets tasks and expectations to assist students in developing a more clear and aesthetically pleasing presentation.

Decide on projects. A different project is set for each grading period. For example, for the first project, the teachers decide to have students use their MIDI keyboards and notation software to write a musical composition based on the music of a period they have been studying in their history classes. Then the students use image manipulation software to create a collage of colors and images that come to mind as they listen to the music composition they or their fellow students have created. The technology teacher helps them add their sound and graphics creations to their portfolios.

Determine group presentations. Each teacher identifies whole-group presentations that they need to offer. For example, the music teacher needs to demonstrate techniques with the MIDI keyboard and music notation software. The art teacher designs a presentation on how to use layering techniques in Adobe Photoshop to create a graphic collage. The technology teacher develops demonstrations of video and audio editing techniques. After their group presentations, the teachers work with each student as needed to complete the required products.

Arrange reviews and final presentations. The teachers arrange for various experts in other locations to do online reviews of the students' creations and to give them feedback. Students will revise their products as time permits and as they feel appropriate. The teachers arrange for an "Evening at Eureka" to be given at the end of the grading period, at which computers would be set up in a lab to display each student's work. Parents and friends are to be invited via the school website and via desktop-published invitations created by the art students.

Step 5: Prepare instructional environment.

The technology teacher created a main page for the student portfolios, with links to each student's work. He also created a link from the school's main page to the portfolio section. The music teacher had a MIDI keyboard classroom, but there were not enough keyboards for each student to have one for a whole period. The teachers arranged the schedule so that half the class attended band, choir, or orchestra rehearsal, worked in the art studio, or worked on their individual portfolios in the computer lab, while the other half worked on composition.

PHASE 3 POST-INSTRUCTION ANALYSIS AND REVISIONS

Step 6: Analyze results.

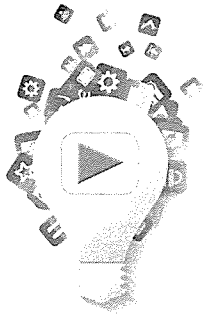
At the end of each grading period, the teachers reviewed the students' portfolios, assessed progress, and discussed ways to make the work go more smoothly. Some of the questions they asked were:

- Did most students meet the individual benchmarks set for them?
- Were students actively engaged in the project work?
- Did the group demonstrations provide adequate initial instruction before students began work on their own?
- Were the classrooms and lab times organized for efficient work?
- Did the Web-based tool that the teachers chose provide appropriate amounts of flexibility and structure for the students to create well-designed, functional portfolios?

Step 7: Make revisions.

The teachers were gratified to see that most students seemed motivated by the idea of using a multimedia Web format to display their work and were making good progress on their benchmarks. However, it was apparent that many students needed more individual instruction than the demonstrations could provide. The teachers decided to record a series of short demos so that students could view them individually or in small groups, as needed, after the initial presentation. They agreed that the scheduling proved to be a challenge. They decided to request that additional MIDI keyboards and software be obtained to support this work. Also, English and history teachers approached them about coordinating the portfolio work with students' writing and research projects. The teachers agreed to work together to merge these skill areas into students' portfolio assessments.

Source: Based on concepts from Duxbury's article "Make Sweet Music with Electronic Portfolios" in *Learning and Leading with Technology*.



CHAPTER 13 BIG IDEAS OVERVIEW

Before you begin reading the rest of this chapter, listen to the Chapter 13 Big Ideas Overview. It will give you a two-minute audio overview of main concepts to look for and help prepare you to work through information and exercises to achieve this chapter's outcomes.

A RATIONALE FOR INCLUDING TECHNOLOGY IN THE ARTS

Technology has always played a part in the arts, providing tools, materials, and processes that aided artists' creative expression. In more recent times, electronic devices in the making and recoding of music and the digital camera in visual arts have changed people's definitions of art. While technology integration in the arts can be difficult because of the traditional ways in which arts instruction is often approached, integration of computers and other forms of electronic technology represents a logical evolution of the arts and arts education.

Many educators and members of the community question the need for instructional technology in the arts curriculum. Peppler (2010) observed that arts education curriculum do not emphasize the use of new technologies, despite the opportunities they offer to "address arts integration, equity, and the technological prerequisites of an increasingly digital age" (p. 2118). Peppler felt that this omission represented a "missed opportunity" (p. 2148). She argued that media arts should be included more extensively in school curriculum. This new form of literacy is especially important for those youths who have been traditionally marginalized in our society, since messages are increasingly being displayed in visual, auditory, or kinesthetic formats, as well as print ones.

Thus, immersion in media arts represents a path to greater participation in the life of our society. The National Standards for Arts Education also make it clear that technologies offer new and powerful means to accomplish artistic, scholarly, production, and performance goals. Clearly, the place of technologies in arts education has never been more relevant.

TECHNOLOGY LEARNING CHECK

Complete TLC 13.1 to review what you have learned from this section about a rationale for including technology in arts education.

ISSUES AND CHALLENGES IN MUSIC INSTRUCTION

Music and technology have always had a unique relationship. Throughout the history of music, technological tools have been developed that afford musicians, teachers, and students the opportunity to experience music through creating, performing, and responding to it. However, there are several issues and challenges related to music education in general, as well as the use of technology in the classroom for teaching music. These issues and challenges are explored in this section.

A Changing Definition for Music Literacy

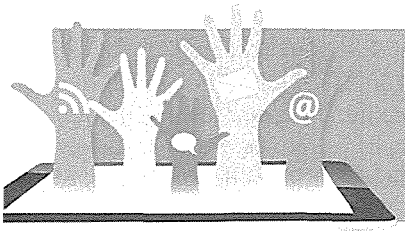
In music education, the term *music literacy* usually means an ability to read standard music notation. But the computer enables—if not encourages—experimentation with alternative ways to represent music. The earliest **music sequencers**, even those with notation capability, have always included a "graphic" or "matrix" editor, a window in which the user could edit music by dragging, deleting, or expanding small rectangles on a grid. Touchscreen interfaces such as those found on tablets have also led to apps that use similar drawing metaphors for creating music. These include apps such as Beatwave, Kaossilator, and Musyc, among others. See a list of the Top Ten Must-Have Apps for Music.

Today, the desktop music production software industry is helping accelerate a trend away from reliance on printed sheets and toward an audio artifact. This means that many students who are discouraged by a requirement to learn notation-based theory can now participate in the school music program as both composers and performers without solely relying on standard notation to perform or compose music. Electronically-produced music is also playing an increasing role in in music production, as noted in the Hot Topic Debate. When the definition of *music literacy* is expanded to include nontraditional performance and composition, music education may be more accessible for the approximately 80% of American high school students who do not participate in band, orchestra or chorus activities (Dammers, 2010, 2012).

Training Teachers to Meet Music Standards

Until states begin requiring that teacher candidates demonstrate proficiency with technology, teacher preparation programs will have a difficult time making a case for including required technology courses in music curricula. Such programs, already overloaded with content, would be reluctant to displace a more traditional course with one whose skills remain in the "optional" category with respect to licensure. Still, most teacher training programs in music include experiences with technology, if not as a full class then as a strand of components in other classes.

The National Association of Schools of Music, which accredits schools of music, recommends that students have opportunities to explore "areas of individual interest" (NASM, 2013, p. 101)



Hot Topic Debate
Can an Electronic Music Ensemble Supplant a Traditional One?

Take a position for or against (based either on your own position or one assigned to you) on the following controversial statement. Discuss it in class or on an online discussion board, blog, or wiki, as assigned by your instructor. When the discussion is complete, write a summary of the main pros and cons that you and your classmates have stated, and put the summary document in your Teacher Portfolio.

Many schools, including some that do not offer traditional ensembles, are starting to organize groups of students to play electronic instruments. These ensembles may not include any instruments that could be considered traditional; they instead use iPads, laptops, and other kinds of technological devices to produce sound. Electronic ensembles also might not perform in public. Do these types of ensembles have a place in the school music program? Can these ensemble experiences help students to develop musicianship? What should be the role of the teacher in an electronic ensemble, especially if the music is largely improvised?

TABLE 13.1 Standards in Music Technology and Music Education

Areas of Competency in Music Technology	MENC Standards
1. Electronic musical instruments (keyboards, controllers, synthesizers, samplers, sound reinforcement equipment) 2. Music production: data types (MIDI, digital audio); processes (sequencing, looping, signal processing, sound design) 3. Music notation software 4. Technology assisted learning (instructional software, accompaniment/practice tools, Internet-based learning) 5. Multimedia: authoring (Web pages, presentations, digital video); digital image capturing (scanning, still/video camera); Internet; electronic portfolios 6. Productivity tools, classroom and lab management: productivity tools (word processing, spreadsheet, database); computer systems (CPU, I/O devices, storage devices/media); lab management systems; networks	1. Singing, alone and with others, a varied repertoire of music 2. Performing on instruments, alone and with others, a varied repertoire of music 3. Improvising melodies, variations, and accompaniments 4. Composing and arranging music within specified guidelines 5. Reading and notating music 6. Listening to, analyzing, and describing music 7. Evaluating music and music performances 8. Understanding relationships between music, the other arts, and disciplines outside the arts 9. Understanding music in relation to history and culture

Source: Areas of Competency in Music Technology: Reprinted by permission. Copyright © by Technology in Music Education (TI:ME - www.ti-me.org). MENC Standards: From National Standards for Arts Education. Copyright © 1994 by National Association for Music Education, www.nafme.org. Used by permission.Areas of Competency in Music Technology: Reprinted by permission. Copyright © by Technology in Music Education (TI:ME - www.ti-me.org). MENC Standards: From National Standards for Arts Education. Copyright © 1994 by National Association for Music Education, www.nafme.org. Used by permission.

such as technology. Professional organizations are working hard to develop standards to guide teacher development with the hope that these standards will provide the guidelines needed for uniformity. Table 13.1 lists the Areas of Music Technology Competency developed by the Technology Institute for Music Educators (**TI:ME**), a professional organization for technology-using music educators, and the music education national standards published by the National Association for Music Education or **MENC**, formerly called the National Association for Music Education or **NAfME**, the professional organization for music educators.

Downloading of Music Illegally

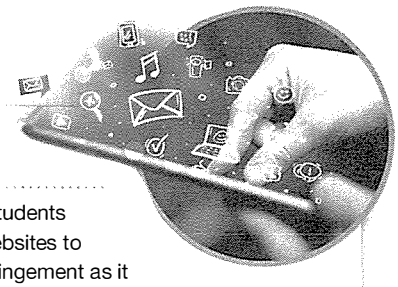
Since the days of bulletin board services and software like Napster, Pirate Bay, and LimeWire (currently under a court-ordered injunction to stop distributing their software) that allow peer-to-peer sharing of files, downloading music illegally has been a concern of the music industry. The sharing of files was extremely popular in the late 1990s and early 2000s, and numerous court cases have surrounded this issue. According to the Recording Industry Association of America (RIAA) website, since file downloads through Napster became prominent in 1999, U.S. music sales have dropped by more than half. The sharing of files is so readily available today that many students do not view the downloading of music as illegal.

Recent data (The Nielsen Company, 2013) show some interesting trends. While overall music sales decreased 6.3% and physical sales (of CDs, LPs, and cassettes) decreased by 13% between 2012 and 2013, music streaming increased by 32% during that same period. In essence, people are still consuming music, but are showing a strong preference for online music streaming services such as Pandora, Spotify, r.dio, and iTunes Radio over physical purchases. It is possible that online musical engagement could make illegal capture of music even more prevalent. The topic of illegal use of copyrighted works such as music has become an essential part of the digital literacy that schools must address, as shown in Technology Integration Example 13.1.

The Intersection of Popular Music, Technology, and Music Instruction

The National Association for Music Education (NAfME, formerly MENC) published a collection of landmark essays addressing the issue of popular music, but "Bridging the Gap: Popular Music and Music Education" made very little mention of popular music's heavy reliance on technology for both production (composition) and live performance (Rodriguez, 2004). Some

TECHNOLOGY INTEGRATION



Example 13.1

TITLE: Why is Downloading Music Illegal?

CONTENT AREA/TOPIC: Art

GRADE LEVELS: 9–12

ISTE STANDARDS•S: Standard 1—Creativity and Innovation; Standard 2—Communication and Collaboration; Standard 3—Research and Information Fluency; Standard 4—Critical Thinking, Problem Solving, and Decision Making; Standard 6—Technology Operations and Concepts

CCSS: CCSS.ELA-LITERACY.SL.9-10.2, CCSS.ELA-LITERACY.SL.9-10.3, CCSS.ELA-LITERACY.SL.9-10.5, CCSS.ELA-LITERACY.RH.11-12.1, CCSS.ELA-LITERACY.SL.11-12.1

DESCRIPTION: In this lesson, students work in small groups and use websites to learn the history of copyright infringement as it relates to audio files and review the applicable laws and issues that arise from violations of them. They discuss their own practices and compare them to the legal standards. Finally these use Web resources to create a presentation in which they take a position on the controversy and use information they have found to make a persuasive argument to defend their position.

SOURCE: Based on an idea from the lesson plan *Copyright Infringement or Not? The Debate over Downloading Music* by Suzanne Taylor at http://www.readwritethink.org/classroom-resources/lesson-plans/copyright-infringement-debate-over-855.html.

recent publications include descriptions of many kinds of alternative music programs including those that focus on popular music styles (Clements, 2010; Smith, 2013). Any music teacher seeking to start and sustain a program component dedicated to rock, hip hop, rap, or other pop genres must have (or have access to) extensive knowledge of desktop music production and live sound reinforcement—not to mention a credible familiarity with pop music's complex web of music, culture, and traditions.

The Music Director as Small Business Administrator

Typical secondary school music programs may involve hundreds of students, rooms full of instruments and other equipment, wardrobes of uniforms and choral robes, libraries of sheet music, methods books and other print resources, and large budgets. The music director usually oversees the largest inventory of physical assets outside the athletic department. The music director is responsible for tracking students' academic progress and other duties common to all classroom teachers. In addition, the music director must be his or her own director of development, constantly on the lookout for continuing or increased funding. All of these issues make knowledge of information management software a high priority—if not a stated requirement—for the efficient operation of a successful music program.

TECHNOLOGY LEARNING CHECK

Complete TLC 13.2 to review what you have learned from this section about issues in music education that affect how technology is integrated.

TECHNOLOGY INTEGRATION STRATEGIES FOR MUSIC INSTRUCTION

In a superb review of research related to technology and music learning, Webster (2002) identified several categories of music experience that have been the focus of technology integration and are still excellent guidelines today, including music listening, performance, and composition. He also acknowledged the crucial role that technology plays in research and assessment within the educational environment. In addition to general-purpose software (e.g., word processing, spreadsheet, Web authoring), two broad categories of computer-based tools play a primary role in serving the needs of music teachers: instructional software (programs developed primarily

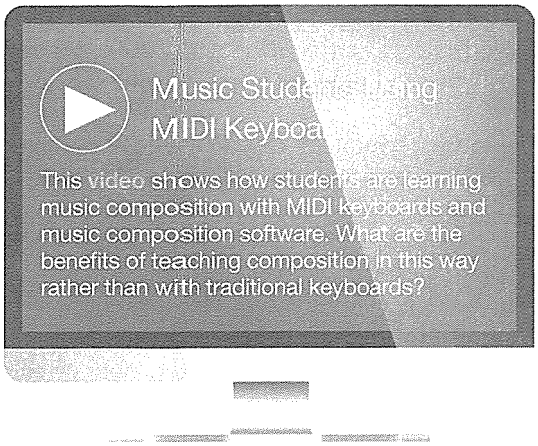
for teaching music skills) and music production software (programs that facilitate music composition, recording, and performance). More recently, Bauer, Harris and Hofer (2012) explained how musical activities can be associated with particular technologies in accord with the TechPACK model.

The first step in the process of integrating music technology may well be the purchase of electronic keyboards or synthesizers. For financial reasons, many schools that have to choose between a computer lab and a keyboard lab for their music programs choose the latter. Another relatively recent entry into the music performance realm is the "intelligent" accompaniment system (SmartMusic). With a library of over 80,000 compositions at the time of this writing, students can select a piece from either the ensemble or solo literature and practice with an accompaniment system that follows their performance as tempo is varied for expressive purposes. Perhaps the greatest contribution that SmartMusic can make to the broad goals of music education is that it helps teachers assess students' progress through automated means; it checks students' performances for correct pitches and rhythms and provides assessment data. In a school or university with little or no budget to provide accompanists, such technologies provide significant opportunity. Strategies that make use of all these resources include support for music composition and production, music performance, self-paced learning and practice, teaching music history, and interdisciplinary strategies. These are summarized in Table 13.2 and discussed next.

▲ The first step in the process of integrating music technology may well be the purchase of electronic keyboards or synthesizers. (Photo courtesy of Jay Dorfman)

TABLE 13.2 Summary of Technology Integration Strategies for Music

Technology Integration Strategies	Benefits	Sample Resources and Activities
Support for music composition and production	• Offers a range of mixing and sound design options to support composition for students of any age • Supports both traditional and nontraditional composition • Offers teachers maximum flexibility in designing music curriculum	• Apple/Emagic Logic • Apple's GarageBand • Reason (Propellerhead) Software • BubbleMachine
Support for music performance	• Expedites preparation for performance (e.g., rearranging music for alternate instrumentations, re-creating lost or missing parts from the score, transposing parts, and simplifying difficult passages) • Helps teachers with theory lessons, quizzes, and other handouts to aid student performance	• Sibelius • Finale and Print Music software • MidiNotate
Support for self-paced learning and practice	• Offers individual, personal help with needed skills, ear training, or music theory	• Practice Musica
Support for teaching music history	• Internet sites provide easy-to-access background information on composers and musical periods/ compositions • Website generation offers a venue for students to share their research	• Classic Motown timeline • Internet Public Library 2 • See also pbs.org for other interactive and educational timelines and music history resources
Support for interdisciplinary strategies	• Builds on natural relationships between music and other topics (e.g., physics) • Helps promote musical literacy while teaching related concepts	• Math & Music



Support for Music Composition and Production

For the purposes of this chapter, music production and music composition mean the same thing. The three essential tools in this process are sequencers, **notation software**, and **vocal processing software**, and each can contribute substantially to teaching both production and performance. Sequencers allow the user to record, edit, and play back digital audio and MIDI data. Notation programs concentrate music production on the traditional realm of composition with standard notation. They focus on score and page setup, part extraction, text formatting, and other print-related issues. In other words, a sequencer facilitates music making in the aural domain, whereas notation facilitates music making in the visual domain. Vocal processing software is to voice audio what word processing software is to text. It allows users to make changes to the pitch and create interesting vocal distortions. Auto-Tune by Antares is the premier software of this kind. It was created by Andy Hildebrand, an engineer working on seismic data, who suddenly realized this type of software had vocal-editing potential. This software allows a unique vocal distortion technique called **auto-tuning**.

All three of these types of programs allow students to compose music in both traditional and nontraditional ways. With these tools, they can enter music with the mouse, play it with a MIDI-equipped keyboard or other input device (e.g., guitar or wind controller), or import it by opening standard MIDI files created by others (e.g., their fellow students, their teachers, or files found on the Internet). Designed primarily for desktop music production, the sequencer typically offers more options for creating a sonic artifact: more sophisticated mixing and sound design features. New types of sequencers such as Ableton's Live also offer new paradigms within the realm of sequencing software. Notation software is designed primarily to facilitate the production of music as a visual artifact, music on paper or on screen that can then be performed by a live musician. A recent entry into the notation software market is NoteFlight, an online notation program that adds social, collaborative functions so that teachers and students can work on projects together and receive feedback from others across the Internet.

Music production software includes sequencing (MIDI and digital audio), digital audio editing (often a component of a sequencing program), and music notation. Although these programs offer teachers maximum flexibility in designing curriculum, they may require the teacher to have more specialized knowledge of the individual software package because each product operates with different functions.

While hardware sequencers can still be found, often as components of sophisticated workstation keyboards, most sequencing platforms are computer applications. Computer-based sequencers require a more complete MIDI workstation. Modern computers all contain the sound card required to use a sequencer, and most external MIDI equipment can interface with the computer through common USB connections. Computer sequencing software is very powerful, requiring increased processing speed, storage capacity, and a bigger screen on which to display data as compared to hardware workstations.

Most sequencing programs simulate the functions of the physical recording studio. Many applications even include graphics that are designed to look like physical studio gear (for an interesting example, see Reason from Propellerhead, which can also be used to teach students correct cabling of studio components with virtual cables). Music is recorded on tracks and assigned to channels for playback and editing. Software plug-ins are digital equivalents of outboard (hardware) signal modifiers such as echo chambers and compressors and, depending on the processing power of the computer being used, provide the composer with a desktop recording studio equipped with virtually unlimited mixing options. Many sequencers offer the ability to record sound directly onto the computer's hard drive with the use of a microphone. Live, simultaneous multichannel recording is possible with an external digital audio interface. After recording, digital audio data, as represented by a wave shape, can be manipulated (edited) with the ease and precision of text in a word processor.

With very few exceptions, all sequencers support both step- and real-time recording of MIDI data. Once MIDI notes are entered, they can be edited like any other data on the computer:

cut, copied, and pasted. All performance parameters of MIDI data can be controlled by the user independently of one another—including pitch, tempo, volume, and dynamics.

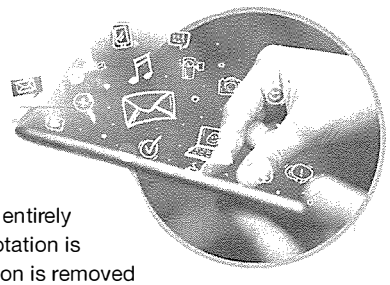
Some programs designed for young children have sequencing components that enable composition. The "Doodle Pad" component of Music Ace, for example, allows the user to drag different-shaped happy faces (representing notes of different rhythmic values) onto a staff. In addition, the user can assign each note to one of several different sounds (e.g., piano, violin) as represented by a different color. Similar functions are available in Hyperscore. With proper direction, however, elementary school students can be taught the basic operations of even the most sophisticated professional software (see Technology Integration Example 13.2).

Projects that begin at a computer workstation in a lab can be used in other situations throughout the music program. Students can create notation files that are then used to facilitate performance in the rehearsal room or at a concert. Students who are especially proficient on an instrument (including voice) can create a sequenced instrumental "bed" to accompany a live performance or group or individual rehearsal. While this may not be the goal of all composition activities, this technique can be used in circumstances in which students are proficient in traditional performance on instruments or voice.

Desktop music systems (e.g., the MIDI sequencer) have prompted new definitions of musicianship that recognize alternative tracks to musical creativity, in addition to the traditional conservatory model of preparation. As suggested earlier, students with little or no "formal" musical training can create and edit compositions using a sequencing program with step-entry capability. Students can also perform analyses of music using preexisting MIDI files and/or digital audio. Once the pieces have been imported into a sequencer, students can explore all aspects of musical form, harmony, orchestration, and other parameters. Sequencers and audio editing software offer students the ability not only to listen to prerecorded music but also to manipulate it. Students can demonstrate their understanding of musical form by literally separating a piece of recorded music into its structural components. In this way, expositions, recapitulations, second choruses, guitar solos and other sectional form elements all become discrete audio events, which in turn can be rearranged—resequenced—into new formal configurations.

Apple's GarageBand has become popular among young people for mixing and playing their own music, and its app counterpart has made these activities even more accessible. Multimedia authoring programs like Flash and Director exemplify another type of technological tool that can be used to facilitate the understanding and exploration of musical form. BubbleMachine, a Flash-based program developed by Scott Lipscomb and Marc Jacoby, is available for free download to educators and allows the user to create interactive listening guides for any audio

TECHNOLOGY INTEGRATION



Example 13.2

TITLE: Organize and Create Music

CONTENT AREA/TOPIC: Music composition

GRADE LEVELS: 2–8

ISTE STANDARDS•S: Standard 1—Creativity and Innovation; Standard 6—Technology Operations and Concepts

MENC: 4, 5

TI:ME: 3, 4, 6

DESCRIPTION: Hyperscore is software designed by developers at the M.I.T. Media Lab that enables students of all ages to compose music. The software is entirely graphical—no standard music notation is used, so the complexity of notation is removed from the composition process. In the Hyperscore environment, students compose by drawing on the screen. Musical elements such as melody and timbre are represented on the "score" with objects of varying shapes, textures, and colors. Pieces can also take on sectional forms by grouping chunks of symbols together. A visual grid represents time, so there is a recognizable element of the visual elements flowing from left to right. Using this software, teachers can encourage students to be creative with composing their own music without the normal conventions of music notation.

MP3 file. Also available from this same website are a variety of template files that can be used to create interactive listening guides for any composition falling into the following established musical forms: sonata form, AABA, and 12-bar blues.

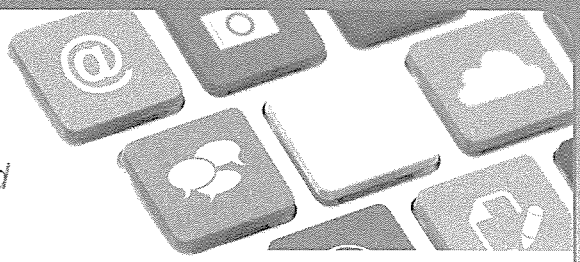
Students can record MIDI data over their favorite audio recordings using different kinds of MIDI controllers. More advanced analysis projects, such as those that might take place in an Advanced Placement music theory class, can now be undertaken using music software as a presentation tool. Consequently, the general music class can accomplish a great deal more than simply providing those students who are supposed to be unmusical or at least untrained with a passive listening experience.

While the preceding scenarios lend themselves best to a lab environment with multiple computers, even a single computer can provide valuable support for a general music curriculum. According to Smith (2010), creative pedagogy, free software tools, and a single computer classroom can be combined to effectively engage students in group composition and analysis of music as they learn collaboratively. Smith (2010) said that when educational resources are limited, using a free **audio recording and editing program** like Audacity can be a powerful educational tool for collaborative work composing, performing, and recording music or manipulating elements such as pitch and tempo in order to deconstruct and analyze the dynamic elements of music as well. The integration of technology like this also provides a medium for the formative and summative assessment of students' creative products and performances, as well as their understanding of fundamental music concepts (Bauer, 2010). There are numerous open-source software options for music production that make it more and more viable in the K–12 classroom (see Open-Source Options).

Support for Music Performance

Software like Finale and Sibelius offers all of the power and flexibility of word processing applied to music notation. In a school music program, this category of software lets teachers rearrange music for alternate instrumentations, transpose parts into more accessible keys for performance, and simplify difficult passages. When printed, notation documents are legible and have a professional look, eliminating the lack of clarity and potential confusion that can result from handwritten parts. And, as is the case with all computer-generated data, existing documents can be

OPEN SOURCE OPTIONS *for Software in Art and Music Classrooms*



TYPES	FREE SOURCES
Free audio editing and recording software	Audacity: audacity.sourceforge.net Power Sound Editor: free-sound-editor.com
Free music notation software	MuseScore: musescore.org NoteFlight: noteflight.com Canorus: sourceforge.net/apps/mediawiki/canorus/index.php?title=Main_Page
Free drawing, photo editing, and graphic design software	Gimp (photo editing): gimp.org Google SketchUp (3-D modeling): sketchup.google.com Inkscape (vector drawing): inkscape.org Sumo Paint (online drawing and photo editing): sumopaint.com/home

corrected and/or revised without having to reenter the music from scratch. Notation files are small in comparison to digital audio, video, and graphics files, so entire libraries (hundreds of scores, parts, and handouts) can be stored using an insignificant amount of disk space. Teachers must exercise caution when using notation software to rearrange music in cases where copyright laws prohibit that practice.

With notation software, teachers can create theory lessons, quizzes, and other handouts that combine notation with text and other graphics. The most recent versions of these programs often include templates or wizards to facilitate creating such informational documents and assessments. The capability of exporting sections of a musical score in a graphic format (GIF, JPG, or EPS) makes inserting images into word processing documents very easy to accomplish. Even when such capabilities are not built into the notation software, screen captures of short passages can be created from the notation document and then inserted into a word processing document.

The distinction between the functions of modern notation and sequencing programs is easily blurred; this is because newer sequencing software often contains scoring functions, and notation software includes mixing and other playback functions generally associated with sequencers. To clarify the roles of the sequencer and the notation program in the teaching of music performance, analysis, and composition, it is helpful to consider the hypothetical scenario of an ensemble class. To support sectional or individual practice, the teacher could enter the score of a piece into a sequencer. Once the music had been entered, the student or teacher could choose which parts needed to be heard, creating a "music-minus-one" type of accompaniment. In this way, for instance, the clarinet section could rehearse to a sequence consisting of the entire ensemble minus the clarinets. Or the second clarinet player could practice sectional passages by selecting only the clarinet parts for playback, but muting the second clarinet part. Meanwhile, the notation program could be used to edit any parts that need to be revised in order to better match the performance level of the students. Notation software is generally more flexible, powerful, and appropriate when the end goal is a printed score; when audio files are the aim, sequencing software is the more suitable choice. See the Open Source Options feature for free software to support music education.

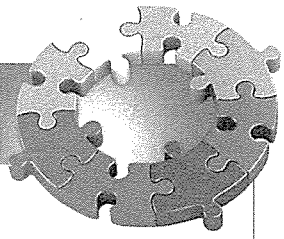
During the past decade, the piano lab has given way to the electronic keyboard lab, where students can develop much more than keyboard skills. Demski (2010) describes how electronic keyboard labs can be used to help students learn about music theory as well as fundamental music elements such as melody, rhythm, and harmony. Keyboard labs can now be networked with devices such as the Korg GEC-III or the Yamaha LC3+ that allow the teacher to communicate with individual students or groups of students by means of a microphone and headphones. This allows instructional guidance as students are afforded the freedom to explore, experiment with, and compose music. Developing composition skills also provides an outlet for creative expression (Demski, 2010). Southcott and Crawford (2011) advocate for pedagogical strategies that encourage using music technology as more than just a technical tool. Also see how to help all students have access to this tool in the Adapting for Special Needs feature.

Teachers should also consider technology for performance beyond traditional instruments. Electronic devices and computers can offer students creative outlets. Intuitive surface interfaces, such as the Native Instruments Maschine and Launch Control and the Ableton Push, allow for control of complex software without knowledge of a keyboard or other traditional musical instruments. Students with access to these kinds of instruments can take part in new and different musical experiences unique to the world of technology. Dorfman (2013) provides profiles of students and teachers taking part in nontraditional ensembles, and shows their benefit to students' musical learning.

Support for Self-Paced Learning and Practice

Instructional software is available to help students learn new skills (tutorials) or practice skills introduced by a teacher (drill and practice). Practica Musica, for example, can be used as a tutorial in music fundamentals with little or no input from the teacher. It can also serve as a drill program when a student needs help with a particular topic related to ear training or music theory. Some of these software packages, such as Auralia, have moved from installing on desktops to cloud-based deployment, allowing students to access the software from any location. Almost all music instructional software packages either have a designated drill component, and many have the capability of maintaining assessment information and other important data for

Adapting for Special Needs



Music and the Arts

Students with disabilities need to participate in music and art just as other students do. In some cases, some accommodations are necessary to ensure opportunities for access and engagement. The resources below describe some resources that may be useful.

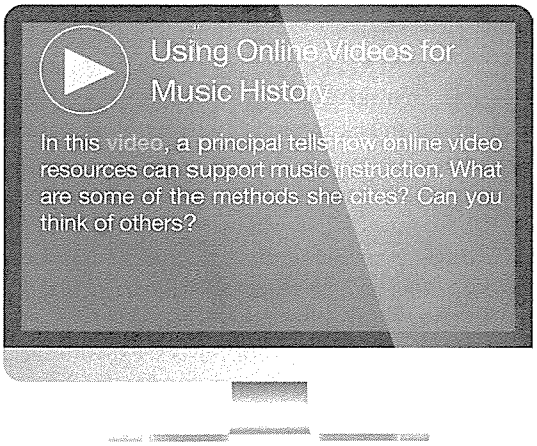
For Music

- *Assistive Technology in Education/Music* (at the Wikibooks website)—An overview of strategies and tools for using assistive technology to provide access to music for students with disabilities.
- *Meet Carly W. and Learn About Her Successful Use of Assistive Technology* (at the Family Center on Technology and Disability website)—This is a profile of a student and the efforts of her teachers to help her learn to use assistive technology to enhance her access and engagement with music.

For Art

- Art for Children and Adults with Disabilities (at the Kinder Art website)—Resources and art activity ideas for children and adults.
- Design and Art (look under the Accommodations and Universal Design topic on "The Faculty Room," a faculty forum on design of classroom environments at the University of Washington website)—Suggestions for teachers and college instructors on how to make art more accessible for students with disabilities.
- Very Special Arts (at the Kennedy Center website)—An international organization devoted to promoting participation in the arts by individuals with disabilities.

—Contributed by Dave Edyburn



multiple students on the same computer, accessible only to the instructor through use of a password-protected account. This capability helps teachers track students' progress on music skills.

Support for Teaching Music History

Of the nine national standards for music education, the only one that refers specifically to music history is the last one: "Understanding music in relation to history and culture." General music teachers have long sought to foster a deep understanding of musical works by situating them in their social and historical context. This is an excellent way to introduce young students to the practice of research while offering more mature students unlimited opportunities for independent projects. The Internet has become the most powerful research tool available to students and teachers at all levels of education. Students and teachers can access online databases, electronic books, online journals, archived and current newspaper articles, audio and MIDI files, video clips, thousands of out-of-print books, and discussion groups on almost any music topic imaginable. Online music archives such as the Naxos Music Library, the National Jukebox of the Library of Congress, and archive.org can be especially useful for teachers who cannot afford to buy recordings of historical music examples. Productive educational use of the Internet is limited only by the user and, to some extent, the connection speed and processing power of the computer. The effective use of such powerful tools requires clear instruction, guidance, and supervision by the teacher.

Building a website can be a perfect culminating activity for a general music class. Students can do much of the planning in groups—even offline, if computer access is limited. Within each group, students can assign themselves areas of the site according to individual strengths and literacies: A student who can't read music may be proficient with a Web page authoring tool; some students can search the Internet for relevant graphics while others look for text or sound. Videos and DVDs continue to be a source of valuable historical reference material, many in the form of informative documentaries. Excerpts from these media can be captured on a computer's hard drive or embedded using provided code from many media sharing sites and then incorporated into a student- or teacher-authored Web page or software presentation as long as care is taken to clearly understand and follow existing copyright laws. With the advent of digital music files, the understanding of

the copyright law as it relates to digital media is a very important aspect of a student's education. Finished projects can be viewed locally on a single computer, burned to a disc for multiple computers, posted on a school network, or uploaded to an Internet site so that parents or other students around the world can see them, link to them, and perhaps even contribute their own material.

Finally, compelling music classes have the potential to be highly effective recruiting tools. Students who initially feel out of place in their school's traditional music program dominated by instrumental and/or choral ensembles may find an exciting and challenging alternative role for themselves by enrolling in a technology-enhanced general music class or a new music class focusing on digital music creation and audio engineering. Often, it is access to music technology that attracts these students, who typically constitute 80–85% of the secondary school population, and provokes in them a new interest in music. In addition to gaining the attention of nontraditional music students, Olson (2010) maintains that technology holds particular promise for music education in the areas of collaborative and interdisciplinary learning.

Support for Interdisciplinary Strategies

Beyond the opportunities for interdisciplinary study that present themselves in a general music class, student-produced music and research can enhance a variety of other aspects of school life. Multimedia-based research projects in the humanities can easily include music that underscores a presentation or that is itself the object of study. A sequencer can facilitate the work of student composers who want to supply music for dance projects or video footage of athletic events. The close relationship between music and physics calls for projects that examine the science of sound by exploring elements such as vibration, pitch, and amplification. Identifying the existence of shared fundamental concepts across disciplines (e.g., ratios represented in math as fractions and in music as note durations) opens the door to a new world of learning potential within which multiple representations of these basic concepts and their connections are used to deepen student understanding (An, Ma, & Capraro, 2011). In music—as in other disciplines such as science or mathematics—creativity, innovation, and knowledge production are inextricably linked (Ghassib, 2010).

TECHNOLOGY LEARNING CHECK

Complete TLC 13.3 to review what you have learned from this section about strategies for integrating technology into in music education.

ISSUES AND CHALLENGES IN ART INSTRUCTION

Like music instruction, art instruction faces many classroom challenges that intersect with technology integration. Some teachers are not adequately prepared to produce digital art, much less to teach their students to do so. Technology appropriate for the art classroom changes rapidly, and staying up to date with the latest software and hardware can be challenging. This section addresses some of these important issues.

Funding for Art Instruction

As a result of lean economic times and the ever-increasing emphasis on accountability in mathematics and reading as reflected in standardized testing related to the No Child Left Behind Act, funding for arts education is at an all-time low (Ellerson, 2010). Public funding of the arts from local, state, and federal governments decreased during 2012 by 3–5% (Stubbs, 2012). Teachers and school administrators must increasingly find ways to stretch funds available for arts education. In light of this reality, funding for technology in art is especially difficult; updating technology resources and buying electronic supplies present continuing problems. For example, production of graphics is a popular art activity, but the cost of expensive ink for printers and specialized paper supplies quickly depletes an annual budget. Teachers are forced to take measures such as password-protecting printers and putting software print controls in place to limit the number of pages a student may print for free.

Ethical Issues Associated with the Use of Images and Other Materials

Since it is easy to use images from the Internet and other sources, it is increasingly important to teach students that they must cite sources and request permission to use information, images, or other sourced materials. When students are carrying out research or creating artwork on computers for websites or graphic design or other art projects, they must also learn issues of appropriation and repurposing of images and how this use intersects with plagiarism. Discussions should take place about issues of copyright law and what constitutes infringement. Perhaps a short assignment early in the term could require students to identify the specific issues and how they feel about copying someone else's work, whether text, image, or sound. Consider using electronic resources such as the free activities at the Library of Congress website or from the Duke School of Law to help students understand the rules and implications of copyright in fun, interactive ways.

Accessing Images Used in Art Instruction

If schools use filtering software on computers to protect students from unsavory materials (e.g., pornography), many great works of art are also likely to be filtered out, unless the filter is carefully constructed. Take care to allow these important artworks to be visible and accessible to students. The works of lesser-known contemporary artists can sometimes blur the line between what is generally considered to be art and what is not. In photography, the nude figure has been a common subject. Great artists throughout history have used the nude as metaphor for beauty, nature, and life. Limiting access by allowing only the names of the most famous artists to pass through a filter will not solve the problem. Strategies must be designed for allowing complete access to images of artworks for students to use. If all else fails, teachers must make sure the school library has a good collection of art and art history books. Also, many museums have images from their collections available on CD or DVD for purchase.

The Challenge of Meeting Standards in Arts Instruction

Art teachers look to several sets of standards to guide their preparation and classroom work. The National Art Education Association (NAEA, 2009a) offers standards for art teacher preparation, including one (Standard V) that calls for teachers to use current and emerging technologies in their teaching. The **NAEC** also offers Professional Standards for Visual Arts Educators (2009b); Standard VI calls for teachers to use technology to enhance their teaching methods. A group of professional organizations joined with the Consortium of National Arts Education Associations to promote a vision of K–12 arts education as described in the National Standards for Arts Education (at the Kennedy center's ArtsEdge website). The standards suggest that students know and be able to do the following by the time they have completed secondary school:

1. Be able to communicate at a basic level in the four arts disciplines—dance, music, theatre, and the visual arts. This includes knowledge and skills in the use of the basic vocabularies, materials, tools, techniques, and intellectual methods of each arts discipline.
2. Be able to communicate proficiently in at least one art form, including the ability to define and solve artistic problems with insight, reason, and technical proficiency.
3. Be able to develop and present basic analyses of works of art from structural, historical, and cultural perspectives, and from combinations of those perspectives. This includes the ability to understand and evaluate work in the various arts disciplines.
4. Have an informed acquaintance with exemplary works of art from a variety of cultures and historical periods, and a basic understanding of historical development in the arts disciplines, across the arts as a whole and within cultures.
5. Be able to relate various types of arts knowledge and skills within and across the arts disciplines. This includes mixing and matching competencies and understandings in art making, history and culture, and analysis in any arts-related project.

Schools are challenged to find ways of meeting these standards in an educational climate in which the role of the arts is often not a priority. The limited time and resources available for arts instruction often results in these standards being interpreted as *ideals* that may never actually be reached in most schooling scenarios. New technologies can both help and exacerbate this challenge for arts educators. They help by providing access to examples and free resources not available locally. But access to the technologies themselves may be beyond the reach of already-underserved schools, thus further widening the gap between those who are and are not likely to meet the standards.

TECHNOLOGY LEARNING CHECK

Complete TLC 13.4 to review what you have learned from this section about issues in art education that affect how technology is integrated.

TECHNOLOGY INTEGRATION STRATEGIES FOR ART INSTRUCTION

As with music instruction, technology resources in art instruction support a variety of classroom strategies—from simple demonstrations of materials to student production techniques. These are described here and summarized in Table 13.3.

Accessing Art Examples for Classroom Use

Internet sites and DVD collections are rich sources of artwork that students can use as illustrations of artists' work and as models for their own work. Teachers can generate a set of sites to bookmark for regular use in classes. (For examples, see Table 13.3.) They can also get students involved in these searches. For example, they might give students an assignment that asks them to find sources for paintings that use still life as subject matter, that use the technique of chiaroscuro, or that are 15th-century Florentine. Learning may result from the act of collaboratively searching for these types of artifacts. Other example activities include:

- Have students use the school library to find specific works of art, and then challenge them to locate on the Internet other examples of the artist's work or work from the same period.
- To teach about the work of contemporary artists, have students look at galleries and exhibitions online to see the new work.
- For instructional reinforcement, use DVD or Web-based collections on art techniques.
- Create a digital library to use for slide shows and presentations. Assign students who are traveling during the school year or during the summer to visit galleries and museums and bring back pamphlets, postcards, or examples of artwork they see. Scan the examples to create images for the classroom digital library.

Using Teaching Examples and Materials

Teachers can use presentation software such as PowerPoint or Keynote to create lecture slides. Slides are especially helpful when they contain example images inserted after they are scanned or photographed with a digital camera, or downloaded from the Internet. Also, teachers can create interactive websites to help students learn color theory, design theory, and photography techniques. See a list of the Top Ten Must-Have Apps for Art.

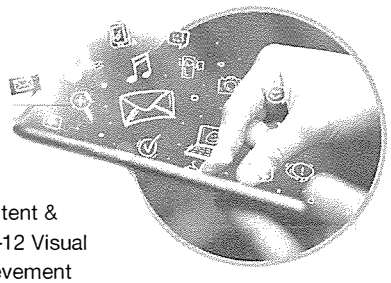
Producing and Manipulating Digitized Images

The most common type of hardware resource in art instruction is image-digitizing equipment. Graphic scanners are computer peripherals that create digital versions of images in a variety of formats (e.g., GIF, JPEG, BMP, TIFF). Artists can also capture an image from a video

TABLE 13.3 Summary of Technology Integration Strategies for Art

Technology Integration Strategies	Benefits	Sample Resources and Activities
Accessing art examples for classroom use	• Internet collections provide ready access to works of art to use as samples, illustrations, and models	• Masters of Photography CD • World Wide Arts resources art history section • Kinder Art's Multicultural Art resources
Using teaching examples and materials	• Multimedia slide lectures are easier to use than slides and allow quick, random access to examples, illustrations • Teacher-created websites can provide easy-to-access exercises in color theory, design theory, and photography techniques	• *Microsoft* Powerpoint • Apple's Keynote • Google Drive Presentations app
Producing and manipulating digitized images	• Offers an easy, flexible system for creating images • Lets novice artists create high-quality products • Lets novice artists scan found objects to use in compositions	• Camcorders, VCRs, digital cameras, scanners • Paint programs, e.g., Mackiev's Kidpix • Adobe's Photoshop Elements • Hardware drawing devices such as Wacom tablets or Apple iPads
Supporting graphic design and 3-D modeling	• Makes possible graphic techniques that can be done only on the computer with this software • Offers many opportunities for artistic expression • Demonstrates how easily images can be altered, thus fostering visual literacy skills	• Image manipulation software, e.g., Adobe *Photoshop* • Morphing software, e.g., Morpheus • 3-D modeling software, e.g., Ulead COOL 31, Blender, or Google SketchUp
Supporting student development of publications	• Lets students illustrate their brochures, newsletters, and other documents with high-quality graphics	• Desktop publishing software • Image manipulation software such as Adobe Photoshop
Virtual field trips to art museums	• Allows students to see models and examples of artworks not locally available • Makes possible multicultural "field trips" to gather examples of art and music from around the world	Virtual Tours of: • Louvre Museum • Art Institute of Chicago • Museum of Modern Art • Metropolitan Museum of Art • Smithsonian museums • National Gallery of Art
Creating movies as an art form	• Students can produce their own creative works for research, reports, assignments, and entertainment	• Apple iMovie and GarageBand • ArcSoft's ShowBiz • Microsoft's Windows Live Movie Maker
Sharing students creative and research works	• Allows students to share and get feedback on their work and see example products of others	• Art Education 2.0: Connecting Art Educators Around the Globe

source (camcorder or VCR) using digitizing software like iMovie, Final Cut, or Premiere. This equipment and software provides users with flexible systems for capturing and manipulating digital images, which can then be edited using software like Photoshop. The ability to digitize still images and video has opened up a whole new genre of art. See Technology Integration Example 13.3.



TECHNOLOGY INTEGRATION

Example 13.3

TITLE: Visual Biography

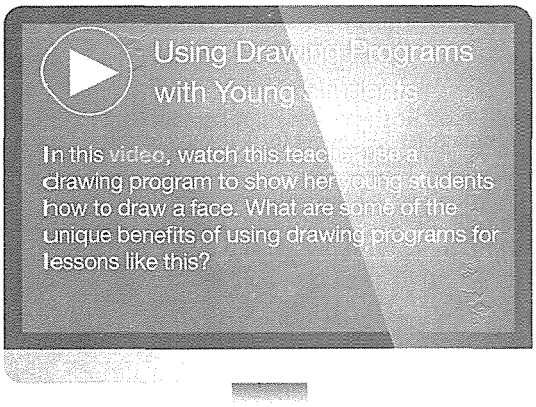
CONTENT AREA/TOPIC: Art

GRADE LEVELS: 6–12

ISTE STANDARDS•S: Standard 1—Creativity and Innovation; Standard 2—Communication and Collaboration; Standard 3—Research and Information Fluency; Standard 6—Technology Operations and Concepts

NATIONAL STANDARDS FOR ARTS EDUCATION: Content & Achievement Standard: Grade 5–8 Visual Arts Standard 1, Content & Achievement Standard: Grade 5–8 Visual Arts Standard 6, Content & Achievement Standard: Grade 5–8 Visual Arts Standard 3, Content & Achievement Standard: Grade 9–12 Visual Arts Standard 6, Content & Achievement Standard: Grade 9–12 Visual Arts Standard 1, Content & Achievement Standard: Grade 9–12 Visual Arts Standard 3

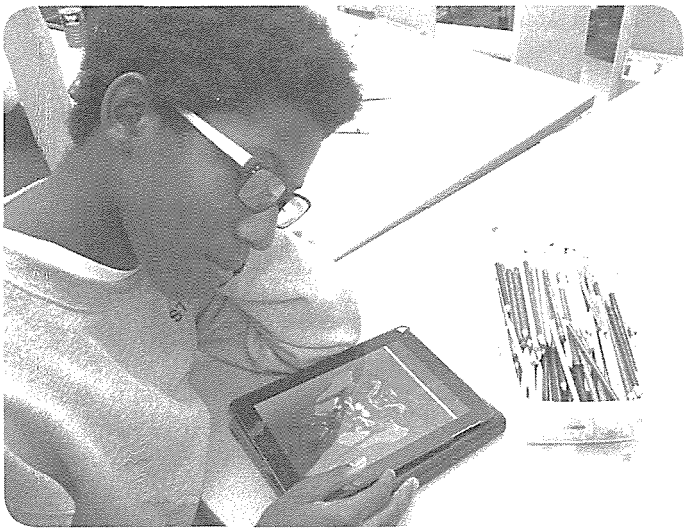
DESCRIPTION: Students can use digital art tools to explore and express a sense of their own identities. Using digital cameras, students search for found objects that represent important parts of their lives. They can also search online and print media, and capture or scan those media. Depending on the students' ages and levels of sophistication, they can make a digital collage of these images using PhotoShop (or similar software), or use movie-making software (such as iMovie) to make a short film. Adding music to the film is a great way to cross disciplinary lines, especially if the students compose original music for their films.

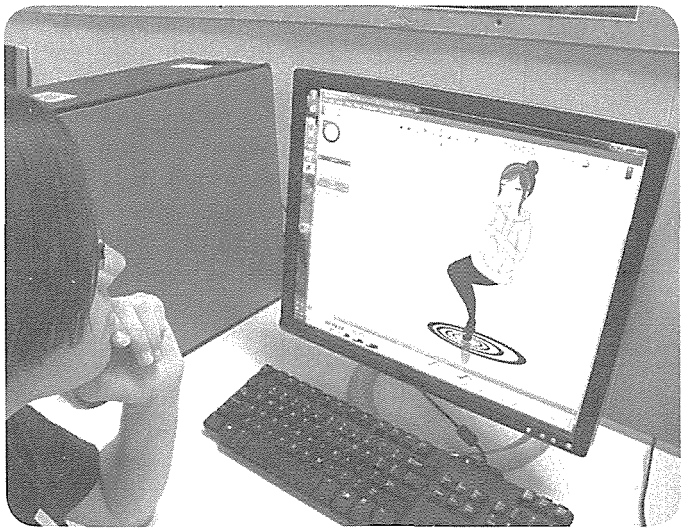


A wide variety of software is available to teachers and students who are interested in producing computer art. Simple paint programs (Paintbrush, KidPix) are available for very young students; in fact, teachers often use these types of programs when first introducing students to the computer. Integrated software and multimedia authoring programs (Flash or Director) always include fairly sophisticated drawing and painting tools; these might be good intermediate tools for the developing computer artist. High-level programs (Photoshop) suitable to the advanced artist would be used primarily at the high school level. Teachers should also explore the wide variety of mobile apps available for editing images. These include the mobile version of iPhoto, Photo Editor by Aviary, PhotoShop Express, and the artistic filters available in application services such as Instagram.

Supporting Graphic Design and 3-D Modeling

Art educators can choose from among a number of software options to let students explore graphic design. A range of animation programs is available, from simple cell-type animation to more advanced programs that offer features like **tweening** or morphing,





▲ A wide variety of software is available to teachers and students who are interested in producing computer art. (Photos courtesy of W. Wiencke)

graphic techniques that can be done only with computer software. Other programs are specifically geared toward cartoon production and allow artists to add music and sound.

An art studio would not be complete without an image manipulation program like Adobe Photoshop, which enables students to edit clip art or digital photos. High-end programs provide hundreds of options and special effects for altering images. Morphing software enables the user to transform images smoothly from one shape or image to another. This technique offers tremendous potential for artistic expression and, by demonstrating how easily images can be altered, helps foster the development of visual literacy skills.

Finally, as Davenport and Gunn (2009) and Bryant (2010) contend, students can use 3-D, modeling, and animation software to communicate ideas visually through computer-generated models, animation, and imagery. Davenport and Gunn (2009) describe a powerful example of the use of these tools in a high school media literacy program they developed to serve indigenous youth from underrepresented populations throughout remote areas of rural Mexico. Students used digital images and video cameras, as well as 3-D and animation software, to visually communicate images and stories about their cultures and traditions. The integration of technology as a medium to design and create not only aided in the opportunity for these students to explore their own identity, but also aided in their empowerment by giving them a voice to share their unique backgrounds and experiences through artistic and cultural expression. Bryant (2010) confirmed that such transformative learning experiences may also occur in traditional art classrooms as students' creativity, engagement, and collaborative problem-solving skills are fostered by the use of 3-D animation and visual imagery to create captivating artwork that holds personal meaning.

Supporting Student Development of Publications

Many schools look to their own graphic arts programs for the creation of brochures and newsletters as part of student learning activities. Because students gain valuable experience through creating and producing these publications, the activities can be considered a kind of internship to prepare for actual jobs as graphic artists for newspapers or other companies. This strategy requires schools to provide both desktop publishing software and access to image manipulation program such as Adobe PhotoShop.

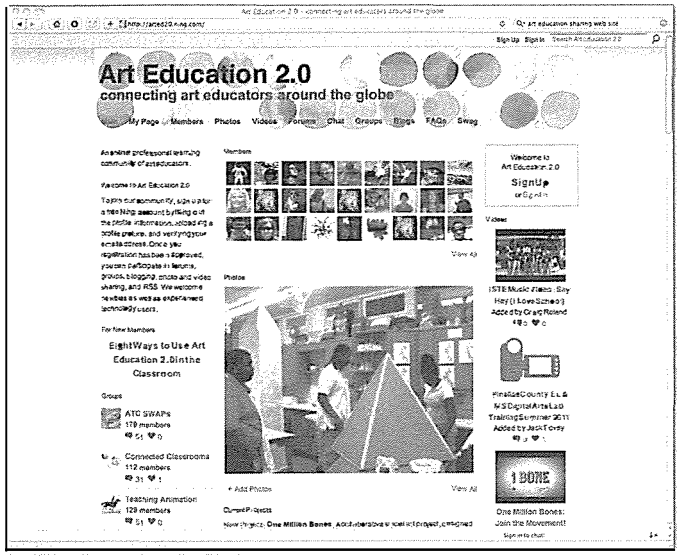
Virtual Field Trips to Art Museums

Many museums around the world have sites that allow a virtual tour through the museum. Although clearly this is not the same as viewing the works in person, virtual tours offer a way for students to explore and experience masterworks. With the development of new 3-D imagery, many museums are exploring ways in which this technology can be used to provide virtual visitors with a more compelling, visceral experience by creating illusions that make the tour, as well as museum artifacts, seem even more realistic (Steinbach, 2011). To support classroom learning, some museum sites even make their server available for students to post their own creations and to learn to create art using a certain medium like papier maché, batik, or origami. These sites also can be the basis for multicultural "field trips" to gather examples of art and music from around the world (Risinger, 2010). When using the Internet for arts instruction, it is important to remember that the images are reproductions; students will need to be made aware of the idea of scale and be reminded that they need to keep in mind the limitations of digital imagery. Check out the Hot Topic Debate feature for this chapter related to virtual field trips. Can a virtual tour of a museum supplant the actual museum field trip?

Creating Movies as an Art Form

Students can now make short or full-length digital movies with software that often comes with the computer. For example, Macintosh computers come with iMovie, and Windows computers come with Windows Live Movie Maker, both of which allow students to produce their own creative works using images, digital video, and sound for the purpose of reports, assignments, and entertainment. These movies can be shared across platforms by saving them in universal

FIGURE 13.1 Collaboration Opportunities for Arts Educators



Attribution CC by Craig Roland 2011. Some Rights Reserved.

formats. When combined with technologies for capturing images such as digital cameras and scanners, and when students accompany visuals with sound, this relatively easy-to-use type of software can assist in producing powerful demonstrations of students' work.

Sharing Students' Creative and Research Works

Through electronic publishing, videos, and presentation software, students can share their art creations with others (see Figure 13.1). Portfolios have long been a way for art students to demonstrate their achievements and abilities, and electronic portfolios are a natural extension of this strategy. Students can create PowerPoint presentations, videos, electronic books, blogs, and websites to show their research and creative work. Artists' books can be created and printed using desktop publishing and color inkjet printers. For higher quality output, students might use paid services that create photo books and projects, such as Shutterfly, Picasa, or iPhoto.

TECHNOLOGY LEARNING CHECK

Complete TLC 13.5 to review what you have learned from this section about strategies for integrating technology into art education.

TEACHING MUSIC AND ART TEACHERS TO INTEGRATE TECHNOLOGY

This section gives recommendations for how teachers can prepare to integrate technology effectively into instruction for music and art learning. Although the Common Core State Standards (CCSS) did not specifically address standards for arts education and K–12 funding for the arts has often been channeled to CCSS subjects, several efforts have focused on aligning CCSS with the arts so that both may be addressed. The College Board released a report entitled *The Arts and the Common Core: A Review of Connections Between the Common Core State Standards and the National Core Arts Standards Conceptual Framework* (2012). Also, the National Coalition for Core Arts Standards (NCCAS) is a group of educators and organizations who seek to document the connection between CCSS and arts standards. The NCCAS website calls for teachers to "integrate new technology in ways that truly engage and energize learners" as part of the mission to align CCSS and the arts. For teachers, the challenge is to explore the intersection between CCSS, arts standards, and technology and prepare to teach in ways that combine them most effectively.

Rubric to Measure Teacher Growth in Music and Art Technology Integration

Begin by reviewing the rubric in Figure 13.2 or Figure 13.3 to measure teachers' progress in effectively integrating technology in music and art instruction. Part I of each rubric addresses knowledge of issues and challenges, and Part II addresses music and art technology integration strategies.

FIGURE 13.2 Rubric to Measure Teacher Growth in Technology Integration for Music Instruction

Part I: Teacher Knowledge of Music Issues and Challenges			
	Basic knowledge (1–2 points)	**Intermediate knowledge (3–4 points)**	**Advanced knowledge (4–5 points)**
A changing definition for music literacy	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
Training teachers to meet music standards	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
Downloading of music illegally	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
The intersection of popular music, technology, and music instruction	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
The music director as small business administrator	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
Part II: Teachers' Technology Integration Strategies for Music Instruction			
	Basic knowledge (1–2 points)	**Intermediate knowledge (3–4 points)**	**Advanced knowledge (4–5 points)**
Support for music composition and production	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Support for music performance	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Support for self-paced learning and practice	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Support for teaching music history	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Support for interdisciplinary strategies	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Total points	_____	**of 50 possible points**	

FIGURE 13.3 Rubric to Measure Teacher Growth in Technology Integration for Art Instruction

Part I: Teacher Knowledge of Art Issues and Challenges			
	Basic knowledge (1–2 points)	**Intermediate knowledge (3–4 points)**	**Advanced knowledge (4–5 points)**
Funding for art instruction	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
Ethical issues associated with the use of images and other materials	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
Accessing images used in art instruction	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
The challenge of meeting standards in arts instruction	I can articulate the nature of the issue.	I can both articulate the nature of the issue and some of the possible ways to address it.	I can articulate my own plan for addressing the issue in my own teaching.
Part II: Teachers' Technology Integration Strategies for Art Instruction			
	Basic knowledge (1–2 points)	**Intermediate knowledge (3–4 points)**	**Advanced knowledge (4–5 points)**
Accessing art examples for classroom use	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Using teaching examples and materials	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Producing and manipulating digitized images	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Supporting graphic design and 3-D modeling	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Supporting student development of publications	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Virtual field trips to art museums	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.

(*Continued*)

FIGURE 13.3 Rubric to Measure Teacher Growth in Technology Integration for Art Instruction (continued)

Part II: Teachers' Technology Integration Strategies for Art Instruction			
	Basic knowledge (1–2 points)	**Intermediate knowledge (3–4 points)**	**Advanced knowledge (4–5 points)**
Creating movies as an art form	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Sharing students' creative and research works	I can describe the strategies and identify technologies to carry them out.	I have designed at least 1–2 activities based on these strategies to enhance my teaching and my students' learning.	I have designed plans for how I will integrate these strategies throughout my curriculum to enhance my teaching and my students' learning.
Total points	_____ **of 60 possible points**		

Learning the Issues and Applications

The first step in technology integration is to become acquainted with the issues and challenges discussed in this chapter and how they shape teachers' uses and applications of technologies. Then teachers can begin developing capabilities to address instructional standards and curriculum goals. The following is a suggested sequence of learning activities.

1. **Issues and challenges in music and art instruction.** After reviewing the information in this chapter, go to the website of the music and art professional organizations. For music, visit the National Association for Music Education (NAfME) and the Technology in Music Education (TI:ME) sites; for art, visit the National Arts Education Association (NAEC) and the ArtsEdge section of the Kennedy Center website. Review the standards at both sites. See professional development resources the sites offer, and decide on which can help you gain insight into the issues and challenges outlined in this chapter. Discuss and reflect on the two questions under the Collaborate, Discuss, Reflect feature at the end of the chapter. Complete Part I of the rubric in Figure 13.2 or Figure 13.3 before you begin this sequence and again at various points in your progress.
2. **Music and art technology integration strategies.** After reviewing the information in this chapter, review examples of the technologies suggested in the Open Source Options feature and the websites and projects described under each section, and do the lesson evaluation and lesson development activities outlined in the Technology Integration Workshop at the end of this chapter. Reflect on how you will plan for implementing these strategies in your own classroom using the TIP model. Complete Part I of the rubric in Figure 13.2 or Figure 13.3 before you begin this sequence and again at various points in your progress.

TECHNOLOGY LEARNING CHECK

Complete TLC 13.6 to review what you have learned from this section about how music and art teachers can develop their knowledge and skills in technology integration.

COLLABORATE, DISCUSS, REFLECT

The following questions may be used either for in-class, small-group discussions or may be used to initiate discussions in blogs or online discussion boards:

1. Digital rights management (DRM) is a term used to describe the use of technologies that limit what a person can do with downloaded content after they buy it. DRM prevents users from copying, printing, and altering the content or saving it to other formats. Music distributors maintain that DRM is necessary in order to fight copyright infringement and help copyright holders maintain artistic control and ensure they make money from future purchases. However, many people object to DRM, saying that they should have the right to do what they want with content they have legitimately purchased. Research the opinions on each side of this controversy and identify arguments that can be made for each side. How would DRM affect music teachers and their students?

2. Using software to manipulate images has long been possible, but it is becoming increasingly problematic in a number of settings. In his 2008 article "Journals Find Many Images in Research Are Faked," Young reported an upsurge in the number of research reports with doctored images. The 2013 World Press Photo of the Year, an image of a burial in Gaza, was denounced as being a composite of several images. However, the *Huffington Post* reported that after careful examination by a team of experts, it was concluded that the photo was "real." The photographer told the *Huffington Post* that the photo was not a composite, but that he had used software to improve its quality. What does it mean to "photoshop" an image? What guidelines should students be taught about how someone should and should not be able to use technology to alter a photograph presented to the public?

Chapter 13

Summary

The following is a summary of the main points covered in this chapter.

1. **A Rationale for Teaching Arts in the Information Age.** Four parts of the justification for including art and music in school curriculum are: expanded modes of expression; literacies for an information age; creative approaches to modern problems; and arts as aesthetic balance.

2. **Issues and challenges in Music Instruction.** These include issues such as the changing definition for music literacy; the need to train teachers to meet music standards; problems with illegal downloading of music; the intersection of popular music, technology, and music instruction; and the music director as small business administrator.

3. **Integration Strategies for Music Education.** Strategies include:
   - Support for music composition and production through using sequencers, notation, and vocal processing software.
   - Support for music performance with notation software.
   - Support for self-paced learning and practice with instructional software to help students learn new skills (tutorials) or practice skills introduced by a teacher (drill and practice).
   - Support for teaching music history with online databases, electronic books, online journals, archived and current newspaper articles, audio and MIDI files, video clips, out-of-print books, and online discussion groups.
   - Support for interdisciplinary strategies through multimedia-based research projects, creating music or video footage of school events, and the study of the science of music.

4. **Issues and challenges in Art Instruction.** These include issues such as funding for art instruction, ethical issues associated with the use of images and other materials, issues involved in accessing images used in art instruction, and the challenge of meeting standards in arts instruction.

5. **Integration Strategies for Art Instruction.** Strategies include:
   - Accessing online art examples for classroom use.
   - Using teaching examples and materials in presentation software.
   - Producing and manipulating digitized images with software.
   - Supporting graphic design and 3-D modeling with animal and image manipulation software.
   - Supporting student development of publications.

- Virtual field trips to art museums.
- Creating movies as an art form with digital cameras movie-editing software.
- Sharing students' creative and research works in various online formats.

6. Teaching Music and Art Teachers to Integrate Technology. Teachers can begin by consulting the rubrics provided in this chapter to measure their own growth in music and art technology integration. After that, they may review issues and challenges in music and art instruction and use chapter resources to learn technology integration strategies they can use to address the issues and challenges.

TECHNOLOGY INTEGRATION WORKSHOP

1. APPLY WHAT YOU LEARNED

To apply the concepts and skills you've read about throughout this chapter, go to the Chapter 13 Technology Application Activity.

2. TECHNOLOGY INTEGRATION LESSON PLANNING: PART 1—EVALUATING AND CREATING LESSON PLANS

Complete the following exercise using the sample lesson plans found on any lesson planning site that you find on the Internet.

a. Locate lesson ideas—Identify three lesson plans that focus on any of the tools or strategies you learned about in this chapter. For example:
- Using sequencers and software for music composition and production, music performance, self-paced learning and practice, teaching music history, or interdisciplinary strategies.
- Accessing art examples for classroom use, using teaching examples and materials, producing and manipulating digitized images, supporting graphic design and 3-D modeling, supporting desktop publishing with graphics, taking virtual field trips to art museums, creating movies as an art form, and sharing students' creative and research works.

b. Evaluate the lessons—Use the Technology Lesson Plan Evaluation Checklist to evaluate each of the lessons you found.

c. Create your own lesson—After you have reviewed and evaluated some sample lessons, create one of your own using a lesson plan format of your choice (or one your instructor gives you). Be sure the lesson focuses on one of the technologies or strategies discussed in this chapter.

3. TECHNOLOGY INTEGRATION LESSON PLANNING: PART 2—IMPLEMENTING THE TIP MODEL

Review how to implement the TIP model in your classroom by doing the following activities with the lesson you created in the Technology Integration Lesson Planning exercise above.

a. Describe the Phase 1—Planning activities you would do to use this lesson in your classroom:
- What is the relative advantage of using the technology(ies) in this lesson?
- Do you have resources and skills you need to carry it out?

b. Describe the Phase 2—Implementation activities you would do to use this lesson in your classroom:

- What are the objectives of the lesson plan?
- How will you assess your students' accomplishment of the objectives?
- What integration strategies are used in this lesson plan?
- How would you prepare the learning environment?

c. Describe the Phase 3—Evaluation/Revision activities you would do to use this lesson in your classroom: What strategies and/or instruments would you use to evaluate the success of this lesson in your classroom in order to determine revision needs?

d. Add lesson descriptors—Create descriptors for your new lesson (e.g., grade level, content and topic areas, technologies used, ISTE standards, 21st Century Learning standards).

e. Save your new lesson—Save your lesson plan with all its descriptors and TIP model notes.

4. FOR YOUR TEACHING PORTFOLIO

Add the following to your Teaching Portfolio:

- Reflections on Hot Topic Debate.
- Summary notes from the Collaborate, Discuss, Reflect activity.
- Lesson plan evaluations, lesson plans, and products you created above.
- Your *Apply What You Learned* Product from Activity 1.