INTEGRATING MUSIC TECHNOLOGY IN THE CLASSROOM: INCREASING CUSTOMIZATION FOR EVERY STUDENT

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As technology continues to develop, its applications become greater and more wide spread. Many schools and educational providers are implementing new technologies in the classroom to enhance learning. Effective technology integration can help meet each child's individual needs while allowing for a more customized learning experience. This is especially important in the music classroom as students often struggle with very specific issues and learn at varying paces.

In addition to encouraging a more individualized learning experience, the incorporation of technology can help teachers meet their teaching goals and set standards. The National Music Education Standards (MENC) detail nine standards that music teachers should strive to meet. According to these standards students should be able to:

1) Sing alone and with others
2) Perform on instruments
3) Improvise melodies
4) Compose and arrange music
5) Read and notate music
6) Listen to and describe music
7) Evaluate music and performances
8) Understand relationships between music and other disciplines
9) Understand music in relation to history and culture[1]

Music educator Thomas Rudolph points out that, "technology can serve all of the above areas to enhance learning."[2] He identifies the three educational settings where technology can be used: tutor, tool, and tutee. Incorporating technology into these three areas can provide students with more constructive feedback and personalized learning, helping to better meet curricular goals.

One of the difficulties music teachers face is their ability to give regular feedback to students. If a student is taking private music lessons, they likely meet with their instructor once a week. The bulk of the student's progress is therefore dependent on their daily, individual practice. In a group class or large ensemble there is even less one-on-one time with the teacher, making it more difficult for the teacher to give regular, personalized feedback. Often students are unsure of how to use their independent practice time most efficiently and may practice notes and rhythms incorrectly, thereby solidifying mistakes or bad habits. But now, with increased accessibility to technology and emerging dedicated apps for smartphones and tablets, there are many ways that technology can aid in assessing students' progress for both the teacher and the student, allowing for a more personalized learning environment.[3]

A specific application of technology in both the private or group music lesson is drill and

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[1] Joseph M. Pisano, "National Music Education Standards," *MusTech*, 2019, Accessed May 5, 2019, https://mustech.net/projects/music-ed-standards/.

[2] Thomas Rudolph, "Teaching Music with Technology," *GIA Publications*, 2004.

[3] Music Educator and member of the National Association for Music Education (NafME) Melissa Clark, provides many examples of ways to use

technology as an assessment tool in a music ensemble setting from using video chats, smart music, google classroom and online resources Melissa Clark, "Using Technology Tools for Assessment in the Ensemble Setting," *National Association for Music Education,* January 12, 2017, Accessed April 14, 2019, https://nafme.org/using-technology-tools-assessment-ensemble-setting/.

practice software, which can "provide a more persistent learning since it allows a drill and practice at desired level and desired amount."[4] The integration of technologies into music lessons can help students better understand specific musical skills, increase student motivation, assist in student assessment, and be used as a learning tool in composition. Of all the technologies available there are four main categories that are most suitable for musical education to enhance customized learning: apps, digital instruments, practice aid technology, and wearables.

Apps

There are many apps that exist with the purpose of reinforcing musical concepts through practice activities and repeated drills. They also provide immediate feedback to the student allowing them to better gauge their own understanding of material. Many apps use basic gamification to increase engagement and students are encouraged to keep learning to progress from one level to the next. Furthermore, apps effectively scaffold one unit to the next, allowing for students to learn at their own level, customizing their learning experience. This is especially useful if learning in a group, in either an in-school or after-school setting.

Note Rush is a popular app to reinforce note reading that can be used as an alternative to flashcards.[5] This can be a great tool to use in music lessons or for students to use at home. The app will
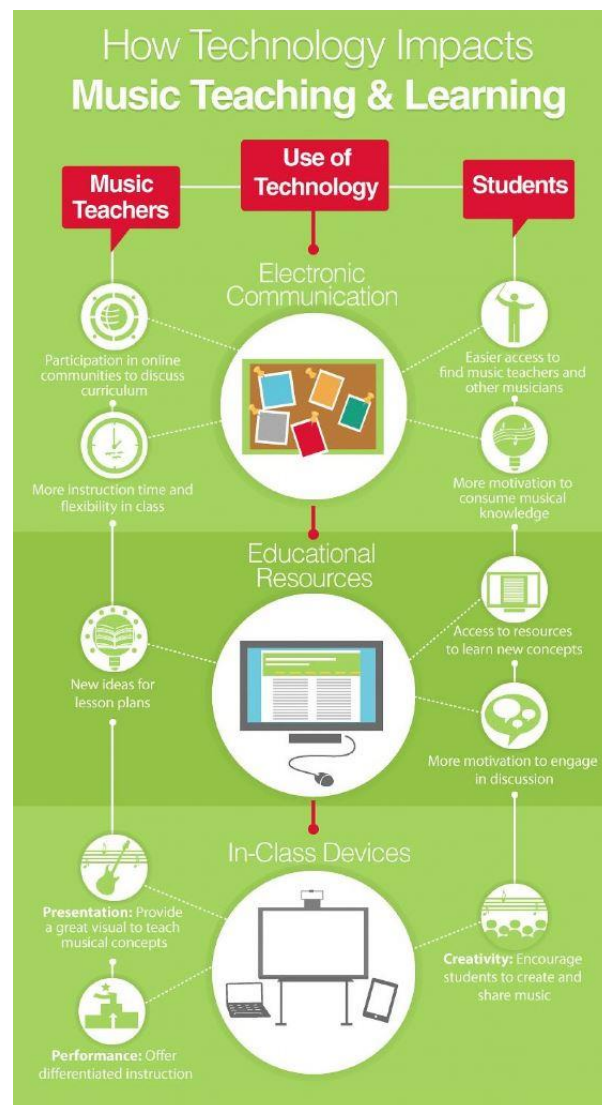

Figure 1: Infographic on the benefits of technological integration into music lesson. (Dunn)

display a note on the staff in a predetermined range that is set ahead of time and provides immediate feedback using a microphone and sound detection technology to determine whether the student is playing the correct note. Other similar apps are Flashnote Derby, Note

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[4] Sevan Nart. 2016. "Music Software in the Technology Integrated Music Education." *The Turkish Online Journal of Educational Technology* 15 (2): 7.

[5] "Note Rush - Learn to Read Music and Play Piano, Keyboard, Saxophone, Flute, Violin and More!" *Note Rush,* Accessed March 17, 2019, https://www.noterushapp.com/.

Perfect!, and Music Flash Class. There are also apps for supporting rhythm learning, such as Rhythm Lab, where students receive instant feedback after tapping a notated rhythm on the screen.[6]
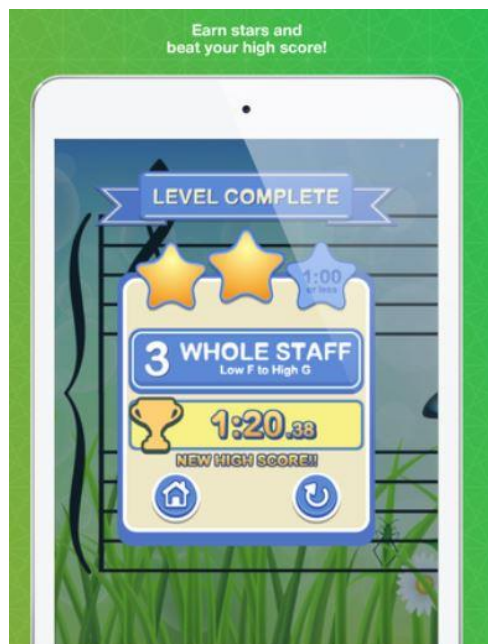

Figure 2: An achievement marker in the Note Rush app (Note Rush)

All these apps can be useful tools for a teacher to use in tracking a student's progress from week to week. These tools can be integrated into weekly assignments and planned practice sessions, where teachers can encourage students to reach a certain goal by the following lesson. Teachers can view progress in the student's app by checking the level they have achieved in their app history, or by doing an in-lesson assessment of the student using the app in the next lesson. Furthermore, these apps can allow for greater parental involvement in the assessment process as

parents do not need to have a musical background to track their child's progress. In a large music classroom, the integration of such apps allows the teacher to understand the level of learning of each student and assign specific practice activities to meet the student's individual need.

Digital Instruments

The emergence of affordable digital and electronic instruments is changing the landscape of music learning. Many have the capability of connecting to apps like Garage Band to heighten the music learning experience.[7] Music teacher Leigh Anne Roeber started a keyboard lab in her school using keyboards and iPads equipped with the Piano Maestro App.[8] Because the app is so self-explanatory, she attests to its practical application in the classroom. Teachers can use it as a tool to better assist each student and their individual needs without disrupting the rest of the class. Using the app with a digital keyboard allows students to evaluate their own learning and self-detect errors. Each level builds upon the last and can be used as a foundational tool before using other programs.

Roeber set up her keyboard lab using technology supported by Sound Tree, the educational division of Korg USA. In another project supported by Sound Tree, White Plains Middle School used the Korg Group Education Controller (GEC3) system to develop a different type of program called silent brass. Using this technology, students

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[6] Joy Morin, "Music Apps," *Color in my Piano,* Accessed April 1, 2019, https://colorinmypiano.com/music-apps/.

[7] "The GarageBand Guide," *GarageBand,* Accessed August 7, 2019, https://thegaragebandguide.com.
[8] "About," *Sound Tree,* Accessed April 14, 2019, http://www.soundtree.com/About.

can practice brass instruments on their own, at their own pace, while all in the same classroom. Matthew Velez, a student at White Plains Middle Schools, is a band student that has participated in silent brass and states that it is "better than playing in a group because you know what notes you got wrong and in a group you can't really concentrate."[9]

The number of digital instruments available is rapidly growing. Jamstick is a guitar midi controller that can be synced with a smart board to show students where their fingers go. This can be a useful tool for teaching guitar in a group setting, and can be used in addition to acoustic instruments. Arts Integration Specialist and music educator Shawna Longo states that "The Jamstick has allowed me to further differentiate my instruction and meet the needs of each of my students. Whether they are beginners or experienced guitar players, all of my students can successfully progress in learning the guitar at their own pace with instant feedback through the exercises that I assign to them."[10]

Figure 3: A student using Jamstick through his computer (Jamstick)

Practice Aid Technology

A sophisticated type of technology that is continually developing is the interactive music software called SmartMusic.[11] This program uses artificial intelligence to identify incorrect notes and rhythms in a student's playing and is changing the way students practice and personal assessment. Teachers can assign specific music for the student to practice by directly uploading music, or by specifying scores that are preloaded in the platform. Students can record themselves playing the piece directly through SmartMusic, which will follow the notated pitches and rhythms checking for errors. Any spots where they made an error will display while they are playing, thereby allowing for immediate assessment. There is also the option to send a recording directly to their teacher. Instructors can create individual exercises with a uniquely defined rubric which the student can complete and submit through the cloud for automatic grading. The program can teach aural skills and tonal memory through activities where students hear a passage and play it back on their instrument by ear. There are even exercises to practice improvisation and build understanding of chord patterns. The program is versatile and can aid in providing a well-rounded musical education experience for the student. Using SmartMusic, students can progress further in their weekly practice as it provides the tempo of a piece and allows them to hear the other ensemble parts when they are alone. They can speed the tempo up or down depending on their

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9 Ibid
10 "Education," *Jamstick¸* Accessed April 14, 2019, https://jamstik.com/pages/education.

11 "Music Practice Transformed," *SmartMusic,* Accessed April 1, 2019, https://www.smartmusic.com/.

ability, customizing it to fit their learning needs.

SmartMusic has many applications and has been used by both in-school music teachers and teaching artists. Furthermore, it appears to influence the time students spend practicing. Brian Nichols researched the impact of SmartMusic on student's practice and determined that using the technology does not impact the students' intrinsic motivation to practice but does affect the length of time spent. Those in the study spent more time practicing than the control group. Nichols recommends adding a feature to the program that incorporates social media so that it might build students' motivation to practice.[12] SmartMusic is continuing to develop, with new features and capabilities being added regularly. In the future there is great potential to use this as a tool to possibly increase students' motivation while providing more accurate and detailed feedback.

Another emergent program similar to SmartMusic is Tonara, which can be used by private and K-12 music teachers to manage their teaching and encourage students to practice at home. The patented component "Compare Recording," evaluates students' live playing in comparison to a recording uploaded by the teacher to determine accuracy of pitch, rhythm, tempo, and fluency.[13] Teachers can create practice goals for students directly in the program, where students can earn points and stickers by successfully completing a practice

session, similar to the educational app Duolingo.[14] Students and teachers can track their practice statistics, on a weekly, monthly, or yearly basis, to become more aware of practice habits.
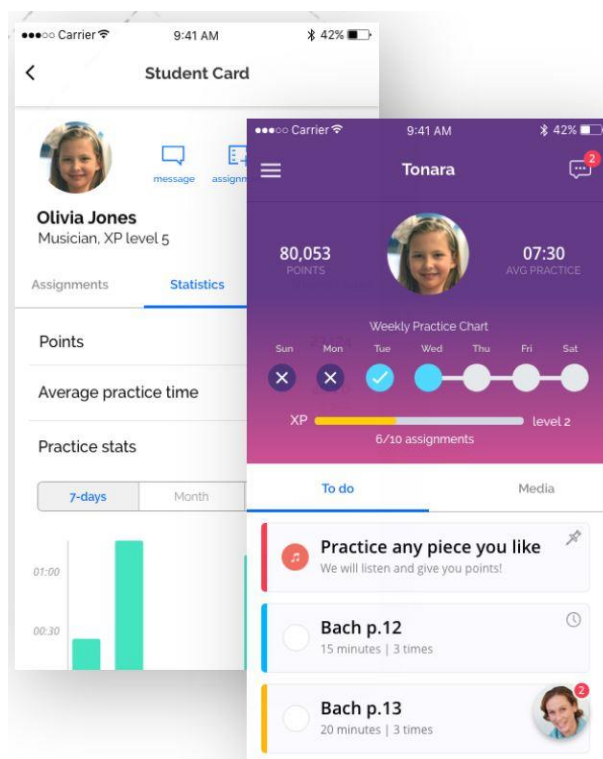

Figure 4: A student's practice "To do" list and 7-day statistical view in Tonara (Tonara).

Wearable Technology
Another less common technology that can aid in students' practice by providing feedback on technique is wearable technology. For example, a real-time feedback wearable jacket, called MusicJacket, can be used by violin students to improve their bowing and physical

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[12] Brian Duane Nichols, "The Effect of SmartMusic on Student Practice," (Doctor of Education in Teacher Leadership, Kennesaw State University, 2014), Accessed March 17, 2019, http://digitalcommons.kennesaw.edu/teachleaddoc_etd.

[13] "Tonara – The Ultimate Music Practice App for Teachers and Students," *Tonara,* Accessed April 15, 2019, https://tonara.com/.
[14] "Duolingo," *Duolingo,* Accessed August 7, 2019, https://www.duolingo.com/.

position.[15] As the student is practicing, the jacket can sense if the arm position and bowing direction is correct. It will send a vibrotactile signal in the form of a vibration to the student if the position is incorrect. This allows the student to immediately correct their posture, resulting in more constructive and healthy practice. There are many ways this could be implemented by music teachers in the future on a variety of instruments, although at this point there are many barriers such as time required for set up, cost, and limited availability.

Figure 5: A student learning violin using the MusicJacket (Linden 535)

Challenges and Efficacy

When implemented successfully there are many benefits to integrating technology into a lesson. It allows teachers to target multiple learning styles, a feature which is particularly beneficial for students who more visual or kinesthetic learners. The technology itself also can be an incredible motivation, which according to Mark Sharples is due to the immediate feedback and tracking consistency.[16] Furthermore, using technologies like SmartMusic can help structure lessons and create more regular and routine practice session. All these benefits promote greater more individualized, student centered learning.

Cost can be a barrier to incorporating these technologies into the classroom. Apps are the cheapest and quickest to integrate, averaging at $1-5 per app, but do require the use of iPads or tablets. SmartMusic is now more cost effective than in the past since they released a new costing structure last year. Educators can gain full access to the SmartMusic library and the notation tool at a base of $40 per year. Additional fees are required for student access, ranging from $4-12 per student per year depending on whether they require basic, standard, or premium access.[17] Digital instruments are becoming more affordable all the time, with the basic version of the JamStick selling at $200. There are also opportunities to apply for grants and create fundraisers to integrate more digital technology into the music classroom. The website SoundTree has fundraising ideas on their website, including the KORG Keys for Kids Fundraising Program where community members can "purchase" a key to build up

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[15] "MusicJacket," *Esense,* Accessed April 1, 2019, http://mcs.open.ac.uk/esense/musicJacket.html.

[16] Mike Sharples, "Methods for Evaluating Mobile Learning," Researching Mobile Learning: Frameworks, Tools and Research Designs (2009): 17-39, Accessed March 17, 2019, http://www.researchgate.net/profile/Mike_Sharples

/publication/252110088_Methods_for_Evaluating_Mob
ile_Learning/links/54995fcc0cf21eb3df60950f.pdf.

[17] "More Flexible Pricing for the New SmartMusic," *SmartMusic,* February 14, 2018, Accessed May 6, 2019, https://www.smartmusic.com/blog/flexible-pricing-new-smartmusic/.

the funds to purchase piano lab instruments. They also provide information on the New Music Makers matching grant they offer and other sources of grant funding.[18] Wearable technology, though having much potential to customize the learning experience for the student, is a rather new technology and may be challenging to use beyond the one-on-one lesson. It is important to be aware of this technology as it continues to develop, with potential to implement it into larger classroom settings.

Another challenge of integrating any technology into an educational environment is ensuring that the technology directly assists in achieving the intended outcome. It should not be implemented just for the sake of keeping up with current trends or enticing students, but with the purpose of enhancing the "existing performance and classroom curriculum and to provide new technology-based programs that will advance curricular goals."[19] By focusing on technologies as a means of developing students' personal assessment and more personalized instruction, they can become more confident and accurate musicians.

An additional challenge can be the learning curve required of the music teacher. In order to implement any of these technologies into a lesson they must fully understand how to use the technology so that it does not take away from the time together, but rather heightens the learning experience. Teachers must be provided with training so that they are confident in implementing new technologies into the classroom and can use it most effectively.

Application by Arts Institutions

There are many ways in which institutions, from music schools to non-profits, can assist in the implementation of these technologies to enhance educational opportunities for their students. Through financial support more students can have access to these apps and programs in their lessons. Many teachers are hesitant to incorporate new technologies into their lessons because of lack of training. Institutions can support their teachers by providing training on how to integrate technology into their lesson plans.

An article published by the National Association for Music Education (NAME) by William Bauer outlines a framework for encouraging teachers to integrate technology into the music classroom called the technological pedagogical and content knowledge (TPACK) model. This model helps teachers to "conceptualize how technology can be effectively integrated into teaching and learning" by taking the emphasis off the technology and placing it on the curricular goals.[20] Based off a study conducted, teachers who went through a training that followed the TPACK model were more likely to integrate new technologies into their class. This model can be used by schools and arts institutions to encourage teachers and teaching artists to incorporate technology into their lessons.

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[18] "New Music Maker," *SoundTree,* Accessed May 6, 2019, http://www.soundtree.com/Grant.
[19] Thomas Rudolph, "Teaching Music with Technology," *GIA Publications*, 2004.

[20] William I. Bauer, "The Acquisition of Musical Technological Pedagogical and Content Knowledge," *National Association for Music Education,* 2012.
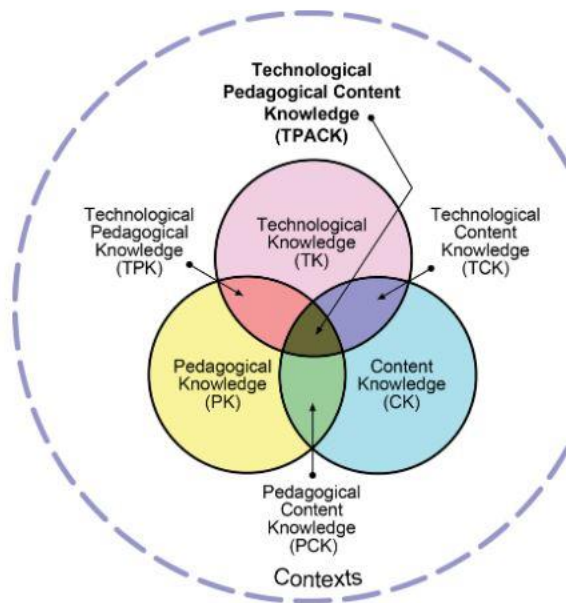
Figure 6: The TPACK model for technology integration into the classroom. (TPACK.org)

As arts managers it is important to be aware of how technology can enhance educational activities. Many music institutions provide educational programming that could be more effective through the application of such technologies. Through partnerships with schools, organizations can better equip teaching artists to have a larger impact on their students using such technologies.

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