CHAPTER 5

Music

Music Games in Education

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Key Summary Points

1. The greatest challenge music educators face is to translate young people's innate enjoyment of music into sustained interest and focus in the classroom. Even when students are fortunate enough to have access to music education, many disengage, and many abandon formal musical study entirely (Mota, 2013).

2. Common reasons for children and teens to become discouraged by music classes or lessons include a steep technical barrier to entry requiring many hours of practice to overcome, the fact that classroom music is typically socially or culturally inauthentic and unfamiliar, and the stress and anxiety of performance.

3. There are three major types of music games: drill-and-skill, rhythm games, and music toys. Each has its pros and cons for learning music.

Key Terms

DAW
Electronic music
Generative music
MIDI
Notation software
Remix
Sequencer
Win condition

Introduction

Games hold promise for the teaching of music due to their accessibility and ability to engage the player. It remains to be seen how much of this promise will be realized. Koops & Taggart (2011) define "work" as a means toward accomplishment, and "play" as a means toward personal physical, emotional, or cognitive well-being. It is no accident games and music share the verb "to play." Work is necessary to master the basic skills that enable musical play, as it is in any creative undertaking. Music games show their strongest educational potential when they make the work feel like play as well (Dillon, 2007).

Among American high school students who have access to elective music classes, only five percent choose to take them (Lowe, 2012). Nearly all young people like music, so why do they abandon its study in such overwhelming numbers?

Harwood & Marsh (2012) observe that traditional music education asks students to perform two challenging learning tasks at the same time: 1) they must learn unfamiliar repertoire, and 2) they must do so using unfamiliar tools and techniques. The technical and notational barriers to entry discourage some beginners. Others find it difficult to relate to the music they are learning. Still others are stymied by the combination of both factors.

Music games can ease some of the pedagogical burden, both in their content and their delivery methods. The game format is generally familiar and appealing to young people. Commercial games such as the *Rock Band* series use recognizable pop and rock songs—material students are more likely to find personally meaningful (see Case Study One). Games can give even novice players a taste of the excitement of performing, a feeling that is normally only available only to very adept musicians.

Beginner-level music students must simultaneously learn (1) music concepts, (2) the notation system encoding those concepts, and (3) the instrumental or vocal techniques necessary to translate the symbols into sound. How useful are games for each of these three tasks?

Most games explicitly aimed at the educational market, so-called "drill-and-skill" games, recreate traditional classroom activities in the computer: reading and writing notation, identifying intervals and scales, and the like. Such tasks are extrinsically motivated, since students typically play the games at the behest of a teacher or parent, and/or as part of or in addition to structured music lessons. Drill-and-skill games have a significant advantage over pencil-and-paper methods because they offer instant feedback, both sonic and visual. Rather than having to wait for a teacher to correct the assignment, students find out instantly whether they have marked a note correctly. Furthermore, students can match notation to sounds without having to simultaneously struggle with instrument mechanics.

Games can help with the learning of music concepts through the use of novel interactive visualization systems. Wilkie, Holland, & Mulholland (2010) demonstrate that the most effective metaphors for aiding in musical understanding are tangible and bodily. Chords and keys are "containers" for notes. Repetitive

patterns are cycles. Pitch is a vertical ladder. A consonant note is "in the center," while a dissonant one is "at the periphery." A song is a narrative, beginning at a "source," moving along a "path" toward a "goal." The best music games use such metaphors to create intuitive mappings between sound and image. For example, the *Rock Band* series represents musical time as a road or track, along which you travel in the first person. Such visualizations can create an intuitive musical understanding that paves the way for learning traditional notation and instrumental skills.

Most games do not teach instrumental or vocal techniques directly. Instrument simulation games such as the *Rock Band* and *Guitar Hero* series are roundly criticized for simplifying and misrepresenting real instruments, and their players are derided as not being "real musicians" (Miller, 2009). *Rock Band 3* is a rare exception in that it attempts to teach actual instrument technique (see Case Study One).

Most mainstream commercial music games center around rhythm, rather than pitch, timbre, or other aspects of music. In rhythm games, you move or press controls in sync to a song, following onscreen notation, often using a specialized controller. Rhythm games fall into several subgenres:

1. **Dance games:** *Dance Dance Revolution, Let's Dance*
2. **Instrument simulations:** *Rock Band, Guitar Hero, Donkey Konga*
3. **Singing games:** *Karaoke Revolution, SingStar*
4. **More abstract games:** *FreQuency, VibRibbon, Rez*

There is a category of experimental music games that are more properly called "music toys," open-ended generative systems in which the player interacts improvisationally with a semi-autonomous synthesis system. Examples include *SimTunes, Electroplankton, Wii Music, Nodebeat,* and *Bloom*. The iPad and iPhone are particularly congenial platforms for music toys. While these programs superficially resemble games in their presentation, they generally do not have a competitive aspect *per se*, and are more like musical instruments.

Case Study One: Rock Band 3

Rock Band 3 was released in 2010 by Harmonix Music Systems for the Xbox 360, PlayStation 3, Wii, and Nintendo DS. As with previous titles in the series, *Rock Band 3* enables you to "play" rock and pop songs while using special controllers mimicking guitar, bass, and drums. Unlike the previous two games, *Rock Band 3* includes a keyboard controller. Players can also sing three-part vocal harmonies. The game includes thousands of songs and can be played by up to seven people at a time.

Critics of rhythm games complain that players are not learning actual, transferable music skills. Harmonix addressed that criticism with *Rock Band 3*'s novel Pro Mode. In place of the usual simplified abstractions, Pro Mode aims to teach players the actual instrumental parts on more realistic controllers. For example, Fender sells a real guitar with custom electronics to use with Pro Mode—not only is it a fully functional MIDI controller, but it can sense the location of the player's fingers to give nuanced feedback. Pro Mode has an easy level that offers simplified versions of songs, similar to the abstractions in previous *Guitar Hero* titles. As the player advances, the complexity increases and the transcriptions become more complete.

Rock Band 3 also includes tutorials on technique and music theory developed by experts from the Berklee College of Music, though these are somewhat perfunctory. More intriguing is Practice Mode, which slows down songs and allows the player to loop specific sections. The game's designers needed a notation system that anyone could learn to sight-read. Their solution is what they describe as "a Montessori approach," a graphical tablature showing chord fingerings as modular shapes. This enables the game to teach actual songs first, introducing theory only optionally, if at all—a strategy used by many self-taught guitarists (Booth & Dubrofsky, 2011).

There is not much data on the effectiveness of *Rock Band 3* in the music classroom. Cassidy & Paisley (2013) found that the game promotes flow and invites disciplined and constructive engagement. They did not explicitly measure gains in musical skill, however. Peppler, Downton, Lindsay & Hay (2011) conducted a study of 26 children in an afterschool club, with a hypothesis that the subjects would measurably improve their music skills. The authors' argument in favor of *Rock Band 3* as a teaching tool centers not on Pro Mode, but on the in-game notation system. They see the game's value not in its teaching of instrument mechanics, but in its interactive visualization of music theory and song structure. The results of their study were inconclusive, but did show some improvement in participants' rhythm and reading skills.

Schultz (2008) observes that, like the MIDI piano roll, rhythm games are interactive graphical scores. They connect visual abstractions to sound in an intuitive way, showing particular ingenuity in the Z-axis "driving mode" representation of musical time. Furthermore, rhythm games give crucial real-time feedback: failing to hit a note correctly both sets off an animated visual response and causes the player's instrument to temporarily drop out of the mix. Peppler et al. (2011) observe that, "This dynamic feedback is rarely afforded to musicians outside of gameplay, who must be told by someone with more

experience (usually a parent, bandmate or teacher) if what they played was contrary to what was written on the page" (p. 6).

Rhythm game notation shares some key features with traditional music notation, including models of metric hierarchy, subdivision, measurement and pattern identification. The beginner-level notation shows only the most structurally important events in each phrase, using an abstraction system similar to the reductions performed by music theorists when analyzing a piece. In spite of its simplicity, the notation still retains the song's overall melodic contour.

Rock Band benefits music students by enabling them to study culturally authentic material directly from recordings, as popular musicians do in actual practice. The visual notation adds considerable value to such aural learning: "[E]ven those trained in formal notational systems report hearing new elements in the music through this activity than from score-reading or listening, alone" (Peppler et al., 2011, p. 5). Furthermore, every Rock Band session is a performance. In this sense, it may be a more "realistic" music experience than the decontextualized pieces and exercises in music class. Much more research is needed on whether the pleasure of *Rock Band 3* translates to the learning of transferable musical skills.

Key Frameworks

Games can address several of the obstacles to music learning listed above in the introduction. Students' frustration with too-difficult or too-simple tasks can be addressed with multiple difficulty levels and self-pacing. Well-designed games offer individually calibrated challenges, carefully matching the player's ability to steadily escalating challenges. While failure in music performance is embarrassing and frustrating, Tobias (2012) observes that, in games, "Failure is designed to encourage players to determine better solutions to a given problem and allows for multiple opportunities to reach a particular goal" (p. 5).

Performance anxiety is a powerful obstacle to music learning. Games can assuage this anxiety by providing opportunities for private virtual performance. Students who are too shy to perform for peers can engage with music in the safety of their bedrooms or headphones.

Most overtly educational music games use the same sorts of artificial melodies found in traditional teaching materials. By contrast, pop-oriented commercial games use material that young people are familiar with and enjoy. More importantly, the games enable players to learn aurally from recordings as well as from notation. Recordings can act as expert peers or virtual master teachers. A desire to imitate pop stars can motivate young people, particularly teenagers, to perform disciplined study.

Ideally, music class should be a genuine community of learning that speaks to students' musical selves. Students often express social solidarity with each other by resisting music class, whereas social solidarity could, instead, encourage other's to further engage with music class. Green (2002) argues that the Eurocentric basis of traditional music education is incompatible with students' enculturation. She proposes integrating the following informal, pop-oriented pedagogical practices into formal music education for young students:

1. Allowing learners to choose the music.
2. Learning by listening to and copying recordings.
3. Learning in friendship groups with minimal adult guidance.
4. Learning in personal, haphazard ways.
5. Integrating listening, playing, singing, improvising, and composing.

Music games support these practices to varying extents.

Well-designed games create engagement by promoting a flow state, a total absorption that makes the player gratifyingly oblivious to anything else. Good musical experiences also involve flow states, and music classes are most effective when they foster flow. There are five elements necessary to bring about flow states (Csíkszentmihályi, 2009):

1. Immediate feedback contributing to a balance between skill and challenge;
2. Merged action and awareness, completely occupying students' attention;
3. Deep, sustained concentration;
4. Control of the situation, and the freedom to generate possibilities; and
5. Loss of self-consciousness.

The single strongest rationale for including games in the music classroom is their self-motivating, flow-promoting quality. Ideally, a student who experiences flow brought on by self-motivated disciplined practice in the game context will be inspired to pursue the same state in other contexts (Dillon, 2007). Challenge is a strong motivation for learning when the student has a commensurate skill level. Well-designed games promote flow by continually adjusting their difficulty level to meet the player's present state of understanding. Rhythm games have an additional quality that strongly promotes flow, which is that they involve physical activity (Custodero, 2002).

Music games have a major limitation in their flow-inducing capabilities: they typically give the player little control over the music being produced. Music toys are the exception; their purpose is to foster expressiveness, and they enable even complete novices to exercise control and implement their own ideas.

Case Study Two: *iGotGame*

The major shortcoming of both drill-and-skill games and rhythm games is the absence of improvisation. The player moves through the song like a train on a track, and the games penalize any variation from the prescribed notes. Not all real-life music is improvisational either, but there is usually some element of personal expressiveness. Not so in music games—mimicry is the only way to play. Rosenstock (2010) recognized this shortcoming, and devised a game to try to address it. Working with students at the Worcester Polytechnic Institute, he developed *iGotBand*, an experimental rhythm game that incorporates improvisation. While the basic gameplay follows the *Rock Band* model, you need not reproduce the given note sequences exactly; you are free to use any rhythm and you can interject notes of your choosing.

Rosenstock's game is an admirable attempt at incorporating improvisation into a music game, but he fails to address some basic problems. The improvisation in *iGotGame* has no bearing on the player's success or failure. This makes it a nice but meaningless feature. Rosenstock readily admits this to be a problem, and his discussion of the issue is enlightening. Games and music share the verb "to play," but in both domains, the word has several distinct meanings. Rosenstock introduces the term *paidia*, meaning childlike play: spontaneous and unruly. The musical equivalent would be freeform jazz, or generative music toys. By contrast, there is play as *ludus*: games with ordered rules and a win condition, such as chess or basketball (and indeed, nearly all video games.) The musical equivalent of *ludus* is classical composition and more formally-bound jazz styles such as bebop.

Like most other rhythm games, *iGotBand* is an example of *ludus*. The improvisational aspect is a dash of *paidia*, but it has no bearing on the win condition, and therefore is not intrinsic to the experience. In fairness to Rosenstock, it is difficult to imagine how one could possibly devise an unambiguous system of rules for judging improvisation. Rosenstock attempts to address this problem by suggesting that players vote on the quality of others' improvisation. This merely defers the issue, however; there is still no rule-based system for making judgments beyond whatever arbitrary criteria players would use for voting.

Improvisation might superficially resemble a game, but Rosenstock inadvertently demonstrates how fundamentally incompatible it is with a win condition. Music toys with game-like interfaces can potentially serve the goal of expressiveness much better than perhaps games can; more research should be conducted to tease out this relationship.

Key Findings

Ruthmann (2006) lists three goals that music education technology should meet. They include:

1. Broadening participation;
2. Enabling greater musical creativity through improvisation; and
3. The widespread teaching of music composition.

Rhythm games have been shown to inspire broader participation in "real music" (Miller, 2009; Peppler et al., 2011). Some games offer composition tools, though these are usually limited. Most games actively work against improvisation (see Case Study Two).

Egenfeldt-Nielsen (2007) uses the term "edutainment" to describe games explicitly designed for educational use, with *Math Blaster!* as his canonical example. He takes a dim view of such titles, for two reasons: the educational content is frequently disconnected from the game elements, and the in-game learning is typically rote, resulting in weak skill transfer. A meta-study of the effectiveness of such edutainment titles showed that while they do work, there is no reliable evidence they perform better (or worse) than any other learning method (Egenfeldt-Nielsen, 2007). Nevertheless, music teachers and parents have embraced drill-and-skill games, perhaps because of their similarity to traditional curriculum materials.

Commercial rhythm games such as *Rock Band* and *Guitar Hero* are the source of considerable controversy. These games certainly require (and inspire) a great deal of disciplined practice. But are players really learning music? Ruthmann (2006) argues that the best curriculum activities derive from real-world activities, ideally retaining the essential values of the original. The objects and operations of the adapted activity should be genuine instances of the original activity, however simplified. By this logic, rhythm games should be very valuable for educators. Many musicians and teachers, however, criticize simplified game controllers that do not realistically represent actual instruments. For example, while the drum kits in *Rock Band* and *Guitar Hero* games correspond somewhat closely to real drum kits, the pads are simply on-off controllers with no dynamics or expression.

As of this writing, there has been little research on how well rhythm games teach traditional music skills and theory. Some early research points to the games' effectiveness (Peppler et al., 2011). Other studies, however, show improvement only in tracking the kinds of visual prompts used in the game notation. Richardson & Kim (2011) explain: "Repeated play of these games may create some form of musical rehearsal, but their non-literal and varying performance mappings are arguably removed from or even counter-productive to both the rehearsal of the specific music approximated and the general practices of traditional music education" (p. 278).

On the other hand, Richardson & Kim's study of student experience of rhythm games includes some anecdotes that reveal the games' unexpected educational benefits. For example, one of their subjects cites the games' power to reduce anxiety: "I have never sung in front of anyone before, but this was the

best way to do it, I guess, because everyone was watching the screen" (Richardson & Kim, 2011, p. 288). The games also encourage close and active listening. Another participant comments, "I'd never listened to music in layers like that" (Richardson & Kim, 2011, p. 288). Such close study of "real-world" recordings is invaluable for situating the notes on the page in a meaningful context (Green, 2002).

In their analysis of the *Rock Band* series and *SingStar*, Gower & McDowall (2012) observe that these games have a major advantage over traditional music education for teaching pitch and rhythm: the games give real-time auditory and visual feedback. Each note played or sung prompts an immediate graphical and sonic event informing the player whether it was right or wrong. Such continual and granular performance assessment would be difficult to deliver any other way. Even in one-on-one private instruction, a teacher cannot readily react to every individual note in the moment.

Beyond their musical value, the aforementioned popular music games are also excellent tools for engaging with the cultural history of popular music (Gower & McDowall, 2012). For example, the *Rock Band* series' library comprises of thousands of songs spanning five decades. Furthermore, the games themselves are potential objects of rich study. The graphical avatars can provoke conversation about gender and cultural stereotypes in music and its pop cultural presentation (Tobias, 2012). The games can also act as a springboard for a more general philosophical discussion of the nature of music performance and authenticity in virtual contexts (Miller, 2009).

Smith (2004) observes that "playing [rhythm] games can feel like a genuinely musical experience: the controller is no longer a trigger but a percussion instrument, and the player stops thinking in terms of locking on targets and instead tries to feel the groove" (p. 65). Smith (2004), however, is concerned that players have little agency in the game, since they are restricted to preprogrammed button presses triggering preprogrammed sounds: "The pleasure of agency in electronic environments is often confused with the mere ability to move a joystick or click on a mouse. But activity alone is not agency" (p. 61). The *Rock Band* and *Guitar Hero* games do have special modes allowing remixing of their content or the creation of new playable songs. These systems are more limited than full-blown music production software, but for that reason, they are also more accessible to novices.

Creativity has entered one music game through an unexpected vector. *Dance Dance Revolution (DDR)* was born in the arcades of Japan and from its inception was a spectator sport or a performance for a real-world audience. The performance aspect of *DDR* has taken on a life of its own with the practice of "freestyling"—dancing while facing away from the screen and toward the crowd, incorporating upper-body moves that have no bearing on the game (Smith, 2004). To pull this off, freestylers must memorize the steps to songs and then how to do them backward so that they can turn and face the crowd. The home version of *DDR* subsequently turned freestyling into an official game feature by adding a mirror mode that turns the steps backward.

Assessment Considerations

Drill-and-skill games aim to transfer concrete musical skills like notation, ear training, and transcription. It is a straightforward matter to assess student progress in this context: either they do the exercises correctly or they do not. By contrast, student work with music toys defies easy assessment. These titles are intrinsically open-ended and expressive, so there is no obvious way to gauge "successful" or "unsuccessful" usage. It is better to consider music games as new instruments, rather than as exercises or games, per se. We can judge a music toy based on how discoverable its rules are, and by the depth and quality of its generative output.

Rhythm games pose the greatest challenges for assessment. On the one hand, they have clear win conditions and internal scoring systems. On the other hand, the game objectives may not map onto the curriculum easily, or at all. One approach to assessment is to evaluate players' expressiveness within the games, as we would with music toys. We might also examine players' mastery of skills and knowledge that generalize into other musical settings.

Future Needs

Teachers may well appreciate the engaging, flow-promoting qualities of rhythm games, but wish that they included other forms of music. Smith (2004) cites one of the rare classical music rhythm games, *Mad Maestro*, first released in 2001 for the PlayStation 2. The gameplay follows the *Rock Band* model, but with the player "conducting" an orchestra playing the classical greatest hits: *The Marriage of Figaro, Swan Lake, Pictures at an Exhibition,* and so on.

We might imagine *Conductor Hero,* in which you use a motion controller to conduct different world-class ensembles, starting with small chamber works and progressing through large-scale symphonies. Such a game, however, is not likely to emerge from the marketplace anytime soon. A satirical article in *The Onion* (2007) illustrates the challenges:

Activision Reports Sluggish Sales For Sousaphone Hero

> In the wake of *Guitar Hero*'s success, we thought the public was more than ready for additional popular American musical genres in a simulated-performance format, but people don't seem to be responding to marches as well as we had hoped…If you score enough points, you can unlock the ultimate level: playing in the John Philip Sousa–led Marine Band at Grover Cleveland's inauguration.
> (p. 1)

Educational and government organizations that wish to produce non-pop rhythm games with the level of polish and engagement found in commercial titles face two major obstacles: the considerable expense of developing complex multimedia software and custom controllers, and the expense and logistical complexity of licensing the music and musician likenesses.

Aside from the music toys, music games permit little or no creativity on the player's part. There are a few exceptions, however. Later titles in the Guitar Hero series have included GH Mix, a composition tool that enables you to create original music in the game environment. The controllers act as primitive MIDI instruments for sequencing notes into the game's "piano roll." Players can also record your own vocals. Songs created this way are fully playable within the game and can be shared with other players via the game's online network.

Harmonix has also created the *Rock Band Network,* a platform for translating original recordings into playable *Rock Band* songs using the audio editing software *Reaper* along with a special plug-in. These recordings need not be rock or pop songs. Tobias (2012) suggests that music teachers take advantage of this feature to expand the musical possibilities of the rhythm game format:

> Opportunities for students, whether in rock bands creating original music or brass quintets performing baroque works, to have their music played with controllers in a video game environment offer varied entry points into these musics and raise compelling questions about what it means to create, listen to, and perform music in this context. Whether deciding how to distribute brass quintet parts across the game controllers or visualizing the rhythms of an original riff, students' use of video games in the music classroom affords new ways of interacting with music from multiple viewpoints. The implications of creating, arranging, and playing Gabrieli on a plastic guitar controller or samba on rubber drums are yet to be seen. (p. 15)

Rather than waiting for *Conductor Hero* to be released, educators may be well advised to follow Tobias' suggestion to repurpose existing titles for their own purposes.

Case Study Three: *My Note Games!*

There are many drill-and-skill music games on the market. The state of the art is well represented by *My Note Games!*, released by Appatta Ltd for iOS in 2011. This app comprises several distinct games. The most basic and introductory exercises are free, and you can purchase upgrades to the full games within the app. Your score across all exercises is kept in the form of "Aural IQ," and the app uses this measure to calibrate difficulty levels. The games include:

1. ***Hear It, Note It!*** A transcription game: You hear a melody and use the game's notation editor to transcribe it. You can listen any number of times until you enter your first note, at which point you must write from memory. If the transcription is incorrect, the melody plays again and you can make corrections.
2. ***Tap That Note:*** You are shown a simple melody with a row of note names below it. You must tap the note names in the sequence they are written on the score. The game can be played in treble, bass, alto, or tenor clef. It tracks your timing as well as your note choices, though not very precisely. You have approximately one second per note, for an implicit minimum tempo of 60 beats per minute.
3. ***Play That Note:*** This game tests sight-reading ability. You play a short melody on your instrument into the built-in mic, and the game tracks your accuracy note-by-note. A variety of instruments are supported, and there is beta support for singing and whistling as well, though the pitch-tracking for the latter two works unevenly at best. The game requires you to keep your instrument in tune, and to that end, supplies a built-in tuner. Here, again, note durations are not very important, so long as you play faster than about 60 beats per minute.
4. ***Play-A-Day:*** This game involves a more demanding sight-reading exercise, which requires more exact timing. You are given eight melodies, and when you can play all of them correctly, you advance to the next eight. The melodies are generated randomly and are not exceptionally musical, which raises the issue of cultural authenticity.

As a delivery system for traditional classroom and homework exercises, *My Note Games!* are well-designed. The immediate feedback is gratifying, the self-pacing and automatic difficulty adjustments are conducive to learning, and the graphics are cheerful and colorful. As a game, however, the app leaves much to be desired. The musical content is dry and artificial, and any motivation is largely extrinsic. Appatta's website copy for *Play-A-Day* sums it up well: "Play it every day and show your teacher how fast you are progressing!" In other words, pleasing your teacher is your reason for playing, not the satisfaction of the game itself. Will students who do not already respond to traditional music pedagogy fare any better when the same content comes in the form of an iOS app? So far, there have been no rigorous empirical studies providing a satisfactory answer to this question (Egenfeldt-Nielsen, 2007).

Best Practices

1. **Encourage interaction with generative music systems.**
    a. Burnard (2012) encourages us to take a broad view of musical creativity in digital contexts. Games that are not centered on music can still offer opportunities for engagement and invention. As game soundtracks become more sophisticated and generative, players inadvertently collaborate with the composer and sound designer to produce the actual music coming out of the speakers.
    b. Burnard also praises the level creation system in *LittleBigPlanet*, which allows player/designers to add interactive music elements to their levels in the form of cartoon boomboxes. Electronic music blurs the line between sound design and composition, and interactive audio environments such as *LittleBigPlanet* give future musicians a taste of both practices.
2. **Avoid the blank canvas.**
    a. Ruthmann (2012) observers that traditional music creation software uses the metaphor of a blank canvas or void. It is intimidating for novices to have to fill an empty screen with notes, samples and loops. Music toys such as the networked collaborative performance program *jam2jam* (http://www.savetodisc.net/jam2jam/) start the user off with pre-existing sound and images to be manipulated.
    b. Even when music toys start with a blank canvas, they present a much lower barrier to entry than an empty *Garageband* session or Sibelius score. Apps such as *Bloom* or *Nodebeat* begin to produce musical sound in response to the most tentative or random user actions. With the music underway immediately, the user can then explore the parameters of the system through playful improvisation.
3. **Encourage play with non-game music tools.**
    a. The music toy *Singing Fingers* records and plays back sound through the visual metaphor of finger painting. You sing or make sounds while drawing on the screen, creating colorful lines. Once your drawing is complete, you can play back your sounds by retracing your lines. The sound is arrayed over the length of the line and can be scrubbed forward or backward at any speed. Ruthmann (2012) suggests drawing a staircase while singing a scale, so that each step of the staircase displays as a different color. Then students can recreate a melody by touching steps on the staircase, giving them a visceral connection between the sound and visual representation of pitches.
    b. Tools such as *Garageband* and *Sibelius* can be made more like music toys simply by pre-filling them with musical material. Rather than giving students an empty session or document, you might give them a dense block of existing music and challenge them to create something new through subtraction only.

c. Ruthmann (2012) suggests a playful use of *Google Translate:* making the software beatbox. By setting both the "From" and "To" languages to German, you can enter consonant groupings that the software speaks in a manner similar to beatbox sounds. Many adolescents love beatboxing, but they can be reluctant to do so in front of their peers, especially in a classroom setting. Letting *Google Translate* do the initial performing gives them a safe space to work out ideas, and even create full-fledged rhythm tracks.

4. **Motivate the creation of music games.**
   a. The most ambitious music educators can use the *Scratch* visual programming environment (http://scratch.mit.edu) to enable their students to create new music and multimedia, and even to generate your own music games. The *Scratch* companion site for teachers (http://scratched.media.mit.edu) offers free lesson plans and project ideas, including working code.

Resources

Book

McPherson, G. and Welch, G. (Eds.). *The Oxford Handbook of Music Education.* Oxford: Oxford University Press.

Games and Tools

There is a growing body of full-fledged music games and tools that run entirely within the web browser, with no additional software or hardware needed. Prominent examples include:

Soundation (http://soundation.com/) is not a game, but rather a digital audio workstation similar to *Garageband*. It is particularly useful for Windows-based environments.

jam2jam (http://www.jam2jam.com/) is a collaborative media performance tool that enables music and video remixing in real time over the internet.

PBS maintains a collection of browser games for children of preschool age (http://pbskids.org/games/music.html).

Websites

Dr. Alex Ruthmann's website (http://www.alexruthmann.com/blog1/): Collects a variety of resources, including several mentioned in the previous section.

The Experiencing Audio Research Group at NYU (http://experiencingaudio.org/): Studies and creates technologies and experiences for music making, learning, and engagement. They "collaborate with technology developers, educational agencies, teachers, students and musicians in the creation of solutions to real world music education challenges."

The *Rock Band 3* Pro Mode design process: Game designers may find inspiration here (http://www.rockbandaide.com/wp-content/uploads/2011/03/Jason_Booth_Sylvain_Dubrofsky_Design_Prototype_Through_Production.ppt).

The Everyday Play cluster on The New Everyday blog (http://mediacommons.futureofthebook.org/tne/pieces/everyday-play):
Curated by Sam Tobin, this a collection of mostly personal reflections on the role of play in daily life.

Scratch (http://scratch.mit.edu): A programming language for creating interactive music, multimedia and games. The website includes curriculum ideas and code examples.

Scratch lesson plans (http://scratched.media.mit.edu)

http://www.savetodisc.net/jam2jam/

Events

Music education hack days: Gatherings that bring together programmers, educators and musicians to quickly produce and present new projects in a casual environment. Past events have taken place in New York (http://musiceducationhack.splashthat.com/) and London (http://www.meetup.com/The-London-Educational-Games-Meetup-Group/).

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