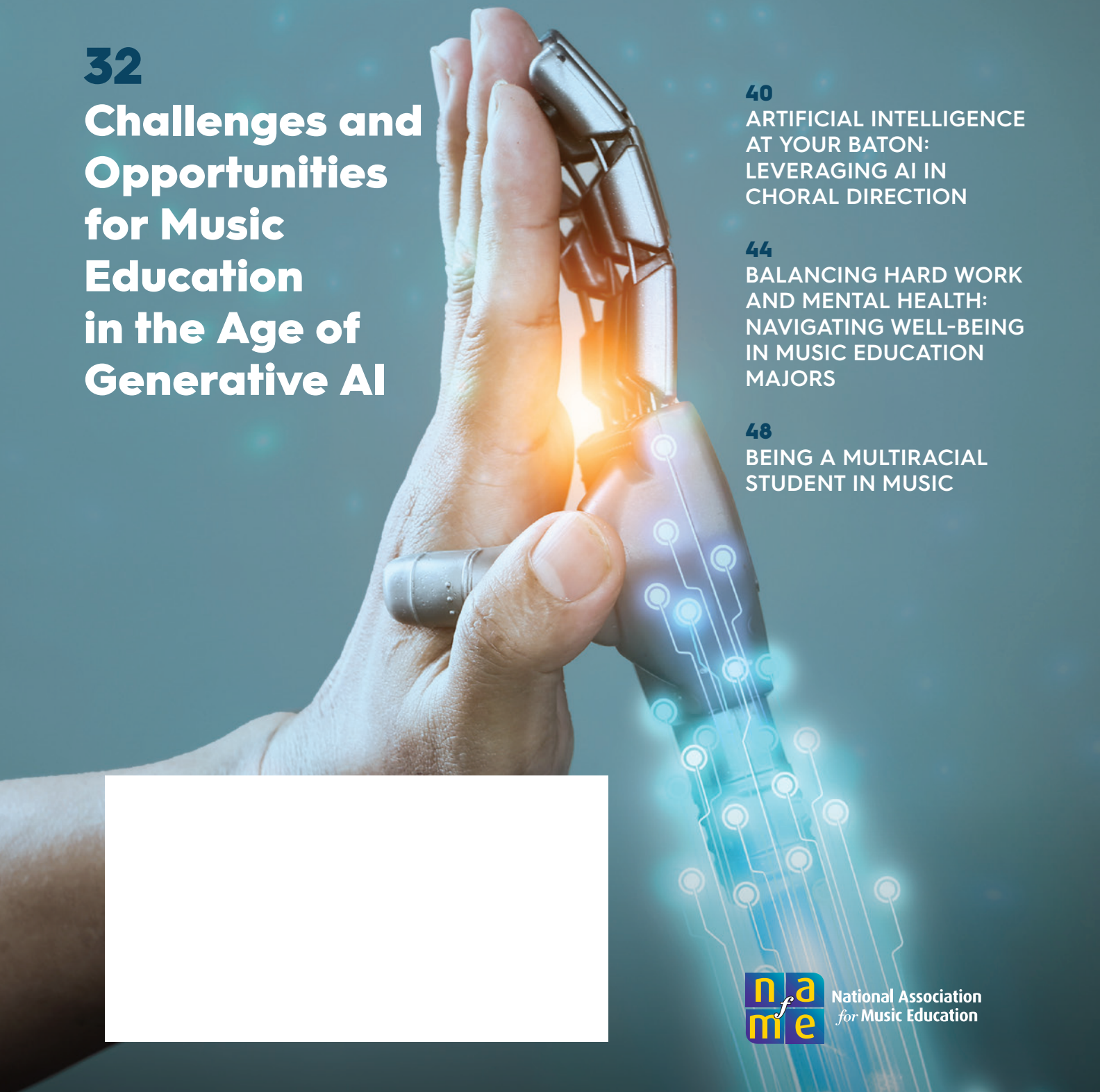
TEACHING music

APRIL 2024
VOLUME 31, NO. 4

A PUBLICATION OF THE NATIONAL ASSOCIATION FOR MUSIC EDUCATION





National Association for Music Education

# Challenges and Opportunities for Music Education in the Age of Generative AI

BY JOHN DONALDSON

**NAfME members share ideas, insights, ethical considerations, and frameworks for thinking about change in the age of Generative Artificial Intelligence.**

Adobe Stock / U2M Brand

## Unprecedented Rapid Change and Increasing Complexity

"The future is already here—it's just not evenly distributed."

This quote from writer and essayist William Gibson reflects the growing complexity and accelerating pace of change in this age of Generative Artificial Intelligence (GenAI), a subset of AI systems designed to generate new content, such as text, images, or music.

According to a study by the investment bank UBS, ChatGPT, a chatbot from OpenAI, is estimated to have reached 100 million monthly active users just two months after it launched on November 30, 2022. In comparison, according to data from Sensor Tower, it took TikTok about nine months and Instagram 2.5 years to reach that many users after launch (source: Reuters, February 1, 2023).

NAfME member **John Kao**, a musician, inventor, entrepreneur, author, and presenter, is a longtime observer of innovation and technology change. His current projects include collaborating on a portfolio of patents focused on the trust architecture for GenAI and working with composer Matthew Suttor on the development of the partially AI-enabled opera I AM ALAN TURING as part of his role as the first Turing Fellow at the Yale Center for Collaborative Arts and Media at Yale University in New Haven, Connecticut.

Kao points out that "We have to understand that this is not just a quantitative change—it is a qualitative change. It is different from most historical innovations in the sense that it is kind of like electricity or steam; it is pervasive. AI and data science are in the process of pervading everything—marketing, communications, infrastructure, and all the activities of businesses, institutions, and government. It is a state change, not just an increment of innovation. It is not about whether to climb on board or not: Everyone is already on board. The question is how to cultivate a necessary level of literacy to at least be aware of what it is and how it is affecting the broad landscape and context that music exists in."

*"We have to understand that this is not just a quantitative change—it is a qualitative change. It is different from most historical innovations in the sense that it is kind of like electricity or steam; it is pervasive."*

— JOHN KAO

This article is a snapshot in time of a complex, fast-moving story. It points to a growing list of resources on the website of the National Association for Music Education (www.nafme.org) for ongoing learning and captures various ideas and insights on GenAI from NAfME members, including how they are using it, frameworks for thinking about technological change, and ethical considerations.

*"Throughout my career in education, there has been one constant: change. Throughout every major change, I have always centered myself by revisiting what I believe is my true passion and purpose—providing high-quality arts (music) education for all students."*

— SHAWNA LONGO

## How Are NAfME Members Using AI?

For this article, we gained insight on how NAfME members are using AI from five interviews and from NAfME members throughout the United States who responded to NAfME's January 2024 AI survey.

**Shawna Longo** is the District Supervisor of Visual & Performing Arts and Consumer Education for the Westfield Public Schools in Westfield, New Jersey. She published an article in the New Jersey Music Educators Association *Tempo Magazine* in May 2023, "10+ Ways to Use ChatGPT in Music."

She shared: "I consistently use AI in my work! I think of AI as a great brainstorming partner. I use it to help get me started when I'm researching topics, drafting slides for professional development presentations, writing email responses, or working on blogs, articles, or podcasts."

*"Embrace the change and growth opportunities that serve you and your situation—and let the others go."*

— LESLEY MOFFAT

**Lesley Moffat**, a middle school band teacher at Heatherwood Middle School in Everett, Washington, and CEO of the mPowered Music Educator Academy, comments that "AI is a powerhouse in so many ways." She uses AI for brainstorming ideas, modifying materials for students, supporting lesson planning, and even generating questions for a game of Kahoot for musical things she wants her students to learn. In her business, she uses AI to help produce her podcasts and spark ideas for content creation. On a personal level, Moffat uses AI to find recipes and plan meals based on particular dietary needs. "When I teach other band directors how to do this," she notes, "they're amazed at how much easier it becomes to create and eat healthier meals with less effort than it takes to go to a drive-thru."

**Sean Meagher** teaches band, choir, and general music at Gilford Middle School, a grade 5–8 school in Gilford, New Hampshire. He is also editor of the New Hampshire Music Educators Association journal *NH Quarter Notes* and Chair of NAfME's Council of State Editors.

"As an educator," Meagher said, "I find that the to-do list never seems to get shorter. I use a website called goblin.tools that has a tool called Magic ToDo that helps instantly break down tasks into a multi-step checklist. Amazing! Additionally, a tool called the Formalizer helps formulate my thoughts in different styles. This can be really helpful when you only have a few minutes to send an email to that parent who's been calling repeatedly, the colleague who woke up on the wrong side of the bed, or an administrator who just made a controversial decision you disagree with. You may need a little help in turning those racing thoughts into something a bit more formal and polite."

As a journal editor, Meagher uses ChatGPT as an important time-saver to pose a question and expedite the research process, speed up the process of double-checking things from *The Chicago Manual of Style*, get suggestions on enhancing clarity, and prepare graphics and photos for publication.

**Ben Guerrero** is an Assistant Professor of Music at Eastern Mennonite University in Harrisonburg, Virginia, where he teaches undergraduate music technology, music education, percussion, and general music courses. With the support of a National Science Foundation collaborative research grant, he and several colleagues are working on a project titled "Toward an Ecosystem of Artificial-intelligence-powered Music Production (TEAMuP)," where an interdisciplinary team aims to empower future musicians to fully leverage AI tools in the creation, performance, and dissemination of their music while also accelerating audio AI research. He and his collaborators are also focusing on topics such as creativity, ethics, music education, and industry disruption.

Guerrero said, "As a music teacher educator, I've mainly discussed the pedagogical implications of AI with my students rather than having them use it themselves for an assignment. I want my students to develop their voices as future music teachers. I don't necessarily want ChatGPT to write a lesson plan for them until they fully understand the process of creating a well-thought-out lesson."

In his music technology class, he also used an image generator for a live demonstration of an image-based composition assignment. In that case, he says, his students quickly realized the limitations of the image generator. None of them ultimately ended up using it in their assignments.

From NAfME's AI survey, it is clear some members are actively using AI, while others are just starting to test the waters to explore it, and some have no current plans to try it. Members are using AI for lesson planning, teacher administration work, research, writing, composing, and helping students develop musical ideas. Others are using AI to:


**Ben Guerrero on the drums, with David Berry, Music Program Director at Eastern Mennonite University, in Harrisonburg, Virginia, on the keyboards.**

(Photo courtesy of EMU - Macson McGuigan)

- Listen to an entire lesson (Muzie.live AI), transcribe notes, and generate lesson note assignments and practice routines for students based on the context of the lesson.
- Create and organize materials for class activities and gamify the learning process.
- Generate ideas for family night activities.
- Help students understand the definitions of certain phrases to better understand concepts.
- Complete and/or edit reflections for professional development.
- Create problem sets for complex content such as music theory, working with a multidisciplinary team of faculty fellows.

**John Kao** mentioned that he has used AI as a type of research assistant for some projects that might otherwise take a week or more and cost a lot of money. He also uses a variety of visualization tools based in AI that "essentially show you what you can imagine in words."

Kao pointed out that "The fact that people can now assemble music using a whole array of digital technology, up to and including AI-enhanced collaborative performance, means that a lot more people can make a larger quantity of meaningful music without the kind of difficulty prior to those tools existing. Because if it is too hard, then people won't do it, especially if they are, for example, resuming their music study later in life."

"In the past," he added, "there was a lot of effort to create learning tools within digital keyboards. Those were great for their day, but those were baby steps. The time is not far off that you will be able to buy an instrument that has AI built into it that will essentially become your learning collaborator. What this means is that music teachers need to reimagine their roles, and, in a sense, become quarterbacks of a much larger array of resources as opposed to simply being in the traditional role of 'I am a teacher, you are a student, and I am going to impart knowledge to you.' These new tools amplify the power of teachers, but also require them to become more digitally literate."

Kao emphasized that "It is a different attitude from being the sage on the stage because you are not in control anymore—you're a collaborator. Your job is to know as much as possible, but other people, including your students, may know stuff that you don't. Kevin Kelly, the former executive editor of *Wired* magazine, who writes a lot about waves of technological change, has a phrase 'we are all endless newbies.' We should accept that we are not going to know everything and need to be constantly learning. Our knowledge is imperfect, and in constant need of updating."

## NAfME Policy Priorities – AI and Music Education

Photo by Ashlee Wilcox Photography, LLC

"Nearly every day there is a new headline sharing positive attributes and potential risks associated with Artificial Intelligence. Regardless of how we may feel about technology changing society, the reality is that AI, specifically Generative AI, is here to stay and is impacting music classrooms throughout the world. Many possibilities exist for GenAI to enhance creativity and instructional practice, and music educators must ensure that such tools are used responsibly. NAfME is committed to exploring the benefits and appropriate use of GenAI in music education. Watch for more information and resources in the months to come."

**- Scott R. Sheehan, NAfME President**

AI and music education is a NAfME policy priority. Visit NAfME's website at ***nafme.org/advocacy/policy-priorities/*** to

- Learn about NAfME's AI Initiative and Task Force.
- Access NAfME blogs, resources to support educator use of AI, and the latest information on trends in AI public policy.
- Share your insights and ideas on AI with NAfME via a short online survey.

**Share what is happening** in your state or area of music education: Contact **Zachary Keita**, Advocacy and Public Policy Communications Manager, zacharyk@nafme.org

## Frameworks for Thinking about Change—and Staying Grounded

A casual glance at any major newspaper or news outlet shows a creative (or scary) tension in every sector, from finance and medicine to academia and politics, highlighting potential breakthroughs and/or deep concerns about AI. *Science Daily (https://www.sciencedaily.com)* is a useful website to see examples of diverse, interdisciplinary breakthroughs involving AI in many fields, just as, in the past, there were major leaps forward in areas like bioengineering or complexity theory when experts from different disciplines gained insights from each other. Music, of course, is one of the best examples of cross-fertilization of ideas and insights resulting in new genres, instrumentations, or ensembles of endless

*Be patient with yourself and your students and remain flexible in adjusting your approach based on ongoing feedback and experiences.*

— SEAN MEAGHER

variety, not to mention the large numbers of songs inspired by societal and technological change.

For individuals, rapid change can generate a range of emotions, including curiosity, excitement, hope, or optimism, but also denial, anxiety, or fear. We asked our interviewees what advice they have for music educators to help them keep their equilibrium and avoid feeling overwhelmed.

**Ben Guerrero** noted that "Not everyone embraces change. I still have family members who refuse to use a cell phone. A growing number of people also choose to disconnect from technology periodically. That's fine. For those who want to learn and grow, I recommend music educators *embrace the paradigm shift with curiosity and skepticism*. Curiosity allows for possibilities, while skepticism diminishes gullibility."

**Shawna Longo** highlighted that "Throughout my career in education, there has been one constant: change. No matter what we do or how we may try to avoid it, change is inevitable. Throughout every major change, I have always centered myself by revisiting what I believe is my true passion and purpose—providing high-quality arts (music) education for all students. Do the research, learn everything you can about the new change, and see how you fit into the bigger picture. By aligning myself with changes, I've been able to successfully ride through many storms and come out stronger on the other side."

**Lesley Moffat** shared that "When change comes along, pay attention to it. When ChatGPT first came out, I learned about its capabilities and was immediately intrigued. The reason I pursued it is because I saw the benefits of having a tool that helps me do things at or above the level I expect them to be in a shorter amount of time, so I decided to embrace it from the very beginning. I've seen a lot of changes come along in my 36 years of teaching, and as the daughter and granddaughter of teachers. It's important to discern whether change leads to growth or if it just leads to more or different work without any benefits. Embrace the change and growth opportunities that serve you and your situation—and let the others go."

**Sean Meagher's** advice is to "find a tool that can be helpful for you and try it out with some of your regular tasks. Just as we've learned to slowly integrate smart home technologies and digital assistants like Alexa into our daily lives, we'll be able to find the good in AI. As with most technological advances, a significant boom in the number of websites, tools, and new features has happened, and that can be really overwhelming. Take a step back, and don't worry about keeping up with the Joneses. You can continue to use whatever methods are working for you. Generative AI is not coming in to replace our songwriting and composition courses. They will, however, need to be addressed within those courses and explored in an open and experimental fashion with students."

Meagher points out that "Being able to highlight errors or problems within works produced by AI can help to dissuade potential academic dishonesty. I previously taught a high school course on digital music production, and the students were able to share with me a number of tools they found online to remove vocals from tracks, modulate keys, change tempos, and more. With the click of a button, the AI would pop out a file for you. This was an exciting find for students looking to remix music they enjoyed into other styles and led to productive conversations about copyright, fair use, and plagiarism. Sticking our heads in the sand will not allow us to explore these conversations openly and honestly with our students. I encourage music educators to help foster ownership by engaging with their students in the process of adding new technologies into their teaching."

Meagher advises us to "Be patient with yourself and your students and remain flexible in adjusting your approach based on ongoing feedback and experiences. Understand that change takes time and that not every implementation will be perfect from the start. By approaching change in a thoughtful and intentional manner, music educators can navigate the integration of new technologies while preserving their core values and remaining centered and grounded in their teaching practice."

**John Kao** mentioned that he is guardedly optimistic about AI. "I think there are some real problems," he said. "For example, AI and military affairs are unregulated right now. I also think AI poses vulnerabilities to civil society. AI unregulated, left unprotected by the ability to differentiate between what is truthful and authentic content and what is not, poses some real threats to social discourse."

"There are vulnerabilities, no doubt," Kao added. "But on the plus side, AI will enable a burst of productivity that will propel economies around the world. I think it will have the potential to reduce a lot of the friction and inefficiency in government and business processes,

and, most important, it will empower people to have better lives, including through health care, providing more objective information based on personal data, and monitoring of health and well-being."

Kao mentioned that "When you get to the top of the hierarchy of needs, where you find self-actualization through activities such as interacting with the arts, there are already many instances of fascinating AI-influenced art, installation art, theatrical art, music art, opera, and so forth. An in-process opera that I am working on with a team at Yale is half-composed by humans and half by AI. A number of the most evocative parts of the libretto came out of the AI component, not the human one, and there was a way about how the process was organized to make it a true collaboration, as opposed to just humans asking generative AI to come up with some stuff."

## Ethical Considerations and Future Mindsets

Here some sample ethical concerns and other practical considerations about how to use GenAI mindfully from our interviewees:

**Sean Meagher:**

- How can we ensure that AI applications in music education are free from biases and provide equal opportunities for students of all demographics?
- How can AI be integrated into music education to provide personalized learning experiences while still fostering collaborative and group learning?

**Lesley Moffat:**

- Is AI helping me do something better and faster than I can do it on my own in a way that respects copyright and student privacy?
- Is the content supplied by AI accurate? Does it come from reliable sources? (The ChatGPT paid version lists the online resources it uses when providing answers.)

**Shawna Longo:**

- How can music educators make sure they have a seat at the table within their school district to ensure that AI policies consider the arts/music?
- How might the algorithmic bias in AI tools perpetuate stereotypes and fail to include underrepresented groups in music education?
- How might cultural appropriation occur when using AI-generated music? Music educators need to understand the cultural context of music and teach students about responsible borrowing and cross-cultural exchange.
- While technology is important and should be embraced, music educators need to find a healthy balance between the use of AI and encouraging the development of creativity and critical-thinking skills.
- How can music educators ensure that student and teacher privacy and data collection are appropriate?
- How can music educators advocate for equitable access to technology and resources?
- How can music educators consider the needs of all students and ensure that AI complements, rather than replaces, personalized learning strategies?

**John Kao** shared: "A lot of AI applications in music are coming but are not here yet. It is important for music educators to understand that it is inevitable and that it is already here. It is not binary, not all great or all evil, but somewhere in between. It is not a substitute for high-end composition, performance, and pedagogy, but it can be a very powerful enabler and encourage a democratization of quality."

Kao added that "The ability to learn things is becoming a kind of base human requirement or resource. The good news is that there is an increasing democratization of access to information. You can also buy inexpensive digital synthesizers now that in past years would have cost thousands of dollars. I don't want to minimize the digital haves and have-nots, but some of that reflects an era where value was associated with hardware. Now, as long as you have a reasonably "smart" phone and Internet access, which is going to be increasingly available with low-Earth satellites, the cost is going to keep coming down. The distinction between haves and have-nots will become blurrier because a lot of music-making and learning is going to be in the cloud, as opposed to in devices."

Photo by Sally Anderson

*"These new tools amplify the power of teachers, but also require them to become more digitally literate."*

— JOHN KAO

*"I recommend music educators embrace the paradigm shift with curiosity and skepticism. Curiosity allows for possibilities, while skepticism diminishes gullibility."*

— BEN GUERRERO

**Ben Guerrero** commented that "The bigger ethical considerations, such as copyright law, will be decided in a courtroom, not a classroom. The biggest concern for a teacher is the pedagogical implications of AI. The concerns about AI are not too different from using any technology in the classroom. Using samples and loops are musical shortcuts that lead to more musical possibilities, but they could be considered cheating depending on the lesson and how it's presented. I would ask teachers this question: How are you using AI to support your pedagogical goals in ways that enhance the learning experience?"

Guerrero added: "I'm not afraid of AI. The player piano didn't replace pianists, the synthesizer didn't replace orchestras, and AI will not replace humans, creativity, or emotions. However, AI will change artists' relationships with time and the creative process. AI can be passive, working quickly in the background in an app or plug-in, saving artists time as they make edits. AI can be active in the creative process, acting as a sounding board or collaborator, providing assistance or feedback, or it can be a launching pad for a new project. In some cases, AI could also be a replacement for artists; click a button and get 60 seconds of AI-generated music for a commercial. But what's the fun in that?"

"The pros of AI music depend on your values and how you use AI-powered tools," Guerrero emphasized. "Yes, technology can make life easier by making certain things more efficient, but sometimes the creative process is a necessary journey for artists. If you value human emotions and communication, AI music will be of little use to you because it's not emoting anything. Just as access to information does not equal knowledge, output from an AI system does not equal communication. Now, if an artist uses AI as part of their creative process, then the possibilities are endless. A question I have is: How are you preparing your future music students who will be living in a world with AI?"

**Other NAfME members** shared these thoughts in response to NAfME's AI survey:

- We need to be mindful of the capacity for large language models (LLMs, such as ChatGPT) to proliferate oppressive societal structures through linguistic patterns or the impact of dependence (emotional and academic) on AI.
- In the case of someone with a physical disability, AI can be used to create music from a person's musical input, parameters, and dataset.
- In what circumstances will music be labeled or categorized as AI-assisted or generated?
- How does this affect music outside of Western music cultures? Will indigenous peoples be able to choose to contribute or deny the use of their music and language in all AI programs? How will music using endangered or extinct languages or languages no longer traditionally spoken but more or less well-documented (Latin) be handled, and how authentic will it be?
- AI can be used for many things that create ease and reduce administrative workload. It should not be used to replace human creation and artistic excellence.
- I hope that computer-generated music won't discourage people from learning it themselves.
- AI should be a creative tool that helps musicians and composers, rather than replacing them. I think priority goes to live acoustic performance and songs that are created out of the minds of composers rather than rehashed through a computer algorithm.
- How will we allow AI to be used when constructing research articles or practitioner articles?
- How can we ensure that research, writing, and article submissions are a product of human work?

## Music Is What Humans Make for Humans

No one knows exactly what the future holds. AI has the potential to cause unanticipated disasters, but also to transform our lives in profound ways, such as helping make energy more efficient and affordable for all. According to a January 11, 2024, article in the New York Times, Sal Khan, the Chief Executive of the Khan Academy, predicts that AI will bring about "probably the biggest positive transformation that education has ever seen … giving every student on the planet an artificially intelligent but amazing personal tutor."

**Jim Frankel** is an author, presenter, and the Head of Digital Education for Wise Music and Director of MusicFirst. Previously, he was the Managing Director of SoundTree, and before that he was an instrumental and general music teacher for 15 years in New Jersey Public Schools. In his December 15, 2023, blog post "No. AI Won't

*"While AI has some incredible potential in the world of music and will continue to be a transformative and disruptive force, it cannot and will not replace music educators."*

— JIM FRANKEL

Replace Music Teachers," he writes that "While AI has some incredible potential in the world of music and will continue to be a transformative and disruptive force, it cannot and will not replace music educators."

He adds that "in-person instruction and interaction is of paramount importance to the education process" and that "students make powerful connections with their teachers" as mentors and role models. Frankel notes that "there is simply no way that an AI bot can diagnose why a 6th-grade concert band isn't able to play through a piece," citing examples such a student having a broken reed, struggling to play with new braces, or facing a challenge in their personal life.

Frankel also emphasizes that nothing can "ever replace the experience of sitting next to a teacher in a lesson, having a good sound modeled for the student, catching the smallest nuances of how a student is holding an instrument, what their embouchure looks like, their posture while singing." Frankel says that teachers "know how to comfort, guide, coach, encourage, cheerlead, discipline, motivate, and lead. Music teachers are very special people with lived experiences, talents, and creativity. They are natural leaders. If you ever think that AI might replace you, remember that."

**Ben Guerrero** says "I would be curious how AI could be used to enhance the workflow and communication among all the stakeholders in music education. As a futurist, I think about the human-computer interaction (HCI) aspect of music making. Computers and AI models are tools for human expression, no different than paper, pencil, or any musical instrument."

**John Kao** emphasizes that "This idea that somehow AI is going to take the place of humans in terms of the actual performance and experiencing of music as a human activity is by definition an unrealistic fear. The example I like to use is that nobody is going to pay to go to a concert hall where there is a computer and a loudspeaker on stage and that is the performance, even though it might be beautiful music and played on some digital instrument. Kao adds that "We appreciate the drama of a fallible human who has achieved a certain level of musicianship and who can then convey that human experience to the ears of the listener. We love it when Aurthur Rubinstein makes mistakes when he plays Chopin—this kind of live performance has a human quality to it. Music is what humans make for humans, but AI can enable it."

Also, just as technological change impacts music, music impacts all aspects of life, including business and innovation. Kao notes that "AI becomes smarter when it accumulates a lot of data, and it can understand patterns. For example, when a student is learning jazz harmony, there are many blind alleys and practice requirements. The process of learning jazz is inherently inefficient. An AI might become a jazz tutor that recognizes what a student needs to practice at that particular moment as the AI becomes more experienced at doing this kind of pedagogy. It is infinitely patient, and it will accumulate knowledge about how people learn these types of technical skills and be available 24/7."

Kao added that "AI is not going to substitute for having a great human jazz teacher, however, because music is inherently a human experience and a human art form. Also, nothing will take the place of human effort—the student's effort—but AI will make learning a lot easier."

As Kao points out in his book *Jamming: The Art and Discipline of Business Creativity*, music is also a powerful practical example and enduring metaphor for creativity and innovation, reflecting the types of creative tension at play when people work with GenAI. "AI and the adoption of new technology enable improvisation to occur," he shared. "*Jamming* was really about what we can learn from jazz musicians and the importance of improvisation as not playing whatever you want, but having the right balance between discipline and inspiration, structure and freedom, and tradition and what is new and emergent. Anyone who has done a startup business knows that it is jazz. Ultimately, we are all improvisers."

**JOHN DONALDSON** is Associate Executive Director of Professional Development and Publications at the National Association for Music Education.