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Imperative Duality of Music Teacher Technological Education

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Imperative Duality of Music Teacher Technological Education

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ABSTRACT

Referencing the TPACK (Technological Pedagogical and Content Knowledge) framework articulated by Mishra and Koehler, this article explains the need for educators to acknowledge and educate themselves regarding different proficiency tracks within the world of music technological content knowledge. We argue that our concept of "Imperative Duality" elaborates upon, and works to balance, the three elements of the TPACK framework: content knowledge, technological expertise, and pedagogical skills. With imperative duality, we explore the idea that educators must possess both content and technological knowledge to facilitate effective and comprehensive music tech instruction. This article also explores some music technology content and technological knowledge examples, expanding upon the benefits and limitations of each, so that we can better understand this need for different proficiency tracks within the field. We explore the importance of understanding the difference in capabilities between software options, and the importance of orienting these software options and a fluency with them within the TPACK framework. We argue that modern educators must have a working knowledge of the available music technology tools, both at the introductory levels and at more advanced levels, in order to both facilitate the classroom, as well as educate students on relevant technological content knowledge.

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INTRODUCTION

In March of 2020, Garry Falloon wrote that, “concerns that were not apparent even 10 years ago, have emerged as major players in our understanding of what it now means to be ‘digitally competent’” (Falloon, 2020, p. 2455). What an incredibly prophetic statement on the cusp of the dawn of the pandemic in the United States. In this article, we will discuss the need to acknowledge and educate ourselves on different proficiency tracks within the world of music technological content knowledge. Our discussion of technological content knowledge is rooted in an understanding of the TPACK (Technological Pedagogical Content Knowledge) framework of education, articulated by Mishra and Koehler (2006). The TPACK framework provides a holistic perspective that recognizes the intricate interplay between content knowledge, technological expertise, and pedagogical skills. This model is presented as a three-node Venn diagram with overlapping sections connecting each of the three nodes. Each intersecting portion of this model holds a combination of the associated types of knowledge. At the center of this model, where all of the nodes overlap together, lies technological pedagogical content knowledge.

Emphasizing the need for a harmonious blend of the three primary elements in the TPACK framework, our concept of "Imperative Duality" highlights how educators must possess and employ all three types of knowledge simultaneously to facilitate effective and comprehensive music tech instruction. That is, a working knowledge of the available music technology tools, both at the introductory levels and at more advanced levels, is necessary for the modern music educator to facilitate the classroom and educate students on relevant technological content knowledge. These two simultaneously needed levels of understanding are the *epistemological andragogical duality* of which this article speaks.

Throughout our experience as music and music technology educators, we have had the pleasure of seeing how different institutions deal with change and redirection. As particular pieces of coursework became abundantly dependent upon technology, we have noticed some common challenges faced by educational institutions, as well as some rather unique challenges.

TECH IN THE CLASSROOM: PROBLEM

In recent years, remote learning and work have become increasingly common, and at times essential. Ensemble work has been a huge challenge within remote learning environments. For example, during the early days of the pandemic, schools that chose to do ensembles were suddenly dependent on music technology to facilitate the dissemination of the information, the recordings of the performances, the mixing and editing of these recordings, and the distribution of the productions or deliverables. But when we say schools, we really mean music teachers. Dexter (2002) has stated that in these contexts, the teacher must assume the role of instructional designer as the primary staff member responsible for educational technology integration.

Many schools do not have a single music technologist amongst their staff. However, even in schools that have a music technologist on staff, it is often the case that that one person could not possibly have the bandwidth to engage with every single performance that needs support. This would be like having one classroom for an entire music school. In the early days of the pandemic, all music teachers and educators were suddenly placed into the role of production manager, and thus music technology was thrust to the forefront. It was not only helpful to the aforementioned pedagogical tasks, technology, and a fluency in it, became necessary to execute these tasks. Since there was minimal face-to-face contact during this time, digitized classroom experiences and performance dissemination became the primary modalities of music instruction.

Now, we believe that, to some degree, we knew this day would come. In our era, the pandemic is not the only parameter driving technological change and the subsequent need for technological fluency in the classroom. Many of us see the value of technology in the classroom, both for classroom facilitation and content knowledge. Modern music making relies heavily on technology, so if we want to offer authentic experiences to our students that reflect their own musical cultures outside the classroom, it makes sense to incorporate some of this technological knowledge into our curricula.

With music technology in the classroom, a disparity emerges when considering tools for their accessibility features, as opposed to their functional capabilities. Many of us have seen manifestations of this disparity when music teachers are sometimes urged to only use tools that offer greater access instead of capability. As an analogy, one might compare scissors that anyone of any age can safely use versus an expertly sharpened blade.

Issues arise when the capabilities of those facilitating a class are often different from the needs of those within the class. Ndongfack (2015) articulates that many teacher education programs have deep-rooted structural problems which hinder the development of comprehensive TPACK knowledge. Basically, the simplest versions of the applications through which assignments can be completed and rendered are often not adequate enough to facilitate the class itself. For example, mini DAWs (Digital Audio Workstations) such as Soundtrap (a tool that will be discussed further in this article) are often adequate for students who are taking their first steps into the music tech world. In fact, the simplicity and ease of use of mini DAWs often make them the ideal choice for those who are new to the field. However, an instructor looking to record and mix student performances may find the features of mini DAWs too limiting, and might instead reach for more complex software tools such as Logic or Pro Tools to facilitate the class itself.

SOLUTION

That's why there has to be room in our teacher education classrooms for two simultaneous tracks of learning, based on music technology proficiency. The teachers we prepare must always be armed with, and be taught the value of, the more robustly technologically capable track. Again, this is where the term duality comes into play – the two streams themselves must coexist, or otherwise we run the danger of not being able to facilitate the highest impact learning possible. Emphasizing only accessibility could thus pass along ineffective practices to subsidiary stages of learners. Our learners deserve the highest quality, and most rigorous, education we can give them. If educators don't acknowledge this duality, and don't work to learn the technological content knowledge involved in both streams, then we run some risks. One risk is that we may create a stream of educators and students who think they have learned the content of this subject (music technology), when they actually have not. Similarly, we run the risk that we may populate the field with educators that are lacking information and are therefore less effective in their teaching. This is an injustice to our students.

What's more here is that the teacher who doesn't recognize this duality is at risk of doing even more damage to the student, and the classroom environment, if a deficit lens is applied. These teachers may see students as somehow culturally and technically lacking the capital to

understand complex or challenging truths or tools. In this case, we are focusing on challenging *technological* truths or tools.

As defined by the Oxford dictionary, "The deficit model of teaching, in which the teacher *provides* the learning to make good a deficit, stands in direct contrast to the belief that the teacher's role is to draw out learners' tacit knowledge and understanding through questioning and facilitation" (Oxford reference, n.d.). So what happens when a deficit model of teaching is deployed in a space of technological learning? In many of our musical education spaces recently, we have noticed two big things. One is a significant shift in paradigm from that of a student-centered constructivist environment to that of more of a behaviorist teaching paradigm with undertones of the banking model of education that Paulo Freire (1970) cautions us against. Freire's critique of the banking model of education—a metaphor for depositing information into passive students as if they were mere containers—challenges us to rethink the purpose of education, advocating for a more dialogic and problem-posing approach that views learners as co-creators of knowledge, thus fostering critical consciousness and societal transformation. Conversely, behaviorist teaching practices silence the humanity and skill inherent in our students. The other thing that happens here is we can more easily underestimate our students' capabilities, particularly with students of color and/or with gender identifications outside of the majority for our field, instrument, genre, or expression more broadly. So to combat this encroaching deficit model, we're looking to arm our teachers with just as much cultural competence as technological competence.

McKoy and Lind state that "cultural competence implies the capacity to function effectively within the context of the cultural beliefs, behaviors, and needs presented by consumers and their communities. In the context of education, cultural competence is reflected in teachers who are able to function, communicate, and coexist effectively in settings with individuals who possess cultural knowledge and skills that differ from their own" (McKoy & Lind, 2022, p. 31).

But let's zoom out for just a moment. The imperatively impactful duality that we're after here isn't based on refuting a deficit model of education, it's only in service of refuting the aforementioned model and lens. The imperative duality becomes impactful when teachers have the capacity to, and understanding of when, to shift gears between complex technological capabilities that will help their students shine, truly lifting the voices of those in their classrooms,

and when to provide more simple and accessible outlets for artistic expression for their students. When teachers, educators, and facilitators confuse these, the classroom can melt down. Performances can also melt down, leaving students invalidated. We have unfortunately seen instances in which the technologies that teachers have used to support their class's creations have not been robust enough to meet the challenges of the students' individual and unique interests. In a concert setting in 2020, we witnessed a facilitator attempt to use the Acapella app to meet the needs of a 10-person instrumental ensemble. The app could only feature four of the musicians at a time, so a robust sense of community was never really achieved. Additionally, this piece of software lacks the basic audio editing tools to polish the mixed recordings to an appropriate production level for the setting, which was a college-level performance. This had a negative impact on student morale and the instructor was not asked to return.

A teacher needs to understand that in most classroom environments, the technology they're using to prepare the lessons or modules, or to produce concerts or distribution events, will often be very different from what the majority of their students use. Gonzales (2017) wrote that "In order to provide a more differentiated music education provision fostered by the use of technology, it is necessary that music educators respond distinctively and effectively, taking into consideration the sociocultural and educational context" (p. 314).

One must remember, there are always outliers that, if we're not keen on supporting even beyond what our lenses of bias can see, we will do damage to. These are young students of all genders, colors, and creeds, who have the ability to learn, but perhaps do not have the access to certain tools right away. The risk lies in teaching down to where we think they should be, or overlooking tools that we think may be too complex for them. This is a sort of a cultural sabotage that we may not even realize we are doing because we assume that we are being helpful. This is a fine line that we will revisit.

There's actually a great advantage to thinking of these technological competences in two streams! A teacher would immediately have a next level for their students to reach. But if you are a music teacher who was only taught one level, then when the students in one's classrooms push on the outer rim of their individual zones of proximal development, one will be woefully underprepared to handle this, and one's likely recourse will be to slow the growth of the students to fall in line with the teacher's capabilities. For example, as we've learned, the Acapella app may be an excellent tool to use when teaching about four-part harmony, or layering voices in a

recording. However, it does not appear to be an adequate tool to use if the course content includes recording a ten-part ensemble, or if the course content includes music production concepts like mixing, mastering, beat making, or synthesis. When shifting into concepts like these, a teacher may need to set aside the Acapella app and reach for a different tool like Logic or Pro Tools where these concepts can easily be demonstrated.

To equip themselves with a robust technological understanding, teachers must actively pursue professional development opportunities that emphasize current and emerging technologies. This could involve participating in workshops, seminars, or courses dedicated to the integration of technology in education, particularly in music technology. Teachers should also seek out communities of practice—networks of educators who share resources, strategies, and experiences—both online and in person, to stay abreast of the latest technological advancements and pedagogical approaches. Engaging with these communities can provide a rich source of ideas and support, enabling teachers to experiment with new tools and methodologies confidently.

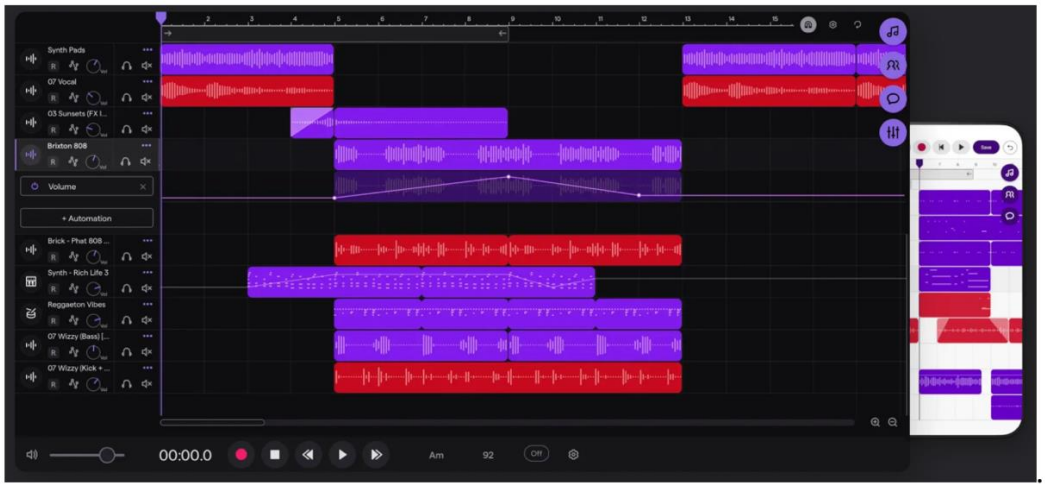
TECHNOLOGICAL EXAMPLES

Up until this point, this discussion has remained mostly abstract, but now we would like to present a concrete example of a particular software tool, namely Soundtrap. Soundtrap is an online, cross-platform digital audio workstation (DAW) for browsers that allows users to create music and sound compositions. Although the company was founded in 2012, they've seen significant growth in recent years.

Soundtrap, and many cloud-based DAWs like it, is fairly limited compared to other DAWs on the market. But, before we go further, we want to make very clear that we're not making a case against cloud-based digital audio workstations. Frankly, the technology that powers these tools seems magical to those of us who started our music tech journey decades ago, and applications like Soundtrap can have immense utility in the classroom.

Figure 1

Soundtrap arrange window



Nonetheless, Soundtrap is an extremely limited digital audio workstation. If platforms like Soundtrap are where facilitators stop their own learning, then we have a bit of a problem because the platform itself poses a limitation. There is a wealth of music technology content knowledge that cannot be represented in a limited DAW like Soundtrap. For example, Soundtrap has a limited number of built in plugins (software that's often used for things like effects processing). A teacher may hit a wall when they decide to teach about a type of audio processing that is commonly used in more robust DAWs like Logic or Pro Tools, but is not represented in Soundtrap. An instructor in Pro Tools or Logic, for example, could easily perform a plugin demonstration when lecturing about standard engineering techniques that rely on classic studio equipment, but Soundtrap lacks classic equipment emulation plugins available on other DAWs. The Soundtrap plugins themselves are often simplified for ease of use, sometimes to the extent that there is just one knob for adjustment on the plugin itself. This can cause a roadblock for instructors looking to demonstrate the effect of specific parameters within a plugin. For example, the reverb plugin that comes with Soundtrap has four parameters, whereas D-verb (one of the stock reverb plugins available in Pro Tools) has seventeen parameters for user control, and is not at all out of the ordinary for DAWs like Pro Tools or Logic. Automation of plugin parameters is

another commonly used feature in DAWs like Pro Tools or Logic that is simply not an option in Soundtrap. In fact, Soundtrap appears to have only three automatable parameters at the time of writing this paper, whereas the more complex DAWs have numerous automatable parameters, far exceeding those of Soundtrap.

Soundtrap also has a limited selection of track types, so an educator looking to teach students about signal routing, gain staging, and mixing techniques that include bussing will hit a similar barrier. For example, an educator familiar with DAWs like Pro Tools or Logic may want to teach their students about aux bus or master bus processing. However, that type of routing workflow is not available in Soundtrap despite the fact that it's a standard part of the music production process for audio engineers. In fact, you would be hard pressed to find a professional mixing engineer who does not use these techniques in every single mix they do. Similarly, an instructor looking to teach their students about import and export technical details like sample rate and bit depth would notice a simplification of these concepts in Soundtrap. A "sound quality" option is available for the entire session in Soundtrap, but the choices are ranked "high" to "extra low," with no mention of technical specifications. Needless to say, a teacher who limits their classroom instruction to this type of DAW will be lacking much of the specific technological content knowledge that, in the words of Mishra and Koehler (2006), is necessary to solve the problem for the educational benefit of the student and the larger learning environment.

The Acapella app provides another great example to illustrate this point. The Acapella app lets you use a mobile device to record, synchronize, and share songs featuring multiple-part vocal harmonies. We've seen it used in classrooms as the main mode of facilitation for what would end up serving as performances. This is all fine until the software poses a limitation, an immovable stone in the way of an artistic goal. The Acapella app, for example, has an intuitive and easy to use interface, making it a great option for those looking to record layers of audio to create small ensemble pieces. However, beyond some trimming ability, there is limited functionality for editing or effects processing within this app. The Acapella app is an effective option for those looking to capture performances, but our immovable stone will appear for those looking to practice music tech content concepts with this app. These limitations are problematic in a typical classroom because we're immediately limiting the possible output of our students. But in a classroom of teachers, this is particularly problematic. We will have done these teachers an incredible disservice by showing them only one way of solving these technological problems

that they are now responsible for solving in their schools given the new paradigm of digital, virtual, and multimodal music education.

Figure 2

The Acapella app.

CONCLUSIONS

For all the reasons outlined above, it's incumbent upon us, not only in our classrooms, but with our colleagues and peers, to offer a clear difference in capabilities between software options – and also to orient these software options and a fluency with them within the TPACK framework of Mishra and Koehler (2006). This is the best framework we've seen for this specific type of teacher education.

According to Ndongfack (2015), fundamental structural issues exist in many teacher education programs that work against building integrative TPACK knowledge. These include a tendency to "focus on developing knowledge of pedagogy and content separately... and empowering them (students) with some basic computer skills, not how to integrate them into the

teaching and learning process," (Ndongfack, 2015, p.1707). But according to Falloon (2020), TPACK theorizes the blending of pedagogical, content and technological knowledge to enhance the learning performance of students in, and sometimes across, subject disciplines. For this reason, music technology should be more thoroughly and comprehensively incorporated into our music education curricula. If we steer away from teaching music technology through a token technology course on the side of a music education program, and instead incorporate music technology in various forms into our existing curricula, then we can better align ourselves with blending of pedagogical, content, and technological knowledge for which the TPACK framework advocates.

And as we apply it to our field, we see that certain apps that offer access to a wide base of users may not provide sufficient opportunities for Technological Knowledge (or TK) in the TPACK model, and this should be supported with an additional application. Likewise, complex programs like Ableton and Adobe Premiere for example, may not offer adequate points of entry for many of the future in-service educators in our classrooms – as well as the populations they serve. They're different tools for different purposes.

In this duality, another layer of depth is added when we think about the population that our students will eventually serve. The teachers who we teach deserve to know and feel confident in these two streams of andragogical duality. Their students deserve to benefit from teachers who lift them up, meaningfully scaffold effective lessons for them, and are able to bring students to elevated technological realms when they show that they're ready for them. After all, as McKoy and Lind (2022) have said, "We have a responsibility to recognize that most of our learners have vibrant and significant musical lives beyond the four walls of the music classroom or the ensemble rehearsal room" (p. 55).

CODA

The concept of "Imperative Duality" in music tech education underscores the inseparable connections between content, technological, and pedagogical knowledge. Aspiring music tech educators must strive to cultivate expertise in all three domains to deliver transformative and comprehensive instruction. By recognizing the significance of the TPACK framework, educators can equip themselves with the necessary skills to empower the next generation of musicians,

producers, and music technologists. Through "Imperative Duality," the world of music tech education can thrive and adapt to the ever-changing landscape of the music industry.

REFERENCES

Abeles, H. F., & Custodero, L. A. (2010). *Critical issues in music education: Contemporary theory and practice*. Oxford.

deficit model. *Oxford reference.* Retrieved 20 Mar. 2024, from https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095707115.

Dexter, S. (2002). eTIPS—Educational technology integration and implementation principles. In P. L. Rogers (Ed.), *Designing instruction for technology-enhanced learning* (pp. 56–70). Idea Group Pub./Information Science Pub.

Falloon, G. (2020). From digital literacy to digital competence: The teacher digital competency (TDC) framework. *Educational Technology Research and Development*, *68*(5), 2449-2472.

Gonzales, P. (2017). Technology in Perspective: Who is in Control? In A. Ruthmann & R. Mantie (Eds.), *The Oxford handbook of technology and music education*, (pp. 311–316). Oxford. https://doi.org/10.1093/oxfordhb/9780199372133.013.28

Freire, P. (1984). *Pedagogy of the oppressed*. Continuum.

McKoy, C. L., & Lind, V. R. (2022). *Culturally responsive teaching in music education: From understanding to application*. Taylor & Francis.

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 6*, 1017–1054.

Ndongfack, M. (2015). TPACK constructs: A sustainable pathway for teachers' professional development on technology adoption. *Creative Education, 6*, 1697–1709.

ABOUT THE AUTHORS

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Drew X. Coles is an accomplished educator, researcher, and leader in the field of music education, with a distinguished record of scholarship, teaching, and service. He currently serves as a Lecturer in the Music & Music Education Program at Teachers College, Columbia University, where he also directs the Hybrid Master of Arts in Music & Music Education Program. Dr. Coles has previously held leadership positions, including Executive Director of the Crane Institute for Music Business and Chair of Music Business at the Crane School of Music, State University of New York at Potsdam, where he led strategic curriculum development, recruitment, and alumni engagement initiatives.

As a scholar, Dr. Coles has published extensively in leading music education and arts management journals, including Music Educators Journal, College Music Symposium, Journal of Educational Thought, School Music News (NYSSMA), INform (Indiana MEA), TEMPO (NJMEA), the American Journal of Arts Management, and the Journal of Arts Entrepreneurship Education. His research explores collaborative pedagogy, music technology, culturally responsive teaching, and the psychology of performance, with ongoing IRB-approved studies in these areas.

Beyond academia, Dr. Coles is actively engaged in editorial service, serving on advisory and review boards for Issues in Teacher Education, Music Educators Journal, College Music Symposium, and the Journal of Educational Thought. He is a board member of the College Music Society and the College Music Society Fund and serves on the Network for Music Career Development Officers' steering committee. His expertise in arts entrepreneurship and leadership has made him a sought-after speaker at national and international conferences, including the College Music Society, the National Association for Music Education, the Association for Technology in Music Instruction, and the American Educational Research Association.

Dr. Coles' professional experience extends into arts administration, having founded and led Pro Arts Management & Consulting LLC and served as Executive Director of the International Chamber Orchestra of America. He has played a pivotal role in program development, fundraising, and strategic planning, securing significant financial support for institutional initiatives.

Cato Zane

Cato Zane is a full-time audio engineer, music producer, and educator. She recently earned a master's in Music and Music Education from Columbia University, and has taught Music Technology and Audio courses for Beat Kitchen School, Platt College, San Diego, and San Diego State University. She has also taught applied studio music lessons for Teachers

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As a freelance audio engineer and music producer, she specializes in alt rock and indie cinematic pop music. With over 20 years of experience in the audio engineering field, Cato has been fortunate to work on a wide range of projects—from traveling Broadway shows and Super Bowl commercials to working with Grammy-winners.

Currently, Cato serves as the head engineer at Lost and Sound Foundry, a boutique studio she recently opened in San Diego after years of working in larger commercial studios. She also works closely with other commercial studios as needed. Beyond her engineering work, Cato runs a small YouTube channel dedicated to audio engineering and music production. Through this work, she has collaborated with companies like Produce Like A Pro, Splice Music, Antares (makers of Autotune), Zzounds, and Tascam, among others. Cato is deeply passionate about music production and audio engineering, and continuously seeks new ways to expand her knowledge, explore the field, and connect with other audio enthusiasts.