The Role of Educational Inequality and Technological Access in Shaping Opportunities in Music Production

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Haizhou Yu

Spring 2025

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Kathryn Webb-Destefano, Department of Engineering and Society

Introduction

Moving into the 21st century, technology has revolutionized music production. With the help of computer software and codified music notation, producers no longer need a fancy studio room, and expensive equipment to make a good piece of artwork. Yet, while some of the barriers to music production have been lowered, they reveal other issues such as the lack of music education. Many beginners lack early education in instrumental training, theory, or even exposure to music in general. This significantly hinders their ability to succeed in music production. Moreover, the tools that help make music, including Digital Audio Workstations, which are the software used to make music, and tools such as MIDI controllers, all have noticeable learning curves. To understand and make use of the devices, people need to know many things, ranging from computer skills, musical skills, to the understanding of physics and sound in order to operate them. These factors further raise the bar, countering out the benefits technologies provided to music production, and are potential reasons why many are steered away from attempting to participate in music production and enjoy the numerous benefits that music production provides to people.

Framed by care ethics, this STS research project aims to examine the educational and technological inequalities that impact access to music production. This study explores how disparities in early music education, access to digital tools, and technological literacy create systemic barriers for individuals who wish to engage in music production. By analyzing case studies, policy initiatives, and technological innovations designed to democratize music-making, this research seeks to understand the broader social implications of these barriers. Additionally, the study investigates how socioeconomic factors influence an individual's ability to acquire necessary skills and resources, as well as the effectiveness of existing solutions in bridging these

gaps. Through this exploration, the research aims to highlight opportunities for reducing these inequalities and propose strategies that extend music production accessibility to a broader and more diverse range of individuals.

Literature Review

In the first academic source, “Time for change? Recurrent barriers to music education”, Henley and Barton (2022) discussed a series of factors that emerges and contributed to the decline in musical education of the United Kindom. The production of music has become democratized through the advances in technology, yet genuine educational and technological barriers still persist. The accessibility of musical training, especially initial musical training and digital aptitudes, is unbalancedly disseminated, thus creating inequalities on who is capable of participating productively in the production of music. Educational disparities, access to technology, and their influence on music production are examined herein using literature that has been established.

Henley and Barton (2022) bring to the fore the persistent barriers in music education in spite of twenty years of policy efforts. Their research brings to the forefront major barriers, such as restricted access to music courses, socioeconomic limitations, and systemic breakdowns in educational transition. The Wider Opportunities and Whole-Class Ensemble Teaching (WCET) projects tried to reduce these inequalities, but their sustained impact has been questioned. The majority of students, particularly those from poor communities, cannot progress beyond initial music education due to financial constraints and inadequate institutional support.

Disparities in music education typically correspond to socioeconomic status (SES) and location. Urban areas, particularly in affluent environments, have extensive music education opportunities, while low-income and rural communities face significant deficits (Henley & Barton, 2022). These students are hindered by factors such as limited access to qualified music instructors, less structured programs, and transportation difficulties. Moreover, lower-income students are disproportionately affected by the change from free whole-class music instruction to payment for lessons, as their families may not have the financial resources to continue their training. These economic barriers create an early divide between students who possess the resources to take private lessons and those that do not.

The second article, "Analog Distinction – Music Production Processes and Social Inequality" (Carsten Kaiserm 2017), explores how the intersection of music production technology development and overall social inequalities in the field are equally present. The essay critically examines how developments from analog to digital technology have influenced access, workflow, and commodification of music production resources, highlighting the persistence of social stratification in the field.

Kaiser documents the transition of music production from hardware-oriented analog systems to software-oriented digital settings. Professional studios of the past were equipped with huge mixing boards, outboard gear, and tape machines, and they offered a high-end environment accessible largely to industry professionals with great financial and institutional resources. The advent of Digital Audio Workstations (DAWs) and software plugins during the mid-1990s enabled music production to be democratized through the lowering of costs and the enhancing of access. However, Kaiser argues that the transformation has not eradicated inequalities but re-drew them.

Even as digital technologies have become ubiquitous, analog devices continue to have deep cultural and economic value. The study highlights the way computer programmers tend to create simulations of analog equipment, attempting to replicate the warmth, richness, and tonal character associated with older machinery. Kaiser offers the concept of the "credibility gap," by which the emulations created with high-tech software are also seen as lacking when compared with their analog counterpart based on things outside of sound—such as feel, work-flow detail, and historic status.

Kaiser further points out that professional studios and experienced engineers prefer analog equipment, not necessarily due to objective sonic reasons but due to analog gear being seen with expertise, authenticity, and tradition. This further sustains a power structure in music production in which analog gear becomes a symbol of status and prestige and not just a means of sound manipulation.

Research further examines how economic and infrastructural forces are accountable for inequalities in music production. Traditional analog studios require:

- Significant investments in expensive hardware.
- Technical know-how and training to employ sophisticated equipment.
- Physical space and infrastructure to handle analog gear. These requirements limit access to expensive production facilities, maintaining a divide between professional studios and independent or home producers.

Conversely, digital production presents a cost-effective alternative, but Kaiser outlines how availability of high-end plugins, good digital emulations, and proficiency in production techniques still varies hugely by socioeconomic status. It presents a paradox: while digital

production tools have opened music production processes to a broad variety of participants, they did not totally eliminate structural inequalities.

Kaiser's study raises important questions about the future of music production and the potential for bridging these inequalities. The article suggests that as digital technology continues to advance, the industry must focus not only on making tools accessible but also on dismantling the prestige-based prejudices that continue to privilege analog workflows.

Secondly, the report insists that education reforms should be adopted to enable prospective producers with varied backgrounds to acquire information and training, either through schools or online learning platforms. These disparities would require both technological innovation and the shift in culture in the music production sector.

Kaiser's Analog Distinction – Music Production Processes and Social Inequality offers a rich analysis of how music production technological shifts intersect with social and economic inequalities. While digital technology has made access more open, entrenched analog superiority attitudes continue to shape industry hierarchies. By critically analyzing these dynamics, the paper makes a more sophisticated argument about the persistent inequalities in music production and the steps to create a more inclusive and equitable environment.

Conceptual Framework

This study employs care ethics as its foundational paradigm to investigate how educational disparity and access to technologyinfluence opportunities in music production. In “Ethics, Technology, and Engineering”, Poel and Royakkers explained the origins of care ethics, which is inspired by Carol Gillgan, with its focus on the value of relationships, interdependence, and responsiveness to others' needs, offering a lens through which to understand how structural

obstacles restrict access to equipment and instruction in music production. Instead of considering access to technology a value-neutral variable, this model emphasizes the ethical imperative to create and disseminate resources in ways that are inclusive and empowering.

Inequalities in music production and education extend far beyond a deficiency of technical competencies; they are more fundamental systemic inequalities concerning access to essential resources, mentorship, and creative spaces. Understanding this issue within thelens of care ethics demands consideration of the real-life experiences of emerging producers, especially those from disadvantaged groups. Thus,it is essential to acknowledge that access to technological hardware—such as MIDI controllers, digital audio workstations, and online educational resources—is unevenly distributed, more often exacerbating current social inequalities.

In line with care ethics, this research contends that technological innovation in music production ought to be envisioned not only interms of efficiency but also to empower end-users by enablingaccessibility, affordability, and intuitive-to-learn experiences. The methodology also emphasizes the importance of participatory approaches to the design process, where the voices of marginalized producers should be centered as paramount to toolmaking and pedagogical intervention design intended to benefit them.

Lastly, this research advocates for a care-based, responsive, and ethically accountable framework of technological access and musiceducation rather than passive neutrality. This calls for a shift toward thecreation and development of music production tools and learning systems that actively close gaps to achieve a more equitable and fairercreative realm.

Analysis: Applying Care Ethics to Music Production Inequality

The differences in access to music production, researched in Carsten Kaiser's, “Analog Distinction – Music Production Processes and Social Inequality”, and Henley and Barton's report, “Time for Change? Recurrent Barriers to Music Education”, can be explained within the framework of care ethics. Care ethics is focused on responsibility, relational processes, and the ethical imperative to promote the well-being of others. By applying this ethics framework, we can examine how inequalities in music production—constituted by access to technology, financial constraints, and industry standing—are a manifestation of a breakdown of care for marginalized producers and propose ethical solutions in the form of inclusivity and care. Care ethics is centered on relations and interconnection, realizing that music production is not just a technical undertaking but a social activity.

Analog studios traditionally functioned as communal spaces where mentorship, collaboration, and skill exchange were formative aspects. Transitioning to digital technologies has enabled more autonomy; however, it has also resulted in greater solitude for incoming producers who are excluded from institutional knowledge, mentorship, and professional networks. Kaiser's research highlights how those in professional environments who have access to analog equipment hold a higher status, thus perpetuating social stratifications that overlook the needs of upcoming musicians who do not have financial or educational privileges. Moreover, Henley and Barton (2022) and many others (Wiggins & Wiggins, 2008) support this claim by explaining how systemic barriers in music education create inequalities in opportunities, limiting access to critical musical training and technological literacy for marginalized groups. Taking vision from another perspective, many new digital music creation devices, such as MIDI keyboards and MIDI controllers, also have steep learning curves. Without education in piano or

other keyboard instruments, new producers might find it nearly impossible to use them effectively. (Airy & Parr, 2001; Bierylo, 2022).

One of the fundamental tenets of care ethics is the ethical imperative to deliver resources and assistance to those in need. Yet the music production sector does not do this to a large extent, especially regarding redressing imbalances in access to technology and education. Kaiser's research demonstrates that although digital technology has alleviated some barriers, access to professional software, hardware, and educational materials is still unequal.

More affluent producers and professional studios can invest in high-end plugins and expert training, whereas disadvantaged producers make do with free or inferior software that restricts their artistic range. Henley and Barton (2022) substantiate this argument by demonstrating the disproportionate distribution of funding for music education and technological hardware, which tends to benefit students who are in urban or more affluent school districts. This structural disregard establishes a self-sustaining cycle in which individuals from lower-income backgrounds have fewer opportunities for access to digital music production, thereby furthering the disparity between incumbent professionals and emerging artists.

From the vantage point of care ethics, this constitutes a failure to care for the future generation of producers. Ethical accountability requires that leaders in the field—software developers, educators, and policymakers—strive to redistribute resources more evenly, for example, by making open-source software, subsidized training programs, and mentoring programs available to underrepresented musicians.

In addition, Kaiser examines the enduring prestige that is affixed to analog equipment, as a status symbol that separates professional producers from amateurish practitioners. This social

divide is in line with the critiques of care ethics regarding moral exclusion—where certain groups are favored over others, resulting in a hierarchy that overlooks the needs of those who lack access.

Henley and Barton (2022) also highlight that elite music education systems reinforce social stratification, thus closing off pathways to higher-level music production classes for those without early exposure. This suggests that gatekeeping within the industry is not limited to the means of production but also to education and training opportunities, which disproportionately benefit individuals who have already gained musical and technical knowledge.

Care ethics principles call for a shift toward inclusive evaluative practices that recognize creative works regardless of the tools used. Through developing an ethic of care, the industry can challenge outdated notions of prestige and, consequently, glory different modes of production, thus ensuring new artists receive equal respect and opportunities as those in traditional studios.

The lack of access to music education and technology equipment poses significant hindrances that prevent individuals from engaging in music production, thus depriving them of its well-documented mental, emotional, and social benefits. Henley and Barton (2022) observe that initial exposure to music education is a critical determinant in the growth of musical engagement, but institutional inequalities in school finance and geographic location limit most students' access to the development of fundamental music skills. Many who lack adequate music education and find it extremely hard to create a chord progression, which is the basis of a song (Stevens, 2016; Brunner, 2017). Similarly, Kaiser (2017) describes how the cost of professional-grade analog equipment and digital software creates a division between individuals who can afford high-quality music production equipment and cannot.

Lacking proper music education and proper technology, individuals are discouraged from engaging in music production at all. This amounts to a lost opportunity to gain the health benefits of music-making, such as stress relief, brain stimulation, and social attachment. Being excluded from music-making due to lack of finance or education continues to perpetuate exclusion cycles, reinforcing already existing social inequalities. From a care ethics perspective, this underscores an ethical obligation on the part of institutions and industry leaders to implement inclusive policies that expand access to music education and technological resources so that all—of all socioeconomic backgrounds—may share the health and creative fulfillment that music production provides.

Apart from alleviating social and economic inequalities, involvement in music production has also been discovered to bring significant mental and emotional well-being benefits. It has been learned that music creation and music production can reduce stress, improve cognitive performance, and promote increased emotional well-being. It is also proven that besides all mentioned above, there are other benefits such as generating social capital, and promote cultural development (Henley et al., 2012; Hallam et al., 2012; Kokotsaki & Hallam, 2011). Involvement in music production allows individuals to engage in self-expression, which is particularly helpful for those encountering social or economic disadvantage. The process of writing, recording, and editing music creates a feeling of accomplishment and improvement, strengthening positive self-concept and self-esteem. Additionally, collaborative music production creates a sense of belonging and community connection, replacing loneliness and promoting interpersonal relationships. All these health impacts further reiterate the necessity of making music production universal, supporting the ethical imperative to provide universal access to music education and materials.

A caring ethical response to address these inequalities would involve committed efforts to nurture and assist underprivileged producers. This may involve:

- Education Support: Increasing the provision of free or low-priced training programs in digital music production, thus allowing prospective producers to develop their talents without financial hindrances. Henley and Barton (2022) advocate for the idea of amplifying governmental monetary support for music education to allow wider access to technology-based learning experiences.
- Technological Redistribution: Organizations and software vendors can offer free or subsidized access to better production tools to disadvantaged groups, thereby bridging technological gaps exposed by Kaiser (2017).
- Community-Building Projects: Establishing mentorship initiatives in which veteran producers actively inspire and motivate new artists, fostering collaboration rather than competition. Henley and Barton (2022) argue that peer-based learning models will be more likely to increase accessibility and participation for students lacking formal training.
- Redefining Prestige: Changing industry values to accept the artistry of digital production as being just as legitimate as analog-based efforts, eliminating elitist biases.
- Lowering learning curves on devices: By incoperating MIDI technologies, manufatures can create easy-to-use devices that benefits new users with less experiences. As an added bonus, previous research on MIDI technologies also highlights their therapeutic benefits, pointing to the additional advantages of interactive MIDI devices and music production in general. (Saide, 2024)

A prime example of such a project bridging these disparities is the University of Virginia public library music production studio that offers free access to professional recording software

and hardware, enabling students and members of the general community to engage in professional music production without any cost. The studio also acts as an example of equal utilization of resources by removing the financial weight of music production, especially for students and aspiring artists who lack finances to acquire professional gear. By being situated in an open access academic university, it also offers formalized support in the form of workshops, mentorship potential, and exposure to a creative community, so that individuals from underrepresented backgrounds may hone their craft in a supportive environment. This project demonstrates the ethics of care in that it actively strives to eliminate barriers, be inclusive, and acknowledge that access to creative making need not be determined by socioeconomic status. By providing audio production hardware resources free of charge and making them available structurally through a reservation system, the studio removes both financial obstacles as well as providing learning through doing and experimentation. In addition, the space also facilitates collaboration through shared use of electric guitars, basses, drums, and DJ controllers, further supporting the community-oriented aspect of care ethics. This project directly acts against the economic and educational barriers presented by Kaiser and Henley & Barton by providing an open facility where anyone can try their hand at music production regardless of economic status.

In an unstructured interview conducted with Mr. Jason Evans Groth, the operator of the sound studio in Robertson Media Center, I got to know that the studio is in wide use, and individuals are utilizing it for a wide range of creative endeavors aside from music production, such as podcasting and audio interviews. This extensive use reflects the broad influence of accessible audio facilities. Mr. Groth also explained how each student gets handed in a packet explaining how each instrutment/equipment works and how should students setup to make them useful in different use cases. This helps students with no knowledge to work comfortably without

sacrificing their scheduled time searching on the internet for answers. In addition, having this kind of high-quality studio on campus has also aroused students' interest and curiosity, and they have tried to make music and gain new knowledge. Not only does this project supply resources, but it also promotes a spirit of creativity and artistic development within the university community, promoting care ethics values of inclusion and engagement. Moreover, by placing the studio within an open institution, it promotes a feeling of community and communal learning, resonating with the relational values of care ethics at its foundation.

Conclusion

Care ethics applied to the inequalities in music production reveals the industry's failure to prioritize interpersonal relationships, accessibility, and equitable support mechanisms. In the two peer review articles, Kaiser's work emphasizes how prevailing hierarchies of technology and social class work to exclude the interests of budding artists, Henley and Barton draw attention to institutional barriers within early music education that generate long-term inequalities. In embracing an ethic of care, the industry is one step closer to being a more supportive and inclusive space, and to ensuring that all producers, irrespective of their financial situation, are able to flourish in music production.

References

Airy, S., & Parr, J. M. (2001). MIDI, Music and Me: Students' Perspectives on Composing with MIDI. *Music Education Research*, *3*(1), 41–49. https://doi.org/10.1080/14613800020029941

Bierylo, M. (2022). The Electronic Digital instrument. In *Routledge eBooks* (pp. 36–50). https://doi.org/10.4324/9781003216728-4

Groth, J. Personal Interview. (2025).

Hallam, S., Creech, A., Varvarigou, M., & McQueen, H. (2012). Perceived benefits of active engagement with making music in community settings. *International Journal of Community Music*, *5*(2), 155–174. https://doi.org/10.1386/ijcm.5.2.155_1

Henley, J., Caulfield, L. S., Wilson, D., & Wilkinson, D. J. (2012). Good Vibrations: positive change through social music-making. *Music Education Research*, *14*(4), 499–520. https://doi.org/10.1080/14613808.2012.714765

Henley, J., & Barton, D. (2022). Time for change? Recurrent barriers to music education. *British Journal of Music Education*, *39*(2), 203–217. https://doi.org/10.1017/s026505172200016x

Kaiser C. (2017) *Journal on the Art of Record Production » Analog Distinction – Music production Processes and Social Inequality*. (n.d.-b). https://www.arpjournal.com/asarpwp/analog-distinction-music-production-processes-and-social-inequality/ ISSN: 1754-9892

Kokotsaki, D., & Hallam, S. (2011). The perceived benefits of participative music making for non-music university students: a comparison with music students. *Music Education Research*, *13*(2), 149–172. https://doi.org/10.1080/14613808.2011.577768

Poel, I., & Royakkers L. (2011). Ethics, Technology, and Engineering. ISBN: 978-1-4443-3094-6

Saide, M. (2024). Exploring the Integration of MIDI Technology in Multimedia Production: Enhancing Creativity and Efficiency, with Applications in Therapeutic Settings. Exploring the Integration of

MIDI Technology in Multimedia Production: Enhancing Creativity and Efficiency, With Applications in Therapeutic Settings. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4885334

Stevens, D. (2016) "So You Want to Write a Chord Progression? Teaching Core Music Theory Using the Phrase Model Handout," *Journal of Music Theory Pedagogy E-Journal 2013-2017*: Vol. 6, Article 2. https://digitalcollections.lipscomb.edu/jmtp_ejournal/vol6/iss1/2

Wiggins, R. A., Jr., & Wiggins, J. (2008). Primary music education in the absence of specialists. *International Journal of Education & the Arts*, *12*. http://www.ijea.org/v9n12/v9n12.pdf